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ERRATA.

- Page 216, line 3 of table, for 5·12 read 35·12.
 " 226, " 1 from bottom, for *duophobus* read *deiphobus* and for *Halictu* read *Halictus*.
 " 230, " 31, for *great-flower* visitor read *great flower*-visitor.
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JOURNAL
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ASIATIC SOCIETY OF BENGAL.

New Series.

Vol. IV.—1908.

1. Gandhakuṭī—the Buddha's Private Abode.

By H. C. NORMAN.

The object of this note is to determine from an examination of Pāli and other sources what precisely a Gandhakuṭī is. The question is an interesting one, both because anything that throws light on the Buddha's habits as a private individual is welcome to the biographer contending with the difficulties of extracting the particles of truth from the masses of legendary fiction, and because students of epigraphy have been confronted with the term and will probably often meet with it again as more relics are unearthed by the patient labours of the archæologist.

The Abhidhānappadīpikā (to begin with the definition of the standard Pāli Kosha) says: *Gandhakuṭī—Jinassa vāsubhavanam* "The perfumed chamber of the Jina." This is repeated by Childers s.v. How far is this definition borne out by Pāli documents?

The Sumaṅgala-Vilāsini in the Brahmajālasuttavaggaṇā gives a clear and apparently authentic account of the Buddha's daily and nightly routine. It has been translated by Warren in his "Buddhism in Translations," so that only the details in reference to the "perfumed chamber" need be considered here. Here we learn that after the eating of the midday meal by the Bhikkhus intelligence of the fact is given to the Blessed One, who then enters the Gandhakuṭī. This concludes the forenoon duties (*purebhat-takiccam*). After entering, the Buddha has his feet washed by his special attendant and then, standing on the jewelled staircase of the Gandhakuṭī, delivers a short homily to the Saṅgha, the members of which receive from him special subjects for meditation and then

disperse. He himself re-enters the "perfumed chamber," and, "if he so desires, lies down for a time on his right side, like a lion." This terminates the first portion of the afternoon. During the second portion the Buddha rises up refreshed in body and looks forth on the world. In the third part the people living near the monastery in which the Buddha happens to be dwelling come in their best clothes, bringing perfumes, flowers and so on. Then the Buddha goes to the Dhammasabhā and delivers an apposite harangue on Dhamma to the assembled multitude; after which the people pay him their respects and go. This ends the afternoon duties (*pacchābhattakiccam*). Thereafter, if he desired to bathe, he would enter the *nahāna-kotthaka* or bathroom, and his special attendant would get ready for him the Buddha-seat in the Gandhakuṭi-cell (*gandhakuṭiparivene*). After telling us how the Bhagavā passed the first two watches of the night sitting on his special seat, the biographer informs us that the last watch was divided into three parts. During the first, being tired with so much sitting, he would pace up and down. In the second part "*gandhakuṭin pavisitvā dakkhīṇena passena sato sumpajāno sīhaseyyam kappeti.*" In the third part the Buddha rises to survey the world and find out who, through meritorious deeds in the time of a former Buddha, has made himself deserving of reward.

In the 15th section of the same work (p. 7 of the P. T. S. edition) occurs a paragraph so interesting that I translate it *in toto*. It describes the doings of Ānanda upon his visit to Sāvattī with a retinue of five hundred monks after the Parinibbāna of the Tathāgata. The inhabitants come out to meet him with perfumes, garlands, and the like. "Reverend Ānanda," say they, "formerly you used to come with the Blessed One, but now where have you left the Buddha to come here?" Uttering remarks of this kind they wept, and a mighty lamentation arose like to that on the day of the Parinibbāna of the Blessed Buddha. "Thereupon the venerable Ānanda having consoled the multitude with a homily dealing with the perishability of things and such like entered the Jetavana and having saluted the Gandhakuṭi once dwelt in by him of the ten powers (*Dasabalenu vasitagandhakuṭim*) opened the door, took down the chair and dusted it thoroughly, swept out the Gandhakuṭi, threw away the rubbish of the faded garlands, moved about the chair and the bed and then put them back in their proper places, and performed all the round of duties that had to be performed in the lifetime of the Blessed One. And whilst he was performing them, at the times for sweeping out the bathroom, setting the water ready and so on, he would salute the Gandhakuṭi and say: "Lo, Blessed One, now is your time for washing, now is the time for expounding the Law, now is the time for haranguing the mendicants, now is the time for lying down like a lion, now is the time for washing your face," and so on. In such ways as this, he performed his tasks weeping bitterly. This was because love arose in his heart through his being acquainted with the ambrosial essence of the host of virtues (read *guṇagaṇāmatarasa—ññutāya*) of the Blessed One, and likewise because he was not yet

freed from the passions (not yet an Arahat), and because his heart was melted at the memory of their kindnesses to one another in countless hundreds of thousands of births."

These two passages point clearly to the Gandhakuṭi being the private "study" of the Buddha, and the mention of the withered garlands helps to explain the prefixed "Gandha." Let us next look at the *Jātaka-Book* (ed. Fausböll = F. J.).

In F. J. I. 92 we read that when Anāthapiṇḍika built the Jetavana he had made in its middle the Gandhakuṭi of Dasabala (*majjhe Dasabalassa gandhakuṭim kāresi*). Round it were separate dwellings for the eighty elders with other residences with single and double walls and long halls and open roofs ornamented with ducks and quails and ponds also, and terraces to walk on by day and night. F. J. I. 119—After the morning meal at Jivaka's house the teacher returns accompanied by mendicants to his Vihāra. When the mendicants have completed their daily tasks, "having risen from his seat he stood in front of the Gandhakuṭi and harangued the assembly of mendicants. Then having told them fit subjects for meditation and dismissed the assembly, he entered the Gandhakuṭi redolent with sweet-smelling perfumes (*surabhigandhavāsitaṃ gandhakuṭim*), and lay down like a lion on his right side." A discussion arising among the monks on the day's doings, the Buddha hears the noise of their talk, rises and leaves the perfumed Gandhakuṭi (*surabhigandhakuṭito nikkhamma*) to see what is the matter. This, by the way, is a very common motif in the *Jātakas* and in the *Dhammapada Commentary*. Other examples are F. J. I. 316 *Sāyanhasamaye Satthari surabhigandhavāsītiya gandhakuṭito nikkhamitvā dhammasabhaṃ gantvā*; I. 330 *surabhigandhakuṭim pavisitvā*; I. 501 *sabbe va gandhakuṭiparivene sannipātehi sabbe bhikkhū gandhakuṭiparivene sannipāteva Bud-dhāsanaṃ paññāpesi*; III. 67 *gandhakuṭiparivene nisīdi*; V. 337 *gandhakuṭito nikkhamitvā*, so 382; V. 413 *sāyanhasamaye gandhakuṭito nikkhamitvā*; V. 456 *gandhakuṭiyaṃ nisimno va dibbasotena kathāṃ sutvā*. In the introduction to the *Palāyijātaka* we read (F. J. II. 216) of a certain *Parivrājaka* called *Palāyi* ("Runaway") who wandered over India overcoming rival dialecticians in wordy warfare. At last he came to *Sāvatti*. The people told him that however many victories he might hitherto have won he would here taste defeat, whereupon he asked to be confronted with the Buddha. So off he went to the Jetavana. When he came to the portico which had been built by Prince Jeta at a cost of nine crores, he asked: "Is this the palace of the *Samāṇa Gotama*?" and hearing it was only the portico he said: "If the portico is so fine, what will his dwelling be like?" "Oh," they said, "his Gandhakuṭi is incomparable" (*gandhakuṭi nāma appameyyā*). Hearing this he said: "Who can dispute with such a *Samāṇa*?" and ran away.

To turn to the *Commentary* on the *Dhammapada*. Here we have a passage: *Revatutthero pi Satthu āgamanāṃ natvā Bhagavato gandhakuṭim māpetvā pañca kūṭāgarasatāni pañca caṅkamanasatāni pañca rattitthānadivaṭṭhānasatāni ca māpesi*, which shows that to

construct a Gandhakuṭi was a matter of the first importance when a monastery had to be built to receive the Buddha and his retinue. In the commentary on verse 68 we meet with an interesting story. A certain mālakāra is in the habit of taking King Bimbisāra flowers every morning. One day he meets the Buddha and does Pūjā to him with the flowers, which adhere to the Buddha's person. The king is pleased, and rewards the gardener with a *sabbatthakadānam* (a gift of eight of everything). The Buddha returns to the monastery and makes for his Gandhakuṭi, at the porch of which all the flowers drop off. Afterwards the monks make a great ado about the wonderful event. The Buddha hears them from his Gandhakuṭi and goes by one of the three ways going to the public hall to enquire what is up—*Satthā gandhakuṭito nikkhamitvā tiṇṇaṃ gamanānaṃ aññāturena gamanena dhammasa-bhaṃ gantvā*. It would be interesting if archæologists could tell us something about these "three ways" and whether they lead from the Gandhakuṭi direct to the public hall itself. So much seems to be certain from our evidence that the Gandhakuṭi was:

- (1) The private dwelling-place of the Buddha.
- (2) A structure standing in the middle of the monastery, with a stair leading up to it. Great care was taken to make both building and stair as splendid as could be.
- (3) The repository of floral offerings which gave it its sweet perfume and its Pāli name.

This seems to be borne out by the passage quoted from the *Dulva* apud Rockhill in Grünwedel's "Buddhist Art" (Eng. tr., p. 46): "On the door of the Buddha's special apartment (*gandhakūṭi*—read *gandhakuti*—"hall of perfumes") a Yaksha holding a wreath in his hand." This points to the connection with flowers. Again Vākpati in line 319 of his *Gāudavaho* says:—

गयशेचिय मन्वउडि कुयन्ति तुह कउलगारीओ

Commentator मन्वकुटी—मन्वद्रयष्टहं. The Indian Antiquary IX. 142-3 has a review on Dr. Rājendralālamitra's book on *Gayā*, where, commenting on *vajrāsanaḥṭhadyandhakuti-prasāde*, the reviewer says: "Gandhakuṭi is a temple in which is an image, not 'a receptacle for aromatics.'" (R.'s version). From what we have seen above, the reviewer does not seem to be justified in his strictures, even though on the same page we have: *tena gandhakuti pratimātrayānvitā vhitā*. Containing an image is an accident not a property of a Gandhakuṭi. It is quite probable that after the Teacher's death the word might come to connote a shrine within a monastery in which an image of the Buddha might be set up and later perhaps a shrine containing images of the Buddha and his two principal disciples Sāriputta and Moggallāna (v. Grünwedel, p. 182). In fact, later the Gandhakuṭi might have become what in Pāli is called a *patimāgharam* "the hall in a Buddhist temple which contains the colossal statue of Buddha." (Childers s. v.),

The word also occurs in a position of importance in the now famous "Mahīpāla" Inscription of Sārnāth. The latest discussion of this inscription is to be found in the Journal and Proceedings, Asiatic Society of Bengal (New series), Vol. II, No. 9, 1906: "Some notes on the so-called Mahīpāla Inscription of Sārnāth. By Arthur Venis." Mr. Venis rightly says "shrine" for Gandhakuṭī, but does not attempt to locate the building. From our Pāli evidence it ought to be found in the middle of a Vihāra. He is certainly quite right in taking *śaila* "of stone" with *gandhakuṭī* and not with *aṣṭamahāsthāna*; grammar imperatively demands such an analysis of the compound as he has given. "From eight holy places," the suggested interpretation of Messrs. Hultsch and Vogel is fascinating and romantic, but I think with Mr. Venis that it is not beyond suspicion. With the latter I would translate: "A Gandhakuṭī of stone having eight great places." What stood in these eight places? Might one venture to suggest the eight Buddhas (the six Buddhas previous to Gautama, Gautama himself, and Maitreya—v. Grünwedel op. cit. p. 188)?

2. Sinhalese Historical Documents and the Maurya Inscription of Sārnāth.

By H. C. NORMAN.

The following may serve the readers of the J.R.A.S.B. as a pendant to the paper, in Volume III of the Journal for 1907, by A. Venis, Esq.: "Some Notes on the Maurya Inscription at Sārnāth."

It is quite evident to anyone reading over the inscription that it is an edict framed to prevent entrance into the Buddhist Order of unprivileged persons who raise schisms in it, and also to ensure strict attention to the keeping of Uposatha days, the sabbaths of the Buddhists. One could also infer from the inscription alone that these things are closely connected—that people had become remiss in their attention to the Uposatha days, because the Order was becoming itself slack and negligent owing to these pestilent schismatics, who had indeed to be "unfrocked" by royal mandate before the evil could be remedied, so widespread had it become. All this harmonises remarkably with what we know from the Sinhalese records. Let us first of all consider the account of the matter given in a somewhat late compilation, the Saddhamma Saṅgaha of Dhammakitti, edited by Nedimāle Saddhānanda in the J.P.T.S. for 1890, pp. 21-89, which is admittedly based on the Chronicles and Buddhaghosa, but contains one or two additional items of information.

Sammāsambuddhāparinibbānato dvinnāṃ vassasatānaṃ upari atthavīsatiṃ vasse sabbe aññatitthiyā satthisahassamattā vihinalābhasakkārā hutvā antamaso ghāsacchādanāṃ pi alabhantā lābhasakkāraṃ patthayamānā sayam eva muṇḍe katvā kāsāyāni acchādetvā vihāresu vicarantā uposathādikammam pi pavisanti. Sāsanaṃ abbudañ ca malañ ca kaṇṭhakañ ca samutthāpesuṃ, tasmā imasmiṃ sakala-Jambudīpe bhikkhu-saṅgho chā saṃvaccharāni uposatha-kammāṃ na akāsi. Tadā Asoko dhammarājā paṇṇarasavassābhiseko ahoṣi. Rājā sāsanaṃ visodhetu-kāmo Asokārāme bhikkhusaṅghaṃ sannipātāpesi. Tasmīṃ sannipatite āyasmā Moggaliputtatissatthero saṅghatthero hutvā rājānaṃ samayaṃ uggaṇhāpesi. Rājā aññatitthiye pucchitvā "na ime bhikkhū aññatitthiyā ime" ti ũatvā setavatthāni datvā uppabhājesi. Tato Rājā: Suddhaṃ dāni bhante sāsanaṃ, karotu bhikkhusaṅgho uposathan ti ārakkhaṃ, datvā nagaram eva pāvīsi. Saṃmaggo saṅgho sannipatitvā uposathaṃ akāsi. Tenāhu porāṇā :—

9. Sambuddhāparinibbānā dve ca vassasatāni ca Atthavīsati vassāni rājāsoko mahīpati.

10. Vasanto tattha sattāhaṃ rājuyyāne manorame
Sikkhanto so mahīpālo sambuddhasamayam subhaṃ.
11. Tasmīṃ yeva ca sattāhe dve ca yakkhe mahīpati
Pesetvā mahiyam bhikkhū asese sannipātayi.
12. Sattame divase gantvā sakārāmaṃ manoramaṃ
Kāresi bhikkhusaṃghassa sannipātāmaṃ asesato.
13. Te micchādītthike sabbe pucchitvā aññatīthiye
Ñatvā satthi sahaṣṣāni uppabbājesi bhūpati.
14. 'Saṃgho visodhito yasmā tasmā saṃgho uposathaṃ
Karotu bhante' iccevaṃ vatvā therassa bhūpati
15. Saṃghassa rakkhaṃ datvāna nagaraṃ pāvīsi subhaṃ
Saṃgho samaggo hutvāna tadākāsi uposathan ti.

Tasmīṃ samāgame Moggaliputtatissatthero parappavādam maddamāno Kathāvattthupakaraṇaṃ abhāsi. "In the 228th year after the Parinibbāna of the Perfectly Enlightened One all the heretics, sixty thousand in number, having lost their gain and honour, at last getting not even food and clothing, became desirous of gain and honour and so, of themselves, they shaved their heads and put on the orange-coloured robe and, living in monasteries, even entered upon the performance of the Uposatha and other duties. They became a canker and a blemish and a pest of the religion. Hence in the whole of India the Order of mendicants did not hold the Uposatha for six years. Then Asoka, the king of righteousness, was in the 15th year of his consecration. The king being desirous of purifying the religion caused the Order of mendicants to be convened at the Asokārāma. When they were assembled, and met together, the reverend elder Moggaliputtatissa having been made president instructed the king in the tenets of the religion. The king then asked the heretics questions, and, finding out that they were not mendicants (bhikkhus) but heretics, gave them white garments and cast them out of the Order. Then said the king: 'Now, sirs, is the religion purified; let the Order of mendicants perform the Uposatha,' and, having given the Order his protection, he entered the city. The whole of the assembly having met together performed the Uposatha. And so those of old have said: 'Two hundred and twenty-eight years after the Parinibbāna of the Perfectly Enlightened, the king Asoka, the lord of earth, dwelling there for seven days in the pleasant royal pleasure-garden, learnt the excellent religion of the Perfectly Enlightened, and during those same seven days the king sent two Yakkhos and caused all the bhikkhus in the land to be assembled. On the seventh day he went to his own pleasant temple¹ and caused the whole priesthood without exception to assemble. Then he questioned all the false-believing heretics, and, having found them out, he, the king, expelled sixty thousand from the Order. Then the king said to the elder: 'As the Order has been purified, reverend sir, let the Order perform the Uposatha,' and having given the Order his protection he entered

¹ The Asokārāma which he had caused to be built.

the fair city. Then, the whole Order met together and performed the Uposatha. At that assembly the elder Moggaliputtatissa smashing the arguments of other (sects) gave utterance to the composition dealing with the (ten) subjects of discourse (the Kathāvattu)."

This is our best summary account in Pāli of the events which led to the third council of the Buddhist clergy, which lasted nine months. The prose portions are based upon Buddhaghosa's Samantapāsādikā, Introduction; the poetical quotations 10, 11, 12, 14, 15 are from the 5th chapter of the Mahāvamsa. The other verses may come from the old Sinhalese Atthakathā Mahāvamsa, which is the source of our Pāli authorities, the Dipavamsa, Mahāvamsa and Buddhaghosa. Verse 9 is interesting as giving a date 228 A.B. for the schism. The additional information in the prose portion "fifteen years" gives us 213-214 A.B. for the coronation, a figure which agrees with the Burmese date as given in Bigandet's work founded on the Mālālaṅkāravattu, and would agree with the date of the Mahāvamsa if we give Candragupta a reign of 24 years instead of 34 years (the Dipavamsa gives 24 years, and so does Buddhaghosa). Both the Dipavamsa and Mahāvamsa consecrate Asoka in 218 A.B., but the Mahāvamsa tells us that he came to the throne in 214 A.B. Buddhaghosa tells us that the interval of four years was occupied in slaying 100 sons of Bindusāra, Asoka's rivals. The evidence, as a whole, seems to point to 214 A.B. as the date of Asoka's accession at any rate, whatever may have happened afterwards.¹ As to the date of the third council, the account given above would make it 234 A.B. Bigandet gives 235, and says that the schism had lasted seven years, which gives us the date 228 A.B. also for the beginning of the disorder. All our old accounts agree in telling us that the matter was brought to a head by the fact that a minister, sent by Asoka to order the Bhikkhus to hold the Uposatha, cut off the heads of several of them,

¹ *Chronological note.*—One cannot help feeling that if the 256 of the R.S.B. edict is a date, and if 214 or thereabout be taken as the date of Asoka's coming to the throne (both dates in years reckoned from an event in Buddha's history), Mr. Venis's ingenious suggestion that we should date the R.S.B. edict nibbānato (if we combine it with a reckoning of 214 parinibbānato) will give one of the most satisfactory reconciliations of two apparently conflicting and yet authoritative sources for our knowledge of Indian history. It is noteworthy that the Dipavamsa begins its chronicle from the Sambodhi of the Tathāgata. On the other hand Vijaya, the first king of Ceylon, landed in Laṅkā in the year of the Parinibbāna. Could this have given rise to a confusion of epochs? The difference between 256 and 214 is 42 years. Most of our accounts give 45 as the number of years between Nibbāna and Parinibbāna. But the learned Haraprasād Śāstrī, in a letter to Mr. Venis, which the latter has been so kind as to allow me to use, says that the Mahāvastu gives 41; 41 + 21½ gives us practically 256, a most interesting coincidence. The same scholar in another letter to Mr. Venis mentions that Takakusu speaks of a dated record at a monastery in Canton, which fixes Buddha's death in 486 486 + 41 = 527 527 - 256 = 271, while 486 - 214 gives 272. Is all this mere fortuitous coincidence?

because they said: "We will not perform the ceremony of Uposatha with the heretics." This gave rise to enquiry and a detailed examination of the whole business by Asoka, with the assistance of Tissa, son of Moggali.

The "white garments" mentioned above also occur in Bigandet's account and Buddhaghosa ("setakāni vatthāni"). The Dipavaṃsa and Mahāvāṃsa do not mention this precise fact, but the Dipavaṃsa has, p. 53:

Theyyasaṃvāsabhikkhuno¹ nāseti lūganāsanam, which Dr. Oldenberg translates: (the king—rājā in the preceding line) "destroyed the Bhikkhu emblems of those who had furtively attached themselves (to the Saṃgha)." This would come to much the same thing as stripping off the orange-coloured robe and giving them "the white dress, that is to say, the one befitting the Pounhas" (Bigandet). These seem to be the "odātani dusāni" of the edict. The assembly was also held at Pāṭali-putra, which the "Pāṭa," of the inscription may be said to represent. And a further coincidence would be furnished by Mr. Venis's reading "bhākhati," which would give excellent sense, for breaking up of the Order is exactly what these heretics are represented as doing.²

Again, if we consider the perturbed state of the Buddhist community at this time owing, first of all, to the tricks of the heretics, and, secondly, to the high-handed action of the king's officer in regard to the holding of Uposatha, we can easily understand why the Upāsakas should be told to come and read the Sārnāth edict (and its equivalents at Allahabad and Sanchi?) on *Uposatha days* in order to be inspired with confidence. The religion of the Sammāsambuddha had received a very severe shock, and a royal edict was the only thing to put matters right.³ Would it be too great a stretch of imagination if one hazarded the suggestion that the phrase "saṃghassa rakkhaṃ datvāna" ("ārakkhaṃ datvā" Buddhaghosa) is actually a reference to a proclamation similar to the Maurya edict, of which Mr. Oertel ("Sujanappasādāya") has unearthed so fine an exemplar on the very spot where the order first took its rise?

¹ Monier-Williams' Skt. Dict., p. 1260. *Steyasaṃvāsika*: One who has stolen into any dwelling in the fictitious character of a monk, Buddh. The Pāli *theyyasaṃvāsako* occurs often in Vinaya texts, for the best illustration see Mahāvagga I., 62 ed., Oldenberg. The punishment for such an offence is expulsion, "nāsetabbo," according to the Buddh. Compare Mahāvagga II., 36: na theyyasaṃvāsakassa nisinnaparisiyā pātimokkhaṃ uddisattham. Yo uddiseyya, āpatti dukkaṭassa.

² Dipavaṃsa p. 52, ed. Oldenberg:—

Nikkhante dutiye vassasate vassāni chattiṃsati
Puna bhedo ajāyatha theravādānam uttamo
Asokārāma vihāramhi pātimokkhaṃ paricchiṃji,
Kārāpento pātimokkhaṃ amacco ariyānam aghātayi.

³ It is possible that the first edict for the clergy referred to in the Sārnāth inscription was actually set up near the Asokārāma at Pāṭali-putra at the "saṃsalanasi," or the place of meeting of the "saṃgama" of our texts.

3. Note on a Persian Charm.

By M. K. SHIRAZI, *Persian Instructor, Board of Examiners.*

Communicated by the Philological Secretary.

It has been handed by tradition down from the Imāms that whoever looks daily at the following diagram after each of the five daily prayers, and also looking at it on first seeing the new moon, immediately after gazes at the object mentioned in the list below for each month, will be protected from all evil, from the oppression of tyrants, and the magic of magicians; he will pass the month in prosperity, will be free from sickness, be secure from injury from man, and be under the protection of God.

After viewing the new moon and looking at the diagram given below, the gaze should be directed at the following objects :—

- | | |
|---------------------------------------------|----------------------------|
| 1. <i>Muḥarram</i> | “ Gold.” |
| 2. <i>Ṣafar</i> | “ A mirror.” |
| 3. <i>Rabī[‘]al-Awwal</i> | “ Water.” |
| 4. <i>Rabī[‘]s-Ṣānī</i> | “ Flocks.” |
| 5. <i>Jumād^ā-l-Awwal</i> | “ Silver.” |
| 6. <i>Jumād^ā-s-Ṣānī</i> | “ An aged man’s face.” |
| 7. <i>Rajab</i> | “ The Qur’an.” |
| 8. <i>Ṣha[‘]bān</i> | “ A rose.” |
| 9. <i>Ramaḏān</i> | “ A sword.” |
| 10. <i>Shawwāl</i> | “ Verdure.” |
| 11. <i>Zū[‘]l-Qa[‘]da</i> | “ A child’s face.” |
| 12. <i>Zū[‘]l-Hijjah</i> | “ The face of a mascotte.” |

DIAGRAM.

العسین علی	العسین موسی	فاطمه جعفر	علی محمد	محمد علی
صلوات الله عليهم اجمعين عَوْنًا لَكَ	العجبة القايم — نَجْدَةٌ	العسین — العجائب	علی — مَظْهَرٌ	مُحَمَّدٌ — نَادٍ عَلِيًّا
بِنَدْوَتِكَ يَا مُحَمَّدٌ ادركني	بِعَظَمَتِكَ يَا اللهُ يا علی	سَيِّدِي يا علی	كل هم وغم يا علی	في النوائب بِوَلَايَتِكَ

يا عقربان يا برهان

يا سابعان يا سلطان



يا عيسى بن مريم
يا مريم

يا عيسى بن مريم
يا مريم

بِسْمِ اللهِ الرَّحْمَنِ الرَّحِيمِ

قل هو الله احد الله الصمد لم يلد ولم يولد ولم يكن له كفوا احد

4. Studies in the Experimental Breeding of the Indian Cottons,—an introductory note.

By H. MARTIN LEAKE, M.A.

The Genus *Gossypium* affords a good illustration of the confusion in terminology, which is apt to arise in the classification of widely cultivated plants. This confusion has been dealt with by previous writers on the subject (1—4). For the purposes of this note it is undesirable to enter into this question again, and the names here used bear the interpretation that has been given to them by Gammie (3).

The present experiments refer to six of the species there (pp. 4—8) noted. They are—

<i>Gossypium arboreum</i> , Linn.	<i>Gossypium indicum</i> , Lamk.
„ <i>herbaceum</i> , Linn.	„ <i>neglectum</i> , Tod.
„ <i>intermedium</i> , Tod.	„ <i>cernuum</i> , Tod.

Of the remaining three species, *Gossypium obtusifolium* Roxb., and *Gossypium sanguineum*, Hassk., have been under observation for too short a period to be dealt with at the present time; while *Gossypium hirsutum*, Mill., is definitely excluded. *Gossypium Stocksii*, Mast., has recently been obtained from the neighbourhood of Karachi, but the generalisations that follow do not include that species, unless especial mention is made of the fact.

The above six species—to which may be added *Gossypium obtusifolium*, Roxb., and, probably, also *Gossypium Stocksii*, Mast.,—form a definite group, the members of which, when crossed *inter se*, are completely fertile. In the same six species—to which may be added *G. obtusifolium* Roxb.,—there occurs a range of variation which, added to the readiness with which the flowers may be handled and the duration of the flowering period, affords most suitable material for a study in plant-breeding.

Little has hitherto been recorded of the behaviour of the various species when crossed with one another. The behaviour of the differentiating characters is unknown and it is, further, doubtful what may be considered a definite character. The problem, in its present stage, is purely theoretical—the isolation of those characters, which behave as units under artificial crossing. The vegetative characters are, naturally, most readily determined, and the present note deals with these. The characters of the cotton—that portion of the plant on which its economic value depends—are not so readily isolated, and further observation and experiment will be necessary before these can be elucidated.

The experiments.—A series of cotton plants have been under

observation for three¹ seasons. In the first of these, systematic experiment was impossible, and the seed saved for sowing in the second season was, without exception, from flowers naturally fertilized. These were sown at Cawnpore, and in that year a systematic series of experiments was commenced. The facts dealt with in the following note relate chiefly to the offspring—numbering some 2,000—raised during the present season from the seed obtained by artificial fertilization. The results of another generation must be awaited before the experiments can be recorded in detail. For the present two points only will be discussed.

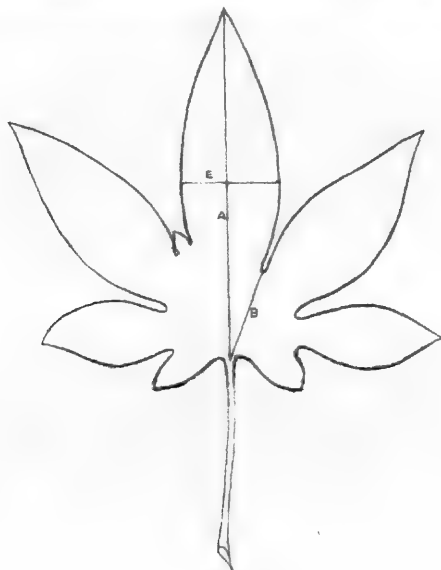


FIG. 1.

1. *The leaf.*—The leaf of the cotton plant is, in all cases, palmately divided, and the degree of this division varies from palmatifid to palmatisect. The extreme variations of this character are very distinct, and it has been employed in the subdivision of the *neglectum* and *arboreum* 'species' into 'varieties.' The character, however, on close scrutiny appears to be elusive. In a field of cotton (*Gossypium neglectum*, Tod.) such as is commonly met with in the United Provinces, the two extreme types are readily identified; but there occur, also, numerous forms which are not readily classed, and which must be recorded as intermediates. The point appeared worthy of closer study, and the first step there-to lay in the identification of a means for the accurate record of the degree to which the leaf is palmately divided. As the result

¹ In the first at Saharanpur and in the second and third at Cawnpore.

of numerous measurements—numbering, in all, over 10,000—it has been found that the value of the factor $\frac{A-B}{E}$ (*vide* diagram opposite) gives the readiest means of estimating this character. Full discussion of this factor, its legitimate use and its limitations, fall beyond the scope of the present note. The plants for which this factor has been determined, number considerably over one thousand, and the limiting values have been found to be 0·8 and 5·1. Plants for which this factor bears a value between 0·8 and 2·1, may be classified as bearing *palmatifid*—or ‘broad’-lobed,¹—leaves, while plants for which this factor bears a value of 3·0 or over may be classified as bearing *palmatisect*—or ‘narrow’-lobed¹—leaves. This numerical expression for the ‘breadth’ of the leaf lobes will be, in future, referred to as the *leaf-factor* of the plant.

If, now, a plant of which the leaf-factor is less than 2·1, be crossed with a plant of which the leaf-factor is greater than 3·0, it is found that the leaf-factor of the offspring in the F₁ generation approximates remarkably to the arithmetic mean of the two parental leaf-factors. This appears to be true for *all* crosses whether they are made between the extreme forms of *G. neglectum* or between such divergent types as *G. arboreum* (leaf ‘narrow’-lobed) and *G. herbaceum* (leaf ‘broad’-lobed). The following examples illustrate this, the leaf-factors of the parent being taken as the average of the values found for the offspring:—

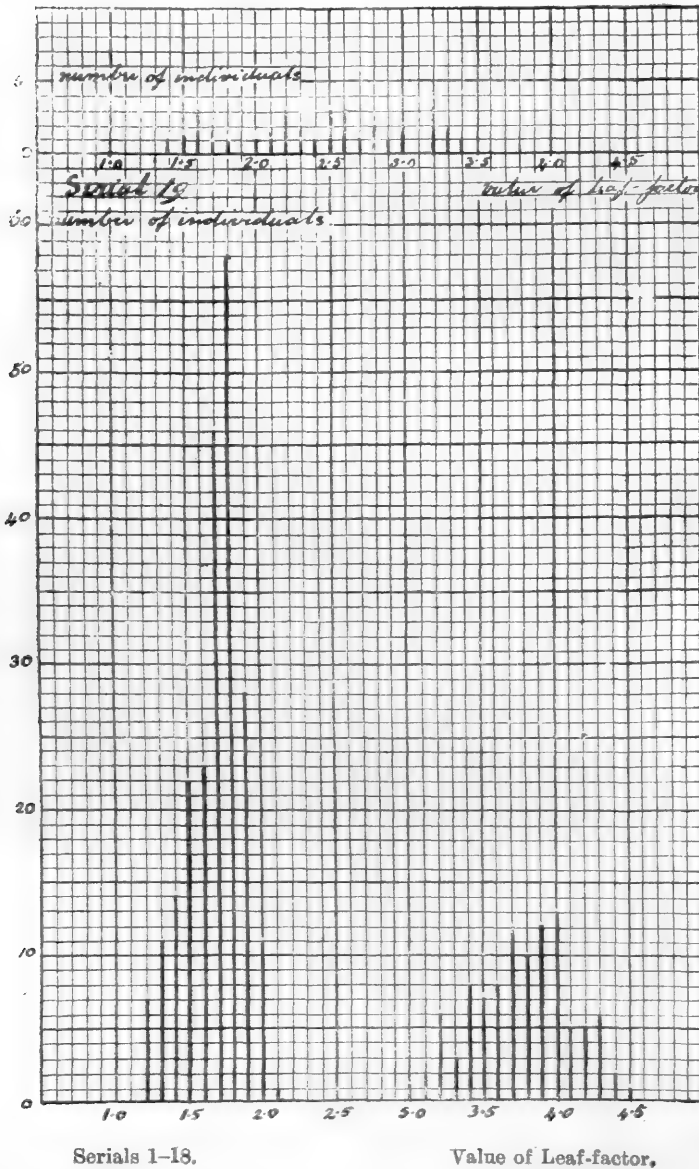
	Leaf-factor.	No. of plants used in determination.
seed parent <i>G. indicum</i> ² ...	1·64	20
pollen parent <i>G. arboreum</i> ...	3·21	3
mean of factor of parents ...	2·42	...
<i>G. indicum</i> × <i>G. arboreum</i> ...	2·45	10

	Leaf-factor.	No. of plants used in determination.
seed parent <i>G. indicum</i> ...	1·64	20
pollen parent <i>G. neglectum</i> ...	3·35	20
mean of factor of parent ...	2·49	...
<i>G. indicum</i> × <i>G. neglectum</i> ...	2·42	17

¹ A notation commonly employed. There is no *a priori* reason for considering the two expressions—the degree to which the leaf is divided and the ‘breadth’ of the leaf lobes—as synonymous. The leaf-factor, however, involves both characters; and since this appears to behave as a definite character, there is reason to believe that they may be considered to be so.

² For the purpose of this note distinction between *G. indicum* and *G. neglectum* is unnecessary.

For the matter in hand the discussion may be limited to the offspring of the two species, *G. indicum* and *G. neglectum*, which have been raised from seed yielded by flowers so protected that self-fertilization is assured. In the following diagram



are given the number of plants found for each value of the leaf-factor calculated to the first decimal place. The leaf-factors of the parents were not determined and they were roughly divided according as the leaf appeared to the eye 'broad'- or 'narrow'-lobed. The following table gives the range in the value of the leaf-factor in the offspring of each parent:—

Serial No.	Type.	Recorded Leaf type of parent.	Leaf-factor (average of offspring.)	No. of offspring used in determination.	EXTREMES OF LEAF-FACTOR.		Total * no. of offspring raised.
					Maximum.	Minimum.	
1	indicum	'broad'-lobed	1·64	16	1·92	1·42	17
2	"	"	1·37	34	1·57	1·17	35
3	neglectum	"	1·68	20	1·80	1·56	35
4	"	"	1·78	20	1·94	1·73	49
5	"	"	1·88	17	2·14	1·67	17
6	"	"	1·73	15	1·88	1·53	16
7	"	"	1·81	20	1·98	1·69	64
8	"	"	1·78	20	1·94	1·69	20
9	"	"	1·80	16	1·99	1·62	16
10	"	"	1·90	9	2·05	1·67	9
11	"	"	1·76	15	1·98	1·63	17
12	indicum	"	1·46	20	1·71	1·27	38
13	neglectum	'narrow'-lobed	3·64	20	4·18	3·18	74
14	"	"	3·59	2	3·64	3·55	2
15	"	"	3·85	18	3·83	2·96	44
16	"	"	4·00	20	4·55	3·39	20
17	"	"	4·16	20	4·34	3·80	37
18	"	"	3·78	20	4·20	3·46	37
19	"	"	...	36	3·40	1·44	36

* When the number of offspring raised exceeds the number used in determination, it has been ascertained that none of those excluded exceeded the given limits.

When the two sections of the above diagram are amalgamated, it is observable that the plants raised by self-fertilization form an uninterrupted series, in which plants with every value of leaf-factor from 1·2—4·5 occur. From the table, however, as also from the two sections of the diagram, it is evident that, with the single exception of serial No. 19, all the parents examined produced, by self-fertilization, offspring possessing a leaf-factor falling within the limits given above for the type to which the parent belonged—in other words, this leaf-factor, with one exception, proved to be a constant character for the particular plant.

This exception requires further consideration. The parent was noted as possessing a 'narrow'-lobed leaf. From the herbarium specimen of this plant which has been preserved, the leaf-factor has been calculated and found to be 2·40. The leaf-factor was, therefore, in reality intermediate. Now it has already been shown that the F_1 generation of a cross possesses a leaf-

factor, which is the arithmetic mean of that of the two parents; and, while it would be legitimate to expect that the F_2 generation of such a cross would contain, among others, plants with typical 'broad', and typical 'narrow'-lobed leaves, it is unnecessary to depend on assumption; since, where observations have extended to the F_2 generation, this expectation has been found to be fulfilled.

The conclusion is, therefore, that the plant which gave rise to serial No. 19, is a natural cross between a 'broad', and a 'narrow'-lobed form of *G. neglectum*.

It has already been noted that in the field in the United Provinces there normally occur, in addition to the typical 'broad', and 'narrow'-lobed forms, plants of which the leaf-factor is intermediate. It is difficult to escape from the conclusion that these plants with an intermediate leaf-factor are crosses, and that cross-fertilization must be of common, though not necessarily of general, occurrence. All observations hitherto made in the course of these experiments—including those on such definite characters as the leaf-glands and colour of the petals—indicate the same fact.

2. *Cross-fertilization of the cottons in nature.*—This fact the common occurrence of crossing among the cottons under natural conditions—requires to be emphasised as it has recently been denied (3 and again in 4); and it is desirable to discuss it in greater detail. Indirect proof exists in abundance. It would be hardly conceivable that a plant, whose flowers are visited by insects as it has been shown that cottons are visited (5), is invariably self-fertilized. That impurity frequently results when the flowers are naturally fertilized, that purity is readily obtained by the artificial self-fertilization of selected plants, and that the pollen of one species is frequently to be observed on the stigma of a second, are points that have come under personal observation. It is unnecessary to enter into the details of such observations when direct evidence exists. Such evidence is to be found in the occurrence of plants—raised from the seed given by flowers naturally fertilized—which, when judged by their offspring, behave in all details as a cross. Several instances of this have come under observation. It will be sufficient, however, to record the salient features of that case of which the most detailed record has been kept.

From a packet of seed of *G. arboreum* 14 plants were raised, and of this number 12 proved true *G. arboreum*. The remaining two plants, though similar to each other, differed markedly from that type. Seeds of one of these (from flowers naturally fertilized) were collected and 30 plants raised. Eight of these 30 plants were self-fertilized, but owing to the lateness of the season at which this was carried out, only four plants yielded any seed. From these four plants 63 have been raised.

The leaf-factor of the two initial plants was not observed since this character had not at that time been identified. The records, however, are sufficiently detailed to show that the leaf-

factor was undoubtedly intermediate. The offspring for which the leaf-factor has been determined can be arranged in a series of which the limiting values for the leaf-factor are 3·47 and 1·26; in other words, among the offspring there occur both plants with typical 'broad'-lobed leaves and plant, with typical 'narrow'-lobed leaves. The intermediate types have, on self-fertilization, again split up, and their offspring include, in addition to intermediate forms, both extreme types. No offspring have, so far, been raised from plants known definitely to have possessed an extreme leaf-factor.

The colour of the petals is somewhat more intricate, and is in the process of further investigation. For the present purpose it may be described in the simplest form. The petals of the parent plant were red upon a yellow ground, and in appearance were indistinguishable from those of the F_1 generation of the cross *G. arboreum* × *G. herbaceum*. Of the 30 plants in the second generation eight bore flowers with yellow petals, while the remainder gave flowers with red petals—this colour varying, however, from the pure red of *G. arboreum* to the red upon a yellow ground of the parent. In the third generation complications have arisen. In all cases the parents of this generation bore flowers with the petals red upon a yellow ground. They may be tabulated thus:—

Parent.	FLOWER COLOUR.				
	Yellow.	White.	Red	Red on yellow.	Red on white.
1	8	...	4	8	...
2	...	...	6	7	...
3	6	1	...	13	8
4	1	...	...	1	...
TOTAL ...	15	1	10	29	8

Other characters, each as the leaf glands, stigmatic glands, colour of cotton etc., have been recorded, and all show similar variation. It is impossible to arrive at other conclusion, then, that plants, such as the above, are the product of natural crossing. In the present case one parent is undoubtedly *G. arboreum*, the other parent is doubtful. The occurrence of two similar plants from the same sample would indicate that the parent was the direct product of a cross between two plants of which *G. arboreum* was the seed parent, but of which the pollen parent remains doubtful.

It is as yet impossible to state with certainty to what extent cross-fertilization takes place. The evidence so far obtained indicates that natural crossing occurs with sufficient frequency to

render it impossible to keep types pure when they are grown in the proximity of other types. During the present season the offspring—numbering nearly 2,000—of 60 plants belonging to the two species, *G. neglectum* and *G. indicum*, have been raised. A few only of these 60 plants have bred true. Without doubt, in certain cases, the parent was itself impure. In other, and not a few cases, however, the variability was as certainly the direct result of natural crossing.

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5. Note on the Shrine of Taunsa.

By LIEUTENANT-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*

The following description of the important Shrine of "Taunsa Sharif," in the district of Dera Ghāzi Khān, has been translated and considerably abridged from a short manuscript-history of the shrine, written and sent to the translator by Miyyān Maḥmūd, *Ṣāhib-zāda*, son of the late *Fakhr^u 'l-Auliya^s* Khwāja Allah Baksh, who occupied the *gaddi* for about fifty-two years. During his *sajjāda-nishīni*, the translator had the honour of being a guest of the shrine for a fortnight. There was then accommodation in the serais for some seven thousand pilgrims, for whom a staff of eight hundred *lāngrīs* or cooks was said to be employed. The history is written up to date.

TAUNSA SHARIF.

Taunsa Sharif lies in the district of Sanghar, about 45 miles north of Dera Ghāzi Khān and six miles to the west of the Indus.

Situation.

There is a tradition that once some king of Khurāsān, on a visit to India, reached the site of Taunsa, and there lost by death a certain pet

Origin of Name.

peacock. To perpetuate its memory, he erected a monument over its tomb. The tomb has disappeared, but the village that rose on its site was named, after the bird, Taunsa, a corruption of *tā^sūs*, a peacock. Latterly, *i.e.*, for the last century, the epithet 'Sharif' has been added on account of sacred associations.

There are two traditions regarding the origin of the village.

Foundation.

According to one, some four hundred years ago, a pastoral tribe called *Bhutta* or *Jat* resided in this spot. Later, another tribe called *Chacha* immigrated here from Rakhni in the Sulaymān Range. When the latter tribe settled at Taunsa, a lady was at the head of the *Bhuttas*, and she married her son to a daughter of the chief of the *Chachas*, and thus both tribes dwelt together, sharing the land. The second tradition is that the *Chachas* were the original inhabitants, and that the *Bhuttas* subsequently settling near them, both intermarried. Though the village is of great antiquity, it was, a century ago, no more than an ordinary pastoral village. It consisted of but a few mud huts; its primitive inhabitants cultivated only common crops, wore a coarse kind of cloth, and subsisted chiefly on milk.

In the middle of the 12th century A.H., there lived, in

Gurgoji, a village in the Tahsil of Bāzār Mūsā Khayl, an Afghan tribe called Ja'far Durāni. One of its members was Zakariyā Khān.

Rise.

Like his brethren he was a cultivator and a herdsman. He was pious and hospitable. Though no richer than his fellow-villagers, he was regarded by all with respect, on account of his ancient family and high character. In the year 1188 A.H., he had one son, born after three successive daughters. Mountain superstition has decided that such a child, locally styled *tirikkil*, is inauspicious; so this fortunate infant was regarded with suspicion by the tribe, and the death of its father, shortly after its birth, confirmed their suspicions.

As the child grew up, the signs of greatness appeared in his countenance; the tribe gradually changed its opinion, and local prophets began to predict great things of his future. While this child was still in his honourable mother's auspicious womb, a saintly beggar came to her threshold asking for alms. Knocking at the door, he cried out, "O inmates of this house! a great and perfect saint will be born to you; his foundations are already laid. Numbers of God's creatures will be benefited by his existence, but I shall not live to see his day; you should therefore bestow on me something now, out of bounty." The beggar was rewarded, and in course of time his prediction was verified.

Another version is that an "abstracted" saint used to visit the mother of the infant during her pregnancy, treating her with unusual respect. On being questioned as to the reason, he predicted that she would bear a noble child who would enlighten the Earth, from the East to the West.

A third tradition states that in old days there were no barbers in these mountain villages, so the mountaineers had to shave each other. When this sainted boy grew up, a certain pious man used to come to shave him, exhibiting great affection; but the boy used to flee from him. People asking the man the reason of his ill-requited service received the reply: "This saint will say prayers over my corpse, and through his prayers I shall attain salvation."

Years later the youth related: "Once, while returning from the Panjab, I heard voices from behind a neighbouring mound. Fancying there were robbers, I proceeded with caution, but found the voices came from men of my own tribe. I found the man who used to shave me lying dead. There was none to say prayers over the corpse, so I performed the burial service, and thus the man's prophecy was fulfilled."

While this sainted youth was still a child, his father marched from this transient world for the mansions of Eternal Bliss.

When about 12 years of age, according to local custom, he travelled to the villages of Sokar, Jhang, Taunsa and others, to study religion, spending some time at each place. As the horse of his ambition could not stop at the ordinary stages, he abandoned his native place for Kot Maṭhan, situated about 80 miles from

Dera Ghāzī Khān. This place was then a seat of learning. In it there dwelt a godly sage, by name Qāzī 'Aqil Muḥammad (Peace be on him), a *khāṣṣa* of Ḥazrat Qibla-yi-'Ālam, *Muḥārawī*. The youth became a pupil of Qāzī Muḥammad 'Alī, brother of the first-named Qāzī, and studied under him for a year or two. During this period this "Murshid" or elder brother of the Qāzī Ṣāhibs went on a pilgrimage to Uch Sharif, on the opposite bank of the river, in the Native State of Bahawalpore, to visit the tomb of Makhdūm Sayyid Jalāl^u 'd-Din Bukhārī. The Qāzī Ṣāhib was accompanied by all his pupils. The Qāzī's predecessor had been desired by his religious teacher, Maulānā Fakhr^u 'd-Din of Delhi, to search for this youth. When the youth came to him, the Qāzī at once recognised him, and, according to the instructions of his Pir, joyously made him his disciple. The youth spent six years in the study of esoteric doctrines (*'ulūm-i bāṭini*), and within this short time attained a perfection, such as others have failed to obtain in a lifetime. After his teacher's death, he left and settled at Taunsa, which place gradually rose to importance. This youth, who had received from his Pir the name of Muḥammad Sulaymān, will henceforward be styled the Khwāja Ṣāhib.

In the meantime the Khwāja Ṣāhib had married. As soon as he settled at Taunsa Sharif, the inhabitants became secure from the inroads

Development. of the mountaineers, and men from all parts came in large numbers to visit him. Disciples came to him, not only from the Panjab, but from Hindustan, Baluchistan, Kashmir, Afghanistan, and from Persia and Arabia. During his prosperous days there was a great influx of learned Muslims. Through his efforts *Madrasahs* were established, to which students from distant parts resorted to study Arabic, Persian, the *Ḥadīṣ*, *Tafsīr* and *Fiqh*. Learned men versed in Physics, Mathematics, Philosophy, and Medical Science, gathered together at Taunsa. The people of the Sanghar District were hopelessly ignorant and illiterate, but the Khwāja Ṣāhib made the district, especially Taunsa Sharif, a rival of Baghdad. Polite manners and rules of conduct for civil life were taught to the people, who began to realize the difference between man and the lower animals.

There were more than twenty teachers for teaching the **Religious Teaching.** Qur'^{ān}; and hundreds of *Ḥāfiṣ*,—blind and seeing,—were turned out yearly. At this period all could at least read the Qur'^{ān}.

Spiritual training (*ta'lim-i taṣfiya-yi bāṭini*) was studied, and Ṣūfis thronged to the spot. *Zikr-i Jalī* (audible prayers) and *Zikr-i Khāṣṣī* (inaudible prayers) were practised, and at night the murmur of prayer and religious cries drowned all other sounds.

At the beginning of his career, the Khwāja Ṣāhib lived a simple life, spending most of his time in solitude. Sometimes, for weeks at a time, none could obtain even a glimpse of him. However, after he attained the Perfect Life (*Takmil-i Sulūk*), he used to hold something like a public assembly where all, from prince to beggar, were treated without distinction.

He opened a public library and collected many ancient books by known authorities. This library was the largest in India, next to the Royal Library.

Public Library.

Great attention was paid to caligraphy. Many people earned their livelihood by this profession. Qur^ʿāns transcribed by Ḥājī Muḥammad were treasured in Kashmir, Persia, and Afghanistan, and copies by him were sent as presents to high personages of Sindh, to Nawāb Bhawal Khān and other nobles, and even to the Emperor himself at Delhi. Though these manuscripts were necessarily not illuminated, still they fetched as much as a thousand rupees a copy.

Practice of Caligraphy.

The chief source of livelihood was agriculture, the land being irrigated by the perennial streams from the Sulaymān Range. Some of the rich disciples of the Khwāja Ṣāhib diverted the current of a nullah named 'Mudchūr,' and owing to this increased supply of water many people took to cultivation.

Agriculture.

For drinking purposes there was at Taunsa but one well. Few could then afford to sink a well, which, in that district, had to be unusually deep. However, during the prosperous days of the Khwāja Ṣāhib three new wells were sunk.

Public Works.

Amongst the influential men who were disciples of the Khwāja Ṣāhib was Muḥammad Massū Khān, Balūch, of the Nutkāni tribe. Born in Mangrota, he was Governor of Sanghar, and practically an independent ruler under Ranjit Singh. It was owing to the influence of the Khwāja Ṣāhib, that Muḥammad Massū Khān earned the reputation of being a rival of Nosherwān and Ḥātim. Under instructions from the Khwāja Ṣāhib, Massū Khān undertook many public works of benefit, such as the construction of irrigation-canals, *bands*, etc. This chief, who lived at a distance of three miles from the Khwāja's village, used to visit him every alternate day, and kept permanently in the village one Shaykh Muḥammad Yār, as his representative, who used also to superintend the alms-kitchen (*langar*).

Massū Khān, Balūch, was succeeded by his grandson

Muḥammad As'ad Khān.

Muḥammad As'ad Khān. At first the new chief sought and followed the Khwāja Ṣāhib's advice, and all went smoothly; but, shortly, the chief fell under the influence of irresponsible and unprincipled men, and by their advice he, one by one, dismissed his old officers. The Khwāja Ṣāhib reasoned with him in vain. The result of his imprudence was that the new chief was twice imprisoned and ended his days like a common man. His descendants, still living, are poor and common people. Ranjit Singh sent to the Khwāja Ṣāhib, through Diwān Sānwal Mal, the Ṣubadār of Multan, some valuable presents as a token of esteem.

This Governor with his son, Mūlrāj, became devoted followers of the Khwāja Ṣāhib.

Nawāb Bhāwal Khān III and his family were also amongst the disciples of the Khwāja Ṣāhib. The Nawāb wished to grant him a *jā-gir* for the extension of the *langar*; but the Khwāja Ṣāhib for certain reasons declined. The Nawāb then sanctioned a money grant for the maintenance of the *langar*, and fixed allowances for those connected with the *langar* as well as for the needy, and there are still some living who are recipients from this fund.

Shāh Shujā' Durāni once came to the Khwāja Ṣāhib requesting him to supplicate the Deity on his behalf,¹ but as he could not conceal his royal arrogance in his speech and as his plans were not for the public good, he had to return unsuccessful.

The Multāni Pathāns, who were then rulers of Derā Ismā'il Khān, were all disciples of the Khwāja Ṣāhib; and the Khwāja Ṣāhib was ever a loyal subject to the Government of the time. During the Sikh rule, he did nothing to offend, and the Governors treated him well. When, with a view to curb the increasing influence of Mūlrāj, the British attacked Multan, the Pathān ruler of Derā Ismā'il Khān sought the Khwāja Ṣāhib's advice. He was counselled to obey the British and to send his men against Multan, which counsel he was wise enough to follow. From that time forward, the Pathāns of Derā Ismā'il Khān have remained well disposed to the British Government, and ready to help whenever necessary. The just Government repaid their services at Multan by granting them *jāgirs*, which are still enjoyed by their descendants. The Wāhhābis of Delhi raised an army for a *jihād* against the Sikhs, and collected in numbers near Peshāwar, inviting the Khwāja Ṣāhib to join them; but he declined to war against his rulers.² His desire was peace and education.

The Khwāja Ṣāhib lived a very simple life, dwelling in a mud-hut. His dress and diet was as simple as possible, and all money received in presents was distributed in charity. His talents and energy were solely devoted to the public good. As death is the lot of all, the Khwāja fell ill; and in spite of all the efforts of Khudā Yār Khān, the physician of Nawāb Bhāwal Khān, and of costly medicines sent by the Nawāb himself, he breathed his last on Thursday before day-break—“Verily to God do we belong; verily to Him do we return”—and found a habitation in the highest heaven. He was so studiously observant of prayers and fasts, that, on the night of his death, he said his *ishā* prayer several times and died while praying. So loved and respected was he by all, that even Hindu

¹ *Mannat murād māngnā.*

² By Delhi Wāhhābis, the author means those Wāhhābis of Patna and elsewhere that had settled amongst the Pathāns across the border. Their leader was Sayyid Ahmad of Rai Bareilly. The British took the side of Ranjit Singh.

ladies mourned his death. It would fill a volume to detail all the miracles performed by him ; but to draw down a blessing on my head I will mention one or two.

No famine visited this bare and rainless country during his life-time ; for when there was fear of drought, he directed the people to pray for rain at the tombs of certain saints, and their prayers always received an immediate answer. So efficacious were his prayers, especially in this respect, that he was styled *Menh-vasā'orā*, or the "Rain-bringer." Once in the month of *Sāvan* (July and August), when the river Indus was in deep flood, his *qāfila* wished to cross, but the Governor had impressed all the boats for Government purposes. The *Khwāja* remarked that the river was occasionally fordable and he directed the *qāfila* to try. All plunged into the water, which at once became knee-deep. When the *qāfila* had crossed in safety, the river again rose to its former level. The writer has heard this fact from persons who were of the party and whose evidence cannot be disbelieved ; it is also corroborated by contemporary writings. Lāl *Khān*, the second son of *Massū Khān*, Balūch, was a high-handed tyrant and imprisoned certain respectable men of the *Khosa* tribe in the village of "Miṭi," about 25 miles south of *Taunsa*, meaning to kill them. Some people came to the *Khwāja Sāhib* to pray for their delivery, and he himself started to plead for them. On hearing of his coming, the ignoble chief put the prisoners to death. On receiving the news, the *Khwāja* returned exclaiming, "Cursed be Lāl, ill-deserving the name ; his name shall die." When Lāl *Khān* heard this, he raised his arm and cried out, "*Hazrat Sāhib, mujhe bandūq mār-deve !*" After this there was fighting between the *Khosas* and *Nutkānis*, and Lāl *Khān* was wounded. When being borne off the field in a *dūlī*, he was continually hit in the very hand he had defiantly raised against the *Khwāja*.

The *Khwāja Sāhib* had three sons who died during their father's life-time. The eldest, *Gul Muḥammad*, left two sons ; *Khwāja Allah Bakhsh*, who succeeded his grandfather, and *Miyān Khayr Muḥammad*, who became a *majzūb* saint of the highest order : all his prayers were heard.

Khwāja Allah Bakhsh succeeded his grandfather at the age of 27, and crowned the improvements started by the former. It was during the time of this 'Pride of Saints' (*Fakhr^u 'l-Auliya^h*) that *Taunsa* became *Taunsa Sharif*. The number of schools was doubled. The pecuniary condition of the *langar* improved greatly, and meat and vegetables were added to the ordinary bread-ration doled out to the students and the poor. Special arrangements, too, were made for the accommodation of pilgrims.

Besides being a saint, a mystic, and a seer, *Khwāja Allah Bakhsh* was also a skilled physician. He was too, by nature, a great organizer. His disciples were innumerable. They came from *Afghanistan*, *Baluchistan*, and *Arabia*, to gain their 'objects.'

[N.S.]

The first thing he did was to settle the accounts of the *langar*. He had all sums due to the shop people transferred to his private account and gradually paid them in full. He then, at the cost of a lakh-and-a-quarter built a *Khāngāh* over the old *Khwāja*, the cost being partially defrayed by Nawāb Bhāwal Khān. The tomb of the elder Khwāja is very fine. Though built only of brick, it surpasses stone, both in beauty of structure and durability. In the north and south of the *Rawza-yi-Sharif* are two *majlis-khāna* unsupported by pillars, which, on account of their dimensions, are considered triumphs of engineering skill. On their east and west sides are domed verandahs.

The income from presents was chiefly spent on improving the *langar-khāna*. Once, during a famine, the young Khwāja Ṣāhib daily distributed large quantities of food to thousands of starving poor. Crowds of the hill tribes swarmed to Taunsa for relief. As his charity tended to make its recipients idle, the *Fakhr^u 'l-Auliya^h* commenced building and made all the poor work, except students and faqirs.

During the short period of his life, five buildings were erected, wells were sunk, carpet manufactories were established, and even glass-lamps were made. Artisans settled in Taunsa, and, as it were, a new epoch of civilization dawned on that favoured spot.

He also encouraged agriculture, and it was through his influence that the Sanghar canal was repaired. He further built an embankment to safeguard the town against inundation, half the cost being defrayed by him, and half by the British Government.

He succeeded in preserving peace amongst the hill tribes round, who, under his guidance, became peaceable artisans. He was a loyal subject to the British. During the great mutiny of 1857, a force composed of his Afghān and Balūch disciples took part in the siege of Delhi. The British Government showed their recognition of his services, and the Viceroy, when making a tour in the district, paid a visit to him at his own residence. When Lord Northbrook visited the Dargāh, he expressed a desire to bestow a *jā-gīr* on the *Fakhr^u 'l-Auliya^h*, who, however, was then absent on a pilgrimage to Ajmere, and so the matter fell through. Later, when the Lieutenant-Governor, Sir D. Fitzpatrick, visited the place, the *Fakhr^u 'l-Auliya^h* was exempted from appearing as a witness in law-courts, as his enemies, in spite, used needlessly to enter his name as a witness, and by causing him to be summoned as such, lower his dignity in the eyes of outsiders. At the same time his camels were exempted from *begār*.

Three classes, chiefly Afghans, used to come to the *langar-khāna*. First, rich men as guests. Second, religious mendicants. Third, small merchants who used to tarry a month or two on their way to Hindustān. Learned men from Hazarah, Rawalpindi, Shahpur, and Jheelum, also visited or settled at Taunsa. Population and trade greatly increased. The *Fakhr^u 'l-Auliya^h* used, annually, to visit Mahār Sharif in Bhawalpore, the burial place of his *Dādā Pīr*. He also, every alternate year, visited Pāk Paṭan, on the occasion of the 'Urs of *Hazrat Bābā Ganj-i Shakur*. On these occasions he used

to take with him a large number of the residents of Taunsa, for the development of trade. He also visited the holy shrines at Delhi, Ajmere, Allahabad, Ahmadabad, and Aurangabad, taking with him men from Taunsa, who thus acquired the arts of architecture, painting, stone-cutting, carving, calligraphy, and tailoring, etc. The art of glazing earthenware was learnt and practised in Taunsa. He also, at his own expense, sent a man to *Hindustān* to learn clock-making. Returning to Taunsa, this artizan made the town clock there, the sound of which can be heard for miles round. All the machinery and materials of this clock were made at Taunsa itself, and European visitors have often remarked on the excellence of the workmanship. The same artizan also made many watches, which were sent out as presents. He is now engaged in making a town clock at Pāk Paṭan, for the tomb of the *Babā Šāhib*.

In 1881, or 1882, the *Fakhr^u 'l-Auliya^z* went on the pilgrimage to Mecca. Hundreds of his followers accompanied him on the *Hajj* and took with them merchandise on which they made a good profit.

The mosque of the old *Khwāja*'s time was improved and made to give ample accommodation to the numerous travellers. A marble dome over the mosque was erected at a cost of seventy-five thousand rupees. By this, the shrine was beautified, and the poor also provided with work.

The *Fakhr^u 'l-Auliya^z* died in 1319 A.H. at the advanced age of 80. Even on his death-bed he

Death.

continued to impart religious teachings to his descendants and disciples. ("Verily from God we come; verily to Him do we return.") He ever tried to keep the peace between the Hindus and the Muhammadans. The day of the *Fakhr^u 'l-Auliya^z*'s death was to the people of Taunsa as the Day of Resurrection. The Government courts and schools were closed; Hindus and Muhammadans shut their shops; there was a general mourning in the town. He was buried in the *Rauza* by the side of his sainted grandfather, and a world-illuminating sun disappeared from the ken of mankind.

The *Fakhr^u 'l-Auliya^z* left two sons. The eldest *Khwāja*

Sons.

Hāfiẓ Muḥammad Mūsā, aged 50, succeeded him, and the youngest *Hazrat* Muḥammad Sā^zin became his right hand. Though the *gaddi* was the right of the elder, the *Tauliyat*¹ of the *Masjid* and the *Kliānqāh* were divided equally between the two brothers, according to the will of the deceased. *Hāfiẓ* Muḥammad Mūsā died five years later, in the month of *Zu 'l-Hijjah*, in 1324 A.H. Though no progress was made in his time, still there was no decline. His son, *Miyān Hāmid*, aged 31, succeeded to the *gaddi*, and *Makhdūm-zāda Hazrat Miyān Maḥmūd Šāhib* continued to act as minister. Though *Miyān Maḥmūd Šāhib* did not succeed to the *gaddi*, he is said to be regarded as the real successor in spiritual matters.

Most of the traders and shop people of Taunsa *Sharif* are

¹ Management of mosques, shrines or holy places.

Hindus, though there are a few Muhammadan merchants. The trade of the town extends to Karachi, Bombay, Lahore, Multan, and **Ḍerā** Ismā'il Khān. Salt, *gur*, rice, cotton, iron, and cloths, are the chief articles of import; while food-grains (especially mustard seed), embroidered shoes, and combs of *kāhū* wood are exported.

Two 'Urs or Anniversaries are held—one in the month of Ṣafar from the 1st to the 13th, and the other in the month *Jumādā 'l-Awwal*, from the 27th to the 29th. The former is

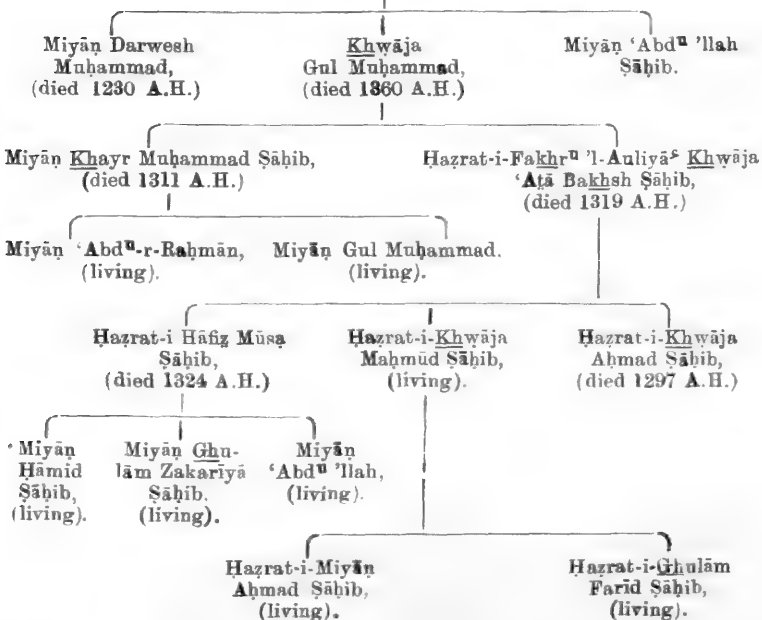
in commemoration of the death of the old **Khwāja**. People attend from a distance, many as traders, but more as pilgrims. A sacred singing party (*majlis-i-samā'*) is held, and experts are rewarded. In this, the whole of the Qur^ʿān is first read aloud (*Khātm-i-Qur^ʿān*) and then the *Qawwāls* sing their sacred *ghazals*. The second 'Urs is held with even greater pomp.

The chief places of interest in Taunsa are the **Khānqāh** and its surrounding buildings, the clock tower, the *Shīs-Maḥall*, the mosque, the Government buildings, *i.e.*, the *Tahṣīl*, the Police station, the Hospital, the Post Office, and the Middle English School.

GENEALOGICAL TABLE.

HAZRAT-I-KHWĀJA MUḤAMMAD SULAYMĀN,

(died 1267 A.H.)



JANUARY, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 1st January, 1908, at 6-30 P.M.

G. THIBAUT, Esq., Ph.D., C.I.E., Vice-President, in the chair.

The following members were present :—

Dr. N. Annandale, Mr. I. H. Burkill, Mr. F. Doxey, Major W. D. Hayward, I.M.S., Dr. M. M. Masoom, Lieut.-Colonel D. C. Phillott.

The minutes of the last meeting were read and confirmed.

The following six candidates were balloted for as Ordinary Members :—

Babu Suresa Chandra Ghatak, M.A., Deputy Magistrate, Eastern Bengal and Assam, Dacca, proposed by Pandit Yogesa Chandra Sastri-Sankhyaratna-Vedatirtha, seconded by Mahamahopadhyaya Satish Chandra Vidyabhusana; *Captain I. M. Conway Poole*, I.A., Allahabad, proposed by Lieut.-Colonel D. C. Phillott, seconded by Lieut.-Colonel W. J. Buchanan, I.M.S.; *Mr. A. N. Moberly*, I.C.S., Sambalpur, proposed by Dr. N. Annandale, seconded by Captain R. E. Lloyd, I.M.S.; *Dr. H. M. Crake*, Plague Medical Officer, Calcutta, proposed by Major L. Rogers, I.M.S., seconded by Dr. W. C. Hossack; *Lieut.-Colonel H. W. Pilgrim*, M.B., F.R.C.S., I.M.S., Surgeon Superintendent, Presidency General Hospital, proposed by Major L. Rogers, I.M.S., seconded by Mr. T. H. Holland; and *Assistant-Surgeon Upendra Nath Brahmachāri*, 1st Physician, Campbell Hospital, proposed by Lieut.-Colonel G. F. A. Harris, I.M.S., seconded by Major L. Rogers, I.M.S.

The Adjourned Meeting of the Society was held on Wednesday, the 8th January, 1908, at 9-15 P.M.

G. THIBAUT, Esq., Ph.D., C.I.E., Vice-President, in the chair.

The following members were present :—

Dr. N. Annandale, Mr. I. H. Burkill, Mr. D. Hooper, Mr. W. W. K. Page, Rev. A. H. Phillips, Lieut.-Colonel D. C. Phillott, Maulvie Abdus Salam, Pandit Yogesa Chandra Sastri-Samkhya-ratna-Vedatirtha, Pandit Umapati Dutta Sharma, Mahamahopadhyaya Satis Chandra Vidyabhusana, and Rev. A. W. Young.

Fifty-eight presentations were announced.

The General Secretary announced that Pandit Rajendra Nath Vidyabhusana and Pandit Promatha Nath Tarkabhusana had expressed a wish to withdraw from the Society.

The General Secretary reported the death of Sayid Abdul Alim, an Ordinary Member of the Society.

The Chairman announced :—

1. That he has received two essays in competition for the Elliott Prize for Scientific Research for the year 1907.

2. That Babu Parmeshwar Narain Mahatha and Babu Bhupendra Sri Ghosh being largely in arrears of their subscriptions have been declared defaulters, and that their names will be suspended in the Meeting Room in accordance with Rule 38.

3. That the elections of Mr. S. Khuda Baksh, Mr. T. K. Ghosh, Babu Satyendra Nath Bhadra and Miss Mary Corbitt, have become null and void under Rule 9, as they have not paid their admission fees.

4. That he has received a circular from the National Museum of Natural History of Paris, asking for subscriptions to the memory of A. Lamarck, in order to erect a statue in his memory, and that the Council invites members to subscribe. Subscriptions may be sent to the Treasurer.

5. That Captain R. E. Lloyd, I.M.S., carried on the duties of the Anthropological Secretary for three months, and that Dr. N. Annandale resumed the duties on his return.

The following papers were read :—

1. *Descriptions of a JĀM-I-CHIHIL KALĪD such as that described in Lane's Modern Egyptians, page 254.*—By LIEUT.-COLONEL D. C. PHILLOTT, Secretary, Board of Examiners.

This paper has been published in the *Journal* for December 1907.

2. *Note on a Persian Charm to be used on first seeing the New Moon.*—By M. K. SHIRAZI. Communicated by the Philological Secretary.

3. *Sinhalese Historical Documents and the Maurya Inscription of Sarnath.*—By H. C. NORMAN.

4. *The Babār-nāma Fragments.*—By H. BEVERIDGE.

This paper will be published in a subsequent number of the *Journal*.

5. *The Shrine of Tamsu.*—By LIEUT.-COLONEL D. C. PHILLOTT, Secretary, Board of Examiners.

6. *Note on Indian Mathematics, II.—Aryabhata.*—By G. R. KAYE.

This paper will be published in a subsequent number of the *Journal*.

7. *Studies in the Experimental Breeding of the Indian Cottons, —an introductory Note.*—By H. MARTIN-LEAKE.

The Adjourned Meeting of the Medical Section was held at the Society's Rooms on Wednesday, January 15th, 1908, at 9-15 P.M.

LIEUT.-COLONEL G. F. A. HARRIS, I.M.S., in the chair.

The following members were present:—

Dr. Adrian Caddy, Dr. Arnold Caddy, Captain F. P. Connor, I.M.S., Dr. H. M. Crake, Lieut.-Col. F. J. Drury, I.M.S., Dr. O. M. Eakins, Dr. H. Finck, Dr. H. C. Garth, Dr. W. C. Hossack, Dr. E. A. Houseman, Dr. W. W. Kennedy, Captain M. Mackelvie, I.M.S., Major J. Mulvany, I.M.S., Captain J. G. P. Murray, I.M.S., Major F. O'Kinealy, I.M.S., Dr. J. E. Panioty, Dr. T. F. Pearse, Lieut. A. D. White, I.M.S., and Major L. Rogers, I.M.S., Honorary Secretary.

Visitors:—Dr. G. C. Chatterjee, Dr. H. C. M. Douglas, Dr. C. H. Elmes, Dr. Faulkner, Dr. S. B. Ghosh, Lieut. G. H. Richard, R.A.M.C., Captain G. B. Riddick, R.A.M.C.

The minutes of the last meeting were read and confirmed.

A specimen of imperforate anus in a child was shown by Captain Connor, I.M.S.

The following paper was read:—

“The Value of the Ipecacuanha in the treatment of Tropical Hepatitis and the prevention of Liver Abscess.”—By Captain J. G. Murray, I.M.S. (with lantern slides).

A good discussion followed in which the following joined: Lieut.-Col. Harris, Dr. Arnold Caddy, Major O'Kinealy, Lieut.-Col. Drury, Major L. Rogers. Captain Murray replied.

Dr. G. C. Chatterjee's paper “On a new test for the differentiation of the Bacilli of Typhoid Group” was postponed until the next meeting for want of time.



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

- Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
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6. A Short Note on the Qadam Rasul Building at Balasore.

By MAULVI ABDUS SALAM, M.A. (*Presidency Magistrate, Calcutta.*)

I have yet come across no document yielding exact information as to when the Qadam Rasul building at Balasore was built. But its foundation is popularly associated with the memory of Nawāb Muḥammad Taqī Khān, Nāzim or Governor of Orissā, and son of Nawāb Shujā-ud din Muḥammad Khān (Nawāb or Viceroy of Bengal), who flourished towards the second quarter of the eighteenth century.

I have seen a copy of a Persian *sanad* which lends colour, in some measure, to the above popular belief. The *sanad* in question purports to have been granted by Nawāb Muḥammad Taqī Khān referred to above, and is dated 24th Shawal 1137, Auli year, which corresponds to 1730 A.D. In this *sanad* Nawāb Muḥammad Taqī Khān notifies to the "Amils, Chowdharies, Qaunongos of Perganah Soonhat, Sarkar Raamna, included in Chakla Balasore Port, adjoining to the south of the Province of Bengal," that he has granted *jagirs* of about 30 *batis*, 12 *mans* out of his purchased lands in Rakha Patna Korea, Khodanda, Mauzas Bahal, Bendoo, Balipal, etc., to certain functionaries connected with the Qadam Rasul building, for due performance of their respective duties.

The Balasore Qadam Rasul building is quadrangular in shape and is said to cover 8 *mans* of land. There are four gateway rooms, intended to afford shelter to travellers; two of these still remain, whilst two others have crumbled down. The archway at the gateway is fairly imposing, and from the gateway runs a paved straight pathway to the interior enclosure, containing the actual Qadam Rasul building and the mosque attached thereto. On both sides of the paved pathway, in former days, a flower garden existed. A stone-paved reservoir of water also exists. The actual Qadam Rasul building contains the foot-marks on a stone slate of the Muhammadan Prophet, and of his companion, Ali. In front of the building there is a raised courtyard containing on one side a small mosque, and on the other the Mausoleum of Nawab Sayed Habibullah Khān, a past Governor of Orissā.

A full account of Mir Habib, surnamed Nawāb Habibullāh Khān (a past Governor of Orissā in the days of Nawāb Ali Vardi Khān) is given in the *Sier ul-Mutakberin* and also in the *Riyaz-us Salatin*. He was a man of capacity, resourcefulness and energy. He subdued and conquered the old Hindu Kingdom of Tipperah, whilst serving at Dacca as Diwān of Murshid Quli

Khān II (son-in-law of Nawāb Shujā ud-din). (See my Trans., *Riyaz-us Salatin*, pp. 301 and 302.) He came with his old master in the same capacity to Cuttack, when the latter succeeded Nawāb Muḥammad Taqī **Khān** as Governor or Nāzim of Orissā, and vigorously administered the Province of Orissā. Dissensions, however, broke out between Nawāb Ali Vardi **Khān** (Nawab of Bengal) and Mir Habib's master, Murshid Qulī **Khān II** (Nāzim of Orissā), culminating in a battle at Balasore, in which the latter was defeated, and, in consequence, had to flee from Orissā to the Dakhin. Mir Habib now resolved to avenge the defeat of his old master, and, with this object in view, took a course which eventually proved suicidal and short-sighted. He flung himself into the arms of the Mahratta freebooters of Berar, became their guide, friend and philosopher, and led them to invade and harry repeatedly the fair provinces of Orissā and Bengal for a period of ten years. In the end a peace was patched up between Nawāb Ali Vardi **Khān** and the Mahrattas, and, under its terms, Habibullāh **Khān** became the Governor of Orissā (nominally under Nawāb Ali Vardi, but actually under the Mahrattas). Habibullāh's triumph was short-lived, as all such triumphs inspired by such unworthy motives generally are; he was soon after invited to a feast by the Mahratta leader Janoji (son of Raghujī Bhonsla), who did not scruple to treacherously murder his old guide, friend and philosopher!

I should add that Nawāb Muḥammad Taqī **Khān**, who endowed large properties in connection with the Balasore Qadam Rasul building, and who is popularly supposed to be its founder, lies buried not here, but in the Qadam Rasul building of Cuttack.

The following inscription exists on a slab affixed to the Mausoleum of Sayid Habibullāh **Khān** in the Balasore Qadam Rasul building:—

وفات مرحوم مغفور سيد حبيب الله خان ابن سيد احمد شوستاني بتاريخ
بيست و چهارم شهر شوال سنه يکهزار و يكصد و پنچ هجري النبوي ۱۱۶۵

Translation of inscription.

'Death of Syed Habibullāh **Khān** (on whom be peace!), son of Syed Ahmad Shustani, on 24th Shawal 1165 Hijri.' [Note.—A.H. 1165 corresponds to A.D. 1755.]

In concluding this short note, I may mention that, whilst at Balasore, I enlisted the sympathetic interest of the then Collector, Mr. Egerton, I.C.S., in regard to the renovation of this old historic building, but, before the work of repair and renovation was completed, both Mr. Egerton and myself left the district. May I, therefore, commend the subject of its repair to the Director of Archaeology in Bengal, as this building, like the Qadam Rasul building at Cuttack, deserves to be treated as a historic land-mark in Orissā.

7. Fat of the Himalayan Bear—*Ursus torquatus*, Wagner.

By DAVID HOOPER.

Bear's grease has enjoyed a considerable reputation for several years in Europe, where it has been used as a pomade for the hair. The article, however, sold under this name is chiefly made of animal and vegetable fats, without having any connection with the ursine family. In India bear's fat is sought after for its supposed medicinal properties, and is an article of commerce, being sold in the bazars of Northern India and by shikaris in hill stations. A sample of the fat obtained from Kangra was shown at the Punjab Exhibition in Lahore in 1864, and a specimen from the Kumaon Hills was sent to the Amsterdam Exhibition in 1883.

The fat of this animal is occasionally referred to by travellers. Dr. A. L. Adams (*Wanderings of a Naturalist in India*, Edinburgh, 1867) alludes to the capture of a bear in Ka-hmir and the collection of a considerable quantity of grease. He observed that the external fat was always preferred to that of the internal parts. It was noticed that the fat from the region of the kidney had a strong smell of urine which the shikaris said no refining would remove. In the *Diary of an Indian Officer* (1865) it is stated that the carcase of one animal afforded several bottles of grease "which the ladies found very acceptable."

The fat is easily refined by heating the fatty tissue in a cauldron, as in rendering lard from the leaf of a pig, and straining while hot through a cloth. Another method is to cut up the tissue into long strips, place them in a bottle till full, cork down and keep in the sun. The fat melts and rises to the surface like an oil, when it may be decanted. At ordinary temperatures it is almost white in colour and nearly solid. Bear's grease is burnt in lamps by the poor, and is used for cleaning guns, but it is most appreciated medicinally as an emollient in rheumatism, and as a healing application to wounds, bruises and sores.

The only available analysis of bear's fat is one found in an article on "Some curious oils" by L. F. Kebley and G. R. Pancoast [*Proc. Amer. Pharm. Ass.* (1902), 50, 362]. It is described as a pale yellow, semi-opaque, oily liquid at summer heat, but solidifies in cold weather; having a peculiar odour and a bland taste. It congealed at 9° C., and had a specific gravity of 0.913 at 15°. It had an acid number of 3.93, a saponification number equal to 203.4, and an iodine figure of 80.43. This fat was obtained from the black bear of the United States, but the cinnamon and grizzly bears often furnish the grease.

The two samples—analyses of which are recorded in the present paper—were obtained from Mussoorie, in the United Provinces. No. 1 was purchased in the Landour bazar, and No. 2 was separated

by ether from a small quantity of genuine, though partly decomposing, adipose tissue supplied by a shikari. The fat is locally known as *Balu-ke-cherbee*, and is obtained from the Himalayan black bear (*Ursus torquatus*). Both samples had a yellowish-white colour, a rancid odour, and a soft, granular and pasty consistence at 21° C. (69·8° F.).

The following constants were obtained:—

	No. 1.	No. 2.
Specific gravity at 50°	... 9013	9007
Melting point	... 37·5°	34·5°
Acid value	... 13·8	33·19
Saponification value	... 203·8	204·25
Iodine value	... 52·77	62·80
Reichert-Meißl value	... 93	86

The fatty acids afforded the following constants:—

Percentage	... 94·78	93·81
Melting point	... 42°	40°
Saponification value	... 205·64	207·37
Iodine value	... 57·28	62·98

The fats possessed no distinct drying properties.

The fatty acids of the second sample were converted into lead salts, and, by means of ether, were separated into two portions, yielding 59·1 per cent. of soluble, and 40·9 per cent. of insoluble acids. The soluble fatty acids formed a yellowish liquid oil having an iodine value of 82·36 and an acid value of 198·34. The insoluble fatty acids were white and crystalline, melting at 54°, and possessing an acid value of 214·84.

By recrystallisation from alcohol the solid fatty acids yielded a small quantity of crystals melting at 70°, corresponding to stearic acid.

It would appear from the above constants that the fat of the Himalayan bear consists chiefly of olein and palmitin, and agrees in many of its properties with lard or pig's fat.

8. Oil of *Lawsonia alba*, Lamk.

By DAVID HOOPER.

Lawsonia alba, Lamk., the henna plant of Western Asia, is known as *mehndi* throughout India, where it is found wild or cultivated. The most important use of henna is as an article of the toilet, the leaves being used for staining the nails, hands and feet, and for dyeing the hair.

In Sir George Watt's "Dictionary of Economic Products" it is stated that the seeds yield an oil of which little is known. Since the oil is not referred to in Dr. M. C. Cooke's "Oils and oil-seeds of India," or any more recent work, efforts have been made by the Reporter on Economic Products to obtain a supply of the seeds for examination. Last year the Superintendent, Government Botanical Gardens, Saharanpur, forwarded a few pounds of the seeds, and they were analysed in the Industrial Section of the Indian Museum.

The seeds are contained in a capsule of the size of a pepper-corn, and consist of angular grains of a cinnamon-brown colour, with no pronounced taste or smell, and 1·5 to 2 millimetres long. One hundred seeds weighed only 0·073 gram or 1·126 grains.

They were found on analysis to contain the following principles:—

Moisture	...	...	...	10·60
Oil (by ether)	...	...	...	10·48
Albuminoids	...	...	...	5·00
Carbohydrates	...	...	...	33·62
Fibre	...	...	...	35·55
Ash	...	...	...	4·75
				<hr/>
				100·00
				<hr/>

These seeds are, therefore, not true oil-seeds, and would yield nothing to pressure in a mill. They were dry and fibrous in character, contained some tannic acid, and would be considered very innutritious dietetically.

The oil was thick, dark-green in colour, and slowly oxidised to a solid jelly. It solidified at 25·5° C., and had a slight acid reaction. The iodine value of the crude oil was 121·63, and of the fatty acids 127·45. The oil, except for its green colour, is similar in nature to poppy-seed oil, but can never be expected to rank among commercial fixed oils.



9. Translation of one of the *Tardīyāt* or Poems on Sport, of *Abū Nuʿāṣ*, the Poet-Jester of the Court of *Hārūn* 'r-*Rashīd*.

By MR. D. PETRIE and LIEUT.-COLONEL D. C. PHILLOTT.

TRANSLATION.

ON THE GOSHAWK-TIERCEL.¹

Grey broke the dawn, as forth betimes I went
To fly my noble hawk of pure descent.
Striking with all his poison'd talons' might,
And without ever wearying in his flight.
Full fifty head he brought to bag that day
Some quick, some dead, but all my goshawk's prey :
A bright-eyed, fair, unruffled tiercel he,
From all rude vice, defect and blemish free.
I, on whose wrist he sits, will never part
With one who is the treasure of my heart.
Great price paid I, — my labour was the same
To fortify his sinews and his frame.
The lure and scanty fare were all my school,
Save when I damped his ardour from the pool ;
Now, though fierce pride sustains his spirit still,
His chastened body swift obeys my will.
My voice he hears, attends my orders all,
And ever hastens to my beck and call.
Oft the quick-rising coot,² black as the night,
Seeks safety in the swiftness of its flight ;
Of none avail the speed that it can show
Against so crafty and so strong a foe.
Often my wind-winged hawk, with courage rare,
Has struck and seized its quarry in mid-air.

ORIGINAL.³

قال ابو نواس ينعمت الزرق
قد اعتدي بزرق صبيح * مفض لمن ينسبه صريح
ملت الغدود وانيس ملكيم * ولدس ما يغوز كالصعيد

¹ *Zurraq*, the male of the *bāz* or goshawk : arabicised from the Persian *jurra*.

² *Tuwwal* is described in a note as being a "long legged water-bird."

³ From the *Diwān* of *Abū Nuʿāṣ*, p. 226, Cairo Edition of 1898.

بِكَيْفِ ضَمَانٍ بِهِ شَيْخِيح * مِمَّا اشْتَرَى بِالْقَوْمِ الرِّيحِ
 فَلَمْ يَزَلْ بِالذِّهْمِ وَاللَّقْدِيدِ * وَرَشَّهَ بِالْمَاءِ وَالذَّلْوِجِ
 حَتَّى انطوى الأجنان الروح * وَعَرَفَ الصَّوْتِ وَوَحْيِ المَوْحِي
 فَكَمْ وَكَمْ مِنْ طُولِ طَمُوحِ * لَمْ يَنْجِهْ طَمُوحًا فِي اللُّوْحِ
 مِنْ فُلْتَانٍ صَلْتَانِ شَيْخِ * نُرْجِلُهُ الرِّيحِ بِكَيْفِ الرِّيحِ
 وَضَرْبَةِ بَيْتُوكِ مَذْرُوحِ * فَأَعطَا قَبْلَ الأيْنِ وَالتَّبْرِيحِ

خَمْسِينَ مُسْتَعْيِي أَلَى مَدْبُوحِ

10. The Bābarnāma Fragments.

By H. BEVERIDGE.

In Ilminsky's edition of the Bābarnāma and in Pavet de Courteille's translation therefrom, the authentic memoirs are followed by some chapters which give an account of the last years of Bābar's life and also contain notices of his officers and of some contemporary poets. The authentic memoirs break off in the beginning of 936 A.H. 1529, or about fifteen months before Bābar's death, and the Fragments carry on the narrative down to his illness and death. They also give some details about the victory of Khānwa and other events of the year 933-36—matters which are also described in the authentic memoirs. In the latter, however, though Bābar gives an account of the preparations for the battle, he does not give us in his own words any description of the victory, and presents us instead with the grandiose Bulletin of Shaikh Zain.

Dr. Teufel has shown in an elaborate paper in the *D.M.G. Zeitung*, Vol. 37, 1883, p. 141, that the Fragments are, in all probability, a translation from the Akbarnāma of Abū-l-Fazl; and he has also argued with great ability and learning that the Fragments cannot be authentic, as their Turki is different from, and inferior to, Bābar's compositions. There can be no doubt that Abu-l-Fazl's account and the Fragments either derive from one common source, or that one of them is a translation of the other, and Dr. Teufel has pointed out that Ilminsky had also observed the coincidence between the two. Ilminsky, apparently, has described the corresponding passage of Abū-l-Fazl as occurring in the introduction to the *Ain-Akbarī*, but by this he clearly means the historical part of the Akbarnāma, which is often spoken of, and was regarded by Abū-l-Fazl himself, as an introduction to the *Ain-Akbarī* on "Institutions of Akbar."

The interesting question is, who was the author of the Fragments, or, if they are not original compositions, who translated into Turki the Persian of Abū-l-Fazl? Possibly the first part of them that, namely, in which the first person is used, was written by Bābar himself, though if so it is extraordinary that it does not occur in the Haidarabad MS. of the Turki memoirs, or in the Persian translation ascribed to 'Abdu-r-Rahīm. But the whole of the Fragments cannot be Bābar's, for they record his death. This part must be an addition made to complete the biography on the same principle as Timur's memoirs have been rounded off with a notice of his death.

My own impression is, and long has been, that Bābar's great-grandson, Jahāngir, is the author of the Fragments, or rather the translation into Turki of the account on the Akbarnāma; and I

think that Dr. Tenfel would have thought so too, had he been aware of the passage in Jahangir's memoirs, which says that he wrote with his own hand four chapters, or parts of Bābar's memoirs. The passage is thus translated in Elliot and Dowson's History of India, Vol. vi, p. 315:—

“With the object of acquiring information about the history of Kabul, I used to read the *Wāqī'at Bābarī* which, all except four parts (*juzū*), was written with his Bābar's own hand. To complete the work, I copied these parts (*ajzā*) myself, and at the end I added¹ some paragraphs in the Turkish language to show that they were written by me. Although I was brought up in Hindustan, yet I am not deficient in reading and writing Turkī.”

The impression above referred to has recently been deepened by my finding from the excellent British Museum MS. Or. 3276, p. 69^b, that in most of the other MSS. of the *Tūzak Jahāngiri* and in Saiyid Ahmās's imprint an important word has been omitted from the passage. According to them, Jahāngir's words are *Magar chahār juzū ke āmrā bu khat khud navishtam*, “Except four chapters (or parts) which I wrote with my own hand.” But in Or. 3276 the words are *Magar chahār juzū gum, āmrā bu khat khud navishtam*. “But four chapters were missing (or wanting), (and) these I wrote with my own hand.” I suggest that the four missing chapters here spoken of are the Fragments or, at least, those portions of them which Babar could not possibly have written. If Jahangir wrote them, their absence from the Haidarabad MS. and from Abul-r-Rāḥim's translation is explained. We know from the *Tūzak Jahāngiri* that Jahāngir was well acquainted with the Akbarnama, and that though he killed the author, he never scrupled to copy his descriptions. What then more likely than that he should desire to show his knowledge of Turkī, and to complete his ancestor's book by finishing the biography which had broken off abruptly more than a twelve month before Bābar's death? I think, too, that the Indian and Persian expressions in the Fragments are better explained by the hypothesis that the Fragments were written by Jahangir than by Dr. Tenfel's idea that they were composed by a Sārt or an Uzbeḡ in order to make his manuscript more valuable.

It will be observed that Jahāngir does not clearly say where and when he wrote the four chapters. The passage occurs in the narrative of the second year of his Memoirs, and is included in the account of his visit to Kabul. But he may have composed the chapters at an earlier period, and possibly as an exercise in his school days. It will also be seen that in the translation in Elliot, Jahāngir is made to say that he wrote the four parts *in order to complete the work*. This looks as if the word *gum* had occurred in the MS. used by the translator.

¹ This is rather an obscure sentence. How could the added words strengthen the evidence that the four chapters were written by Jahāngir, if the latter were in his own handwriting? And why say that the addendum was in Turkī if the four parts were also in that language?

² It is written *kam* in the MS. and it may be *kam*, that is, “short, deficient.”

[N.S.]

Another question remains, namely, where did Abū-l-Faḡl get his information about Bābar's last years and about his officers and the poets of his court? Some of it he got from the Tarikh Rashidi and from Gulbadan Begam's Memoirs, but there are other statements, the source of which does not appear. Abū-l-Faḡl was writing nearly seventy years after Bābar's death, and it is not likely that he got such facts as the merits of Turkī poets from oral tradition, or his own investigations. Like most other Oriental writers he borrows, whenever he can, and generally without acknowledgment. I am inclined to think that somebody—perhaps Bābar's secretary, Shaikh Zain—carried Bābar's memoirs down to his death, writing them in Persian, and that Abū-l-Faḡl, who probably did not know Turkī, copied therefrom. Some support to this view is given by Abū-l-Faḡl's statement that Bābar wrote his memoirs down to the time of his departure from this world. This may be mere rhetoric, but it may also contain a real fact, and may refer to that part of the Fragments which is written in the first person.



11. Note on the calm region in the atmosphere above Calcutta, which, during the cold season, is at a height of about 3,000 feet.

By C. LITTLE.

For many years I have had a desire to obtain definite information regarding the air movements at different heights above us: and at times I have collected items of information which, however, even when allowed to accumulate, have not become sufficiently comprehensive to make publication urgent. The importance of such information is allowed by all who are interested in meteorology. The necessity is readily proved by a reference to weather reports and the attempts to forecast the weather during the coming 24 hours. These attempts are on no higher a basis than the mail forecasts which one reads of in the newspapers, depending, as these do, on the telegraphed reports of the departure and probable arrival of the mail steamer. Until other information can be brought in nothing better can be anticipated.

Ever since I began to see that more information was necessary towards the solution of weather problems, I have been wondering how far it is possible to penetrate into the secrets of the air over Calcutta, in a cold season day, say, with blue sky everywhere and not a cloud visible. When there is cloud visible something can be seen, but even that is of doubtful advantage because the height of the cloud is not known. In other places where men are working in this direction, kites have been used, and what are called sounding balloons. In my opinion kites are of no use in this part of the world, because of the calm region which I have made the subject of this paper. I think it may be taken as certain that, however strong the wind may be at the ground level, if it dies away with increased height, a kite will not rise far and it will never be made to pass through a region of calm or of light winds. Kites which are intended to rise high, have to be made strong, and must be held by steel wire, of which they will take out perhaps several miles. They cannot, therefore, be used except in winds of 10 to 20 miles an hour. Such would be useless in Calcutta, except on a few occasions each year, and then they would be of doubtful assistance.

A long time ago I tried to use the light country kites to show convection current in a still warm day in April and May. They showed these currents very clearly, but watching them was trying to the eyesight.

The days on which I used them were so still that even the lightest kites with the lightest thread would not remain up of themselves. They had to be kept continually going by the jerks with which kite-fliers are familiar. By these jerks I kept them up at a height of two or three hundred feet, until a

convection current came their way. Then away they went, pulling out string at about five miles an hour, almost straight up, and soon they were out of sight. I had nothing except the string moving away into space until, perhaps, 2,000 feet had been pulled out. Then it would slacken and I began taking it in. On these occasions I was never able to get a pull on the kite again. By the time I had the string in the kite was amongst the trees. From that fact I inferred that, as soon as the kite ceased to pull, it got into a downward current which brought it rapidly to the ground again.

There was one item of information which I obtained from these observations, and it was this: If there were any cloud about, there was always one just above one of these convection ascensional currents. The cloud had the appearance of air rising below it and of spreading out, and dissipating at the edges. From what I have since seen, I believe that at that height very important changes take place, that is, at the height of about 3,000 feet. One of these being of the nature of a check to the ascensional convection currents which begin near the earth's surface, the upward current ceases and the downward current begins. Up to the level of the cloud we have an ascending current in the centre surrounded by descending air on all sides. While the kite remained in the central part it moved upwards; when it passed out of that it moved downwards about as rapidly. I don't suppose the kites I observed ever reached half way to the top. If they had reached as far as the cloud, they would have gone no further. My belief is that at that cloud the movement ends.

Watching such small objects in the heat and glare of an Indian summer day meant, I found, that I would soon not be able to see at all. I consequently discontinued it.

But the idea remained that it would be possible to collect valuable information by inexpensive means, I turned my thoughts to paper balloons, and it is some of the information that I have so collected that I propose to put before the Society in this paper.

I had no thought of imitating the wealthy meteorologists in other parts of the world, who could send into space a silk balloon with an equipment of self-registering apparatus, trusting to have the balloon, etc., returned by the finder. I had no money for such work, even if there had been much likelihood of such a balloon ever being returned by the astonished Indian finder. All I could do was to get the lightest paper, make a balloon of the most convenient size, fill it with some sort of gas, and take observations of its position with the best assistance and best instruments available. All of these seem easy, but in reality many difficulties arose at every step. Procuring paper, cutting it into the most suitable and, though only paper, most economical shapes, gumming the parts so that at the time of inflating there would be no escape of gas, the provision gas; and, last but not least, taking observations which would give the position of the balloon at regular intervals. This last part could only be done by trained observers, and the observers had to be trained.

I have much pleasure in stating here that I am under a great obligation to Mr. James Watson, Manager of the Gas Works. When, with the view of trying how far I could rely on coal gas to give the elevation I desired, I asked Mr. Watson if he would allow me to inflate some of my balloons in his grounds, he not only had a suitable pipe fixed up, but he said that the gas required by me for experimental purposes would be at my disposal free of charge.

As I believe these observations to be the first of the kind made in Calcutta, I will state in some detail what was done. The balloons used were of four sizes—2, 3, 4½ and 6 feet in diameter respectively—made of what is called grease-proof tissue paper. As showing one of the practical difficulties I experienced, I may state that the most suitable paper for the purpose is not available in Calcutta except on a special order. I discovered that white ants had a special liking for that paper and would overcome difficulties to reach it which they would not trouble with for ordinary paper. My first consignment was ruined by these penetrating insects.

The two smaller sizes I used with hydrogen gas, the larger sizes with coal gas. I found that the six-foot balloons were about as large as I could manage, taking into consideration the strength of the material and the surface exposed to the ground wind. I also found that the smaller balloons filled with hydrogen gave me almost as much information as the larger ones filled with coal gas. The greatest height the large balloons attained was reckoned by me to be 10,000 feet, and I could easily reach 4,000 with the two-foot balloon and 6,000 with the three-foot one. The heights given in this paper being all under 5,000, the smaller balloons were of sufficient rising power for my present purpose.

The measurements were made with a telescope of 3-inch objective. At first I used a ruled glass diaphragm for measuring the size of the image of the balloon, but latterly I have used a micrometer. For all except comparatively small distances the focal length of the telescope may be taken to be 42 inches. If D be the diameter of the balloon in feet, d of the image inches in the field of view of the telescope, y the distance of the balloon in feet, we have

$$\frac{y'}{D'} = \frac{42''}{d''}$$

or $y=42 \frac{D}{d} = \frac{126000}{x}$ feet for a balloon of 3' diameter, x being

the number of thousandths of an inch given by the micrometer.

The micrometer was an ordinary reading micrometer with the larger divisions in hundredths of an inch, which could be easily subdivided to thousandths or even less. There was, of course, a limit to accurate measurement due to the thickness of the threads of the micrometer and the difficulty of placing the wires in an accurate tangential position to a small moving object, but I consider I made reliable measurements of the diameter of the image to five thousandths of an inch.

The measurements of the time elapsed, and of the altitude and azimuth circles have latterly been taken and recorded by Babus Rakhaldas Chakravarty, Demonstrator and Babus Rajanikanta De and Janaki Nath Lahiri, Student-assistants in the Astronomical Observatory of the Presidency College. I have also received much ready assistance from Mr. S. Woodhouse of the Mathematical Instrument Department.

From the above it will be seen that a good deal of trouble is involved in such observations, and that they cannot be made with any pretence to accuracy without fairly extensive preparations, and what is most difficult of all to obtain in this part of the world, skilled assistance.

It is not my intention to give in this paper the whole or even a considerable part of the results I have obtained. I hope to have them worked out at leisure, and published elsewhere when I have time and opportunity to look up the work done by others in this direction. Here I have little chance of keeping up with the times; all I can hope for is to keep up with, and perhaps get ahead of, meteorological work in Calcutta and its neighbourhood, no very lofty ambition as I understand it.

One definite problem which I have had in view for some time is the calm region, a short way up during the cold season. One has occasional hints of its existence. For example, when the captive balloon at Olympia, two years ago, was cast loose for a voyage in space, it moved eastward and rose slowly until it reached this calm region. There it remained as if anchored for a long time. I accidentally saw it in that position and thought it must be fixed by some mechanical means, it was so motionless. I subsequently saw in the newspapers that it was becalmed.

On any ordinary cold weather day, when there is not very much wind, there is no difficulty in obtaining information of the height of the calm region and of the thickness of that layer of still air. One of the first series of observations I obtained at the gas works was of a kind characteristic of the first half of the cold weather, and I will give figures and diagrams showing what the air currents were that evening, the 19th December 1907. The former are given in the table immediately following, and the diagrams in Plate I.

I may explain that in the lower curve will be found the horizontal position of the balloon, the scale being 2,000 feet to the inch, with east and south in the usual topographical directions. The position of the balloon in the curve at the various times of observation, that is, at intervals of two minutes, is shown by the numbers at the side of the curve, these being the numbers of the observations in the table.

The upper curve in the diagram gives the height of the balloon, the corresponding numbers of the observations being shown along the base line, and the scale being 2,000 feet to the inch.

The observations Nos. 4, 5, 6, 7 are of most importance in connection with the subject of this paper. From the observations

or from the horizontal position curve, it may be readily seen that not only is the air, at the height the balloon was then, at very nearly in a state of rest, but that above 4,000 feet altitude there is quite a different wind direction from what there is below 3,000. In fact the directions are almost diametrically opposite. Between observation No. 4 and No. 5 the wind is from the north-east, and that between No. 5 and No. 6 from the south-west. After passing the 4,000-foot altitude the westerly wind becomes more rapid, and oscillates about a direction a little to the north of west, that is, up to a height of about 7,000 feet. For higher altitudes the direction tends to become almost due west, but it is very exceptional for the balloons of the size I have used, and with the gas at my disposal, to rise above 7,000 feet. On one occasion only did the observations indicate a height of about 10,000 feet, and then the balloon was moving eastward.

TABLE I.

Table giving observations, etc., for December 19th, 1907, corresponding to the curves in Plate I.

No. of observation.	Time in minutes from beginning.	Diameter of the image in thousandths of an inch.	Azimuth observation.	Altitude observation.	Distance in feet deduced from col. 3.	Height deduced from col. 5 and 6.	Horizontal distance deduced from 5 and 6.	No. of observation.
1	2	3	4	5	6	7	8	
0	0	...	0	0	0	0	0	0
1	2	99.0	E 38° S	27°	1,900	850	1,700	1
2	4	53.0	60	27	3,560	1,600	3,200	2
3	6	33.7	70	24-40	5,600	2,300	5,100	3
4	8	29.5	78	26	6,400	2,800	5,800	4
5	10	27.0	80	28	7,000	3,300	6,200	5
6	12	25.9	77	31-30	7,300	3,800	6,200	6
7	14	25.9	73	35	7,300	4,200	6,000	7
8	16	24.2	61	37	7,800	4,700	6,200	8
9	18	19.7	45	32	9,600	5,100	8,200	9
10	20	17.5	38	29	11,000	5,500	9,800	10
11	22	14.3	33	26	13,200	5,800	12,000	11
12	24	12.6	26	24-30	15,000	6,100	13,500	12
13	26	10.5	21	21	18,000	6,400	16,500	13
14	28	5.2	17	17-30	23,000	6,700	22,000	14
15	30	7.5	15	16-30	25,000	7,000	24,000	15
16	32	7.0	14	15-30	27,000	7,300	26,500	16
17	34	6.7	13	15-0	28,000	7,300	28,000	17
18	36	6.3	14	14-15	30,000	7,200	29,500	18

TABLE II.

Table giving observations, etc., for January 25th, 1908, corresponding to the curves in Plate II.

No. of observation.	Time in minutes from the beginning.	Diameter of the image in thousandths of an inch.	Azimuth observation.	Altitude observation.	Distance in feet deduced from col. 3.	Height in feet deduced from col. 5 and 6.	Horizontal distance deduced from col. 5 and 6.	No. of observation.
1	2	3	4	5	6	7	8	
0	0	...	0	0	0	0	0	0
1	2	97.0	E 15° N	50°	1,300	1,000	800	1
2	4	49.4	20	46	2,550	1,800	1,800	2
3	6	35.5	26	47	3,550	2,600	2,400	3
4	8	29.7	28	51	4,250	3,300	2,700	4
5	10	25.4	29	54	4,950	4,000	2,900	5
6	12	23.8	22	58	5,300	4,500	2,800	6
7	14	22.1	6	59	5,700	4,900	2,960	7
8	16	19.4	E 12° S	54	6,500	5,300	3,800	8
9	18	15.5	23	44	8,100	5,700	5,800	9
10	20	12.6	19	37	10,000	6,000	8,000	10
11	22	10.5	12	31	12,000	6,200	10,000	11
12	24	9.3	7	28	13,600	6,400	12,000	12
13	26	8.0	4	26	15,700	6,700	14,000	13
14	28	7.2	2	23	17,500	6,800	16,000	14
15	30	6.6	1	22	19,000	7,000	18,000	15
16	32	5.7	0	19	22,000	7,200	21,000	16

I will presently attempt to show how important the layer of the atmosphere between 3,000 and 4,000 feet is in connection with weather changes, and how necessary it is that information should be collected regarding that level during the cold season. At this stage I will merely point out that the existence of this layer of still air was until now only a matter of surmise, because no attempt has been made to find out what is happening except on the ground level. All I have been able to show is that there are unexpected changes of wind at that height. Correct information is required regarding the humidity and temperature also. Such observations could, without much difficulty, be organised and at no great cost. Though the cost would not be great it is not within my limits.

Throughout the observations I have made in the cold season—and they are fairly numerous—embracing disturbed as well as settled weather, the westerly current appears day after day to begin at almost the same height. The balloon if sent off in the evening follows in settled weather a curve almost invariably like that of Plate I. up to the figure 5, then it almost quite suddenly and at times with such unexpected velocity shoots off to the east that

the image passes in a few seconds out of the field of view of the telescope. If there is smoke or haze about, as not infrequently happens in the cold weather, the balloon is lost for good and the observations cease for that day. In the case I have given, it will be seen that between observations 12 and 14 the velocity is greater considerably than between 9 and 11. In the former case it amounts to over 20 miles an hour, whereas in the latter it is only about half of that. Sometimes it seems as if the higher velocity were lowest, and it is in such cases that unless carefully watched the balloon may be lost altogether. But whether these results as regards magnitude be correct or not, there can be no question as to the sudden change of wind direction and velocity in passing through the calm region.

Another point of, I think, first-class importance, emerges from the observations I have made in weather which, though not seriously disturbed, is still not of the settled cold-season type. The settled cold weather is cloudless, and the slight disturbance to which I refer is shown by passing clouds. These are usually of two kinds, (1) cirrus at a height of probably of 20,000 feet or more. They pass across the sky from almost due west, and while within range of observation undergo almost no change. They are supposed to be due to a disturbance such as takes place in a thunderstorm, originating probably in a region of heavy cloud and rain in the west, and it may be at a distance of hundreds if not thousands of miles. Moving, as they probably do, with velocities of 30 to 40 miles an hour, the moisture which is thrown up in the thunder cumulus to a height of, it may be, 20,000 to 30,000 feet, is carried eastward and falls slowly in the form of minute crystals. With these high cirrus clouds this paper has no connection. But there is a second class of cloud which becomes visible occasionally in the cold weather, it may be all through the day, but more especially in the evening. These are low clouds and have an intimate connection with the calm region which I am here discussing.

Assuming the air movement, at the different levels through which the balloon passes, to be horizontal, the curve giving the horizontal displacement of that object will also give the air movement. It will be seen from the curve that in the lower levels there is a good deal of variation, and that above 4,000 feet the general wind direction is westerly. If, therefore, a cloud is seen to have a motion from the west it would undoubtedly be higher than 4,000 feet, whereas a cloud which was at rest or was moving from a direction say southerly or northerly, would as certainly not be in the upper current. If it were at rest it would certainly be in the calm region, and if it had a motion differing considerably from one towards the east it would as certainly be below the calm region. What I have observed is that a great part of the cloud which forms in the cold season consists of two layers, one just below and one just above the calm region, and I have also noticed that the reverse or compensating movements of these two layers of air, that is, of one immediately below and one just above the calm region, have a well-marked connection with the occurrence of rainfall.

If further evidence be necessary as to the existence of cloud below the calm region, I may state that a balloon, while under observation, has been frequently seen to enter a cloud at an elevation of less than 3,000 feet.

Beginning with the lowest cloud as having a height of about 3,000 feet, it is comparatively easy to indicate the height and character of the more lofty cloud formations at a time when weather is just beginning to be unsettled. At such times a not uncommon feature in Lower Bengal is a line of huge cumuli on the eastern horizon lit up by the setting sun. The base line which is well defined, and is at a height of 3,000 feet, has an angular elevation of about 2° at a distance of 18 miles, allowing 200 feet for the effect of dip. The cumulus clouds are rapidly changing. They rise to a height which is well defined, and which, with the base line at a height of about 2° , is generally about 8° , if there be no thunder. If at 18 miles' distance the top of the cloud subtends an angle of 8° , then the height is roughly 12,000 feet. At that height stratus clouds form, and it is by no means uncommon to see the cumulus with its tip just visible over the layer of stratus through which it has penetrated. At the same time the layer of air in which the stratus cloud forms, appears to have a retarding effect on the ascending cumulus, because, generally, the ascending motion ceases at that point. The top of the cloud becomes flat and is seen to drift away eastward.

If the ascensional motion should be sufficiently strong to overcome the obstacle which it meets at that level, then electrical effects begin. It appears that in air which has not been seriously disturbed lightning begins at a height of about 15,000 feet. A thunder-storm occurs with a cumulus cloud which has risen above 12,000 feet, and it may be to a height of between 20,000 and 30,000. The cirrus cloud which I have referred to above is formed in the highest layer to which the cumulus ascends. I have been unable to fix by this means the height of the cloud layer which is just above the calm region, that is, at a height of more than 4,000 feet.

These measurements can be made with what is, I believe, fair accuracy with a line of cumuli at the distance I have mentioned or at a somewhat greater distance. But as they all depend upon the height of the base line, it will be evident that any considerable increase in the distance will materially lower that line towards the horizon and will, therefore, make its estimation more difficult owing to haze, etc., as well as to the loss of measurable quantity.

I may mention, as showing the distance at which these cumuli are visible in the clear air such as we have at the end of the monsoon season, that I have seen just above the horizon the bright tip of a cloud which I knew from its appearance to be about 6,000 feet high. It must have been 200 to 300 miles away.

Plate I

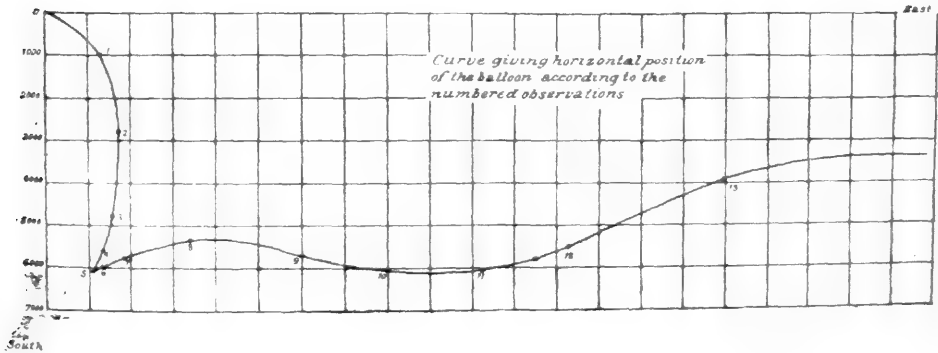
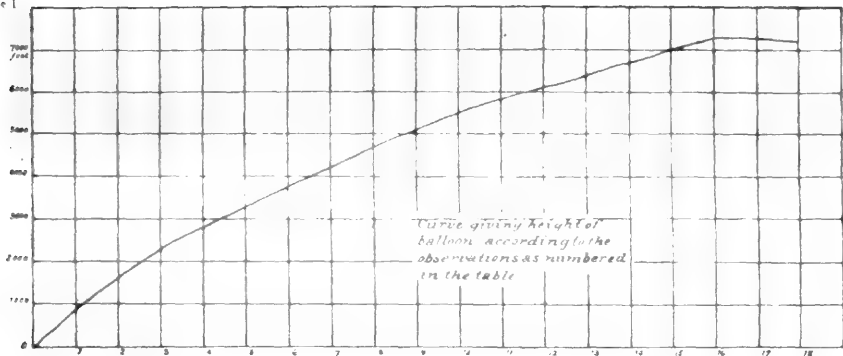
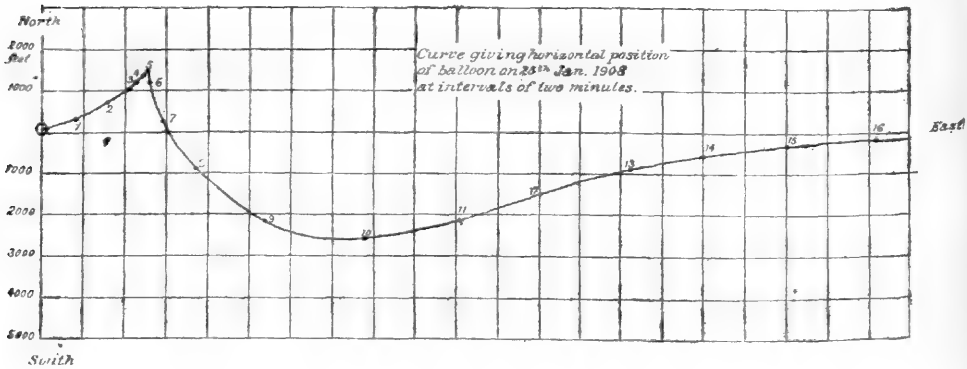
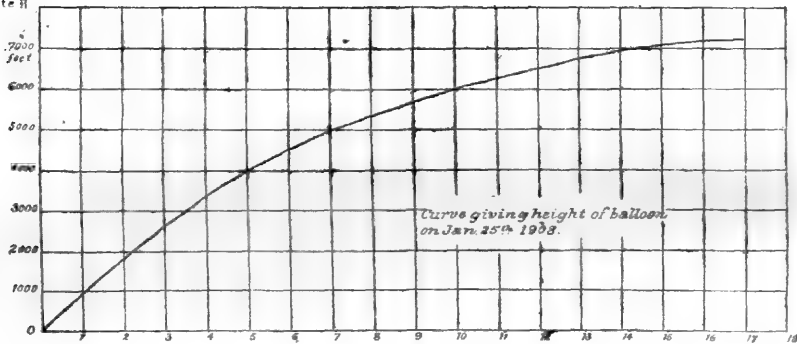
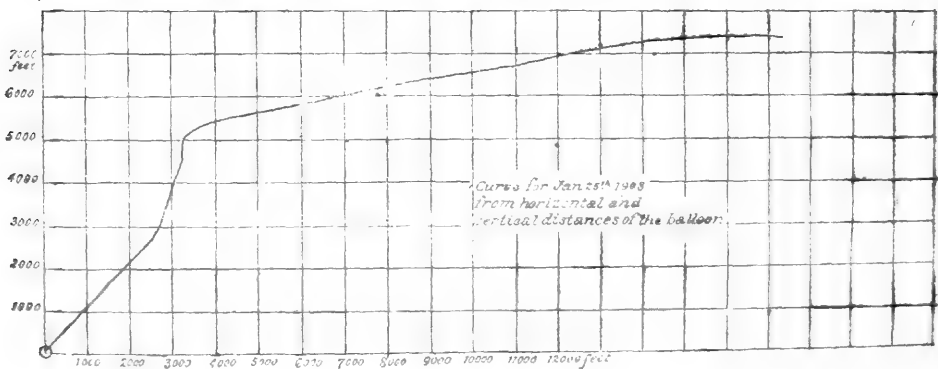
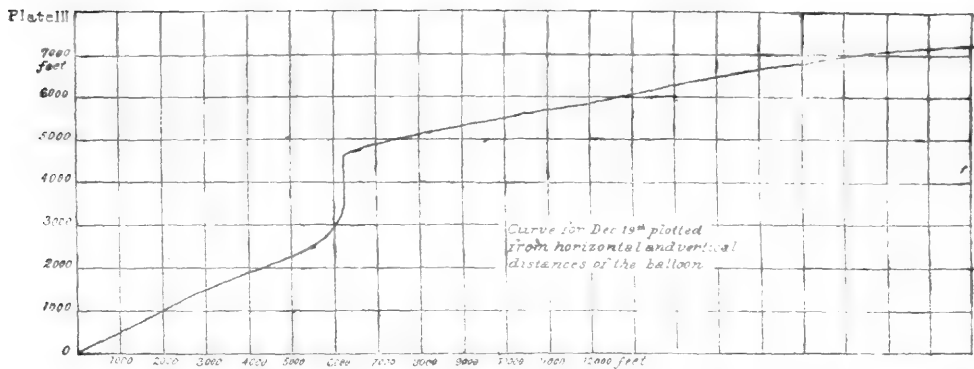


Plate II





12. Hindustani-English Vocabulary of Indian Birds.

By LIEUT.-COLONEL D. C. PHILLOTT and PANDIT GOBIN LAL
BONNERJEE, *Board of Examiners.*

In the dictionaries, the names of birds, like the names of plants, are rarely translated correctly. Jerdon, however, is remarkable for his extreme accuracy, though his spelling is somewhat erratic. The following vocabulary has been compiled almost entirely from Jerdon and his spelling has been retained, except in the cases of those words that have been met with by the compilers in the course of reading. The Urdu and Hindi names only have been extracted. The number against a name is the serial number in Jerdon. Vocabulary of the Urdu and Hindi names of birds is compiled from Surgeon-Major T. C. Jerdon's "Birds of India."

A

- Abābūl*, The Common Swallow (*Hirundo rustica*, L.). 82.
,, The Common Indian Swift (*Cypselus affinis*, Gray). 100.
Abulī, The Indian Bank Martin (*Cotyle sinensis*, Gray). 89.
Ābī, The Large Stone-plover (*Esacus recurvirostris*, Cuvier). 858.
Ābī Barā } The Large Stone-plover (*Esacus recurvirostris*,
,, *Khariwānak* } Cuvier). 858.
Ablaq Maynā, The Pied Starling (*Sturnopastor contra*, Linnæus). 683.
Agyiyā, The Rufous-tailed Finch-lark (*Ammomanes phænicura*, Franklin) 758.
Agin or Agyā, The Singing Bush-lark (*Mirafra cantillans*, Jerdon). 757.
Agyiyā, f., The Bengal Bush-lark (*Mirafra assamica*, McLelland). 754.
Alipāt (in Sindh), The Shoveller (*Spatula clypeata*, Linn.). 957.
Amrai kā Ghughū, The Brown Fish Owl (*Ketupa ceylonensis*, Gmel.). 72.
Andhā Baylā, The Pond Heron (*Ardeola leucoptera*, Boddaert). 930.
Andhī Chirī (*i.e.*, The Blind Bird), Hodgson's Frog-Mouth. (*Otothrix Hodgsonii caprimulgus*, Lin.). 106.
Argul, The Bearded Vulture; 'Golden Eagle' of the Anglo-Indians (*Gypaetus barbatus*, Lin.). 7.
Ateran (in Dera Ismail Khan), The Common Swallow (*Hirundo rustica*, L.). 82.

Āwānk (in Kapurthala), The Night-heron (*Nycticorax griseus*, Linnæus). 937.

B

Babla, The Common Indian Swift (*Cypselus affinis*, Gray). 100.

Bagati Jumiz (Golden Eagle), The Dwarf Eagle (*Aquila pennata*, Gmel.). 31.

Bagerā or *Bageri*, The Short-toed or Social Lark (*Calandrella brachydactyla*, Temminck). 761.

Bag-hāns (*i.e.*, Heron-goose), The Flamingo (*Phœnicopterus roseus*, Pallas). 944.

Baghoda, The Short-toed or Social Lark (*Calandrella brachydactyla*, Temminck). 761.

Baglā, *andhā* } The Pond Heron (*Ardeola leucoptera*, Boddaert). 930.

„ *kanā* }
 „ *Barā* } The Large Egret (*Herodias alba*, Linnæus). 925.
 „ *Malang* }
 „ *Torra* }

Bahmanī (or *Bāhminī*) *Chil*, The Maroon-backed Kite (*Haliastur Indus*, Bodd.). 55.

Baḥri, vide *Bhyri*.

Bakht-titar, The Common Sand-grouse (*Pterocles exustus*, Temminck). 802. Vide *Ban-titar*.

Bamani bayā, The Striated Weaver-bird (*Ploceus manyar*, Horsfield). 695.

Bamuni Mainā, The Black-headed Myna (*Temenuchus pagodarum*, Gmelin). 687.

Banaras, The Black-necked Stork (*Mycteria australis*, Shaw). 917.

Ban-bakrā (*i.e.*, Jungle-goat), The Himalayan Black Bulbul (*Hypsipetes psaroides*, Vigors). 444.

Ban-bakrā, The Rusty-cheeked Scimitar-babbler (*Pomatorhinus erythrogenys*, Gould). 405.

Banchil, The Cheer Pheasant (*Phasianus Wallichii*, Hardwicke) 809.

Bang-gor (*gaur* ?), The Hair-crested Stork (*Leptoptilos javanica*, Horsfield). 916.

Ban-murgh, The Red Jungle fowl (*Gallus ferrugineus*, Gmelin). 812.

Ban-sarrah, The Black-throated Jay (*Garrulus lanceolatus*, Vigors). 670.

Ban-titar, The Black-throated Hill-Partridge (*Arboricola torquola*, Valenciennes). 824; also *bakht-titar* q.v.

Bānū.ā, The Indian Snake-bird (*Plotus melanogaster*, Gmelin). 1008.

Barā-baglā, The Large Egret (*Herodias alba*, Linnæus). 925.

Barā-podnā, The Yellow-eyed Babbler (*Pyctorhis sinensis*, Gmelin). 385. [859.]

Barsiri, The Stone-plover (*Oedienemus crepitans*, Temminck).

- Bar-titar* (or *Bhar-titar*), The Common Sand-grouse (***Pterocles exustus***, Temminck). 802.
- Bāsha* (the female), The European Sparrow-hawk (***Accipiter Nisus***, Linn.). 24.
- Bāshin* (the male), The European Sparrow-hawk (***Accipiter Nisus***, Linn.). 24.
- Bata*, The Large Egret (***Herodias alba***, Linnæus). 925.
- „ The Spotted-billed Duck (***Anas pœcilor-hyncha***, Pennant). 959.
- Batan*, The Spotted Redshanks (***Totanus fuscus***, Linnæus). 896.
- Battan*, *Burra*, The Grey Plover (***Squatarola Helvetica***, Gmelin). 844.
- Battan Choṭā*, The Golden Plover (***Charadrius longipes***, Temminck). 845.
- Bater*, The Black-breasted Quail (***Coturuix coromandelica***, Gmelin). 830.
- Bater Barā*, The Large Grey Quail (***Coturuix communis***, Bonaterre). 829.
- Bayā*, The Common Weaver-bird (***Ploceus baya***, Blyth). 694.
- Bāz* (the female), The Goshawk (***Astur palumbarius***, Linn.). 21. *Jurra* (male).
- Besrā* (the female), The Besra Sparrow-hawk (***Accipiter Virgatus***, Tem.). 25.
- Bharka Bharak*, The Common Snipe (***Gallinago scolopacinus***, Bonap.). 871.
- Bhanvrā*, Black Vulture (***Otogyps calvus***, Scop.). 2.
- Bhalal* (in Muttra), The Bengal Bush-lark (***Mirafra assamica***, McLelland). 754.
- Bhīmrāj* or *Brīng-rāj* (i.e., King of the bees), The Large Racket-tailed Drongo (***Edolius paradisens***, Lin.). 284.
- Bhiriri* (in Bhagalpur), The Bengal Bush-lark (***Mirafra assamica***, McLelland). 754.
- Bhooro*, The White eared Crested Bulbul (***Otocompsa leucotis***, Gould). 459.
- Bhora* or *Bho-ara*, The Indian Lorikeet (***Loriculus vernalis***, Sparrm.). 153.
- Bhuchanjā* or *Bhujangā*, The Common Drongo-shrike, The “King-crow” of Europeans in India (***Dicrurus macrocerus***, Vieillot). 278.
- Bhurut*, The Indian Sky-Lark (***Alanda gulgula***, Franklin). 767.
- Bhyr* or *Bhair*, The Snow Partridge (***Lerwa nivicola***, Hodgson). 817.
- Bhyri* for *bahrī* (the female) } The Peregrine Falcon (***Falco***
„ *bachchu* (the male) } ***peregrinus***, Gmel.). 8.
- Boot-bur*, The Painted Sand-grouse (***Pterocles fasciatus***, Scopoli). 800.
- Bor* (in Kashmir), The Night-heron (***Nycticorax griseus***, Linnæus). 937.
- Brait* (in Kashmir), The Little Egret (***Herodias garzetta***, Linnæus). 927.

- Buchangā* for *bhuchangā*, q.v., The Common Drongo-shrike, The "King-crow" of Europeans in India (*Dicrurus macrocercus*, Vieillot). 278.
- Bukht-titar* or *Bur-titar*, The Large Sand-grouse (*Pterocles aenariarius*, Pallas). 799.
- Bulal chasm*, The Small Minivet (*Pericrocotus peregrinus*, Lin.). 276.
- Bulal chasm*, The Yellow-eyed Babbler (*Pyctorhis sinensis*, Gmelin). 385.
- Bulbul*, The Common Bengal Bulbul (*Pycnonotus pygæus*, Hodgson). 461.
- Bulbul*, The Common Madras Bulbul (*Pycnonotus hæmorrhous*, Gmelin). 462.
- Bulbul, Husainī* } (The white bird) } The Paradise Fly-catcher
 " *Shah* } } (*Tchitrea paradisi*, Lin.).
 " *Rung* } (The red bird) } 288.
 " *Sultāna* }
- Bur*, The Bittern (*Botaurus stellaris*, Linnæus). 936.
- Burī chirī* (i.e., The bad bird), The Indian Screech-owl (*Strix javanica*, De Wurmb). 60.
- Būtimār* (in Kapurthala), The Blue Heron (*Ardea cinerea*, Linnæus). 923.
- Buza* } The Warty-headed or Black Ibis (*Geronticus papil-*
 " *Kālā* } *losus*, Temminck). 942.
- Bya*, The Rose-coloured Starling (*Pastor roseus*, Linnæus). 690.

C

- Chachari*, The Indian Tit-lark (*Corydalla rufula*, Vieillot). 600.
- Chākā*, The Common Snipe (*Gallinago scolopacinus*, Bonap.). 871.
- Chāhān* (in Dera Ismail Khan), The Indian Roller (*Coracias indica*, Linn.). 123.
- Chāk*, The Grey and Yellow Wagtail (*Calobates sulphurea*, Bechstein). 592.
- Chak-dil*, The White-throated Fantail (*Leucocerca fusciventris*, Franklin). 291.
- Chakotra*, The Common Grey Horn-bill (*Meniceros bicornis*, Scop.). 144.
- Chakwā* or *Chakwī*, The Ruddy Shieldrake (*Casarca rutila*, Palms). 954. [145.]
- Chalotra*, The Jungle Grey Horn-bill (*Tockus gingalensis*, Shaw).
- Chamma: h buza* or *Chamcha-buza*, The Spoon-bill (*Platalea leucorodia*, Linnæus). 939.
- Chanda-ban-i*, The Alexandrine Parrakeet (*Palæornis alexandri*, Lin.). 147.
- Chandina* (in some parts of India), The Hair-crested Stork (*Leptoptilos javanica*, Horsfield). 916.
- Chandiari*, The Hair-crested Stork (*Leptoptilos javanica*, Horsfield). 916.

[N.S.]

- Chandūl* or *Chandūr*, The Large-crested Lark (*Gulerida cristata*, Linnæus). 769.
- Chapākī* (in Derajat), The Spotted Owlet (*Athene brama*, Tem.). 76.
- Chappour*, The Grey-headed Lapwing (*Chettusia inornata*, T. and Schleg.). 854.
- Charaj* or *Charz*, The Bengal Florikin (*Sypheotides bengalensis*, Gmelin). 838.
- Charaz* or *Charz* (in Baluchistan hills near Dera Ghazi Khan). The Lesser Florikin (*Sypheotides auritus*, Latham). 839.
- Charchara*, The Plain Brown Munia (*Munia malabarica*, Linnæus). 703.
- Chargh* (the female), The Saker or Cherrug Falcon (*Falco sacer*, Schlegel). 10.
- Charghela* (the male), The Saker or Cherrug Falcon (*Falco sacer*, Schlegel). 10.
- Chatak*, The Pied-crested Cuckoo (*Coccyzus melanoleucos*, Gmel.). 212.
- Cheea*, The Lesser White-throat (*Sylvia curruca*, Gmelin). 583.
- Cheor* or *Chīr*, The Cheer Pheasant (*Phasianus Wallichii*, Hardwicke.) 809.
- Chappa* or } Hodgson's Frogmouth (*Otothrix Hodgsonii capri-*
Chippak } *mulgus*, Gray). 106.
- Chil*, The Common Kite (*Milvus Govinda*, Sykes). 56.
- Chilchil*, The Striated Bush-babbler (*Chatarrhœa caudata*, Dumeril). 438.
- Chillu*, The Stone Pipit (*Agrodroma campestris*, Lin.). 602.
- Chimnāj*, The Button-quail (*Turnix Sykesii*, A. Smith). 835.
- Chīnd-kh-khurai*, i.e., Frog-eater (in Bammu). The Purple Heron (*Ardea purpurea*, Linnæus). 924.
- Chinjara*, The Hair-crested Stork (*Leptoptilos javanica*, Horsfield). 916.
- Chipkha* or *Chippak*, (the male, incorrectly female) The Shikra (*Micronisus badius*, Gmel.). 23.
- Chirchira*, The Madras Bush-lark (*Mirafra affinis*, Jerdon). 755.
- Chīrī* } The Indian House Sparrow (*Passer*
" *khas* (in the south) } *indicus*, Jard. and Selby). 706.
" *Jungli*, The Yellow-necked Sparrow (*Passer flavicollis*, Franklin). 711.
- Chitlā* or *Chītālā*, The Spotted Dove (*Turtur suratensis*, Gmelin). 795.
- Chobaha*, The Spotted Sandpiper (*Actitis glareola*, Gmelin). 891. [703.]
- Chorga*, The Plain Brown Munia (*Munia malabarica*, Linnæus).
- Chughl*, The Spotted Owlet (*Athene Brama*, Tem.). 76.
- " *Besra*, The Brown Hawk-owl (*Ninox scutellatus*, Raffl.). 81.
- Chughl, Jungli*, The Jungle Owlet (*Athene radiata*, Tickell). 77.
- Chūhāmār*, The Long-legged Buzzard (*Buteo canescens*, Hodgson). 45.

- Chukor*, The Chukor Partridge (*Caccabis chukor*, Gray). 820.
Chulla charz, The Lesser Florikin (*Sypheotides aritus*, Latham). 839.
Chupka or *Chopka*, The Spotted Sandpiper (*Actitis glareola*, Gmelin). 891.
Churaka, The Little Grebe (*Podiceps philippensis*, Gmelin). 975; also *Pandūbi*.

D

- Dab-churi*, Hodgson's Frogmouth (*Otothrix Hodgsonii caprimulgus*, Gray). 106.
Dabhak (Squat-bird) Hodgson's Frogmouth (*Otothrix Hodgsonii caprimulgus*, Gray). 106.
Dabhak churi (*i.e.*, Squat-sparrow), The Black-bellied Finch-lark (*Pyrrhulanda grisea*, Scopoli). 760.
Dabki, The Button-quail (*Turnix Sykesii*, A. Smith). 835.
Dad hāl (in Dera Ismail Khan), The Dwarf Eagle (*Aquila Pennata*, Gmel). 31.
Dahak, *Dauk* or *Duwak*, The White-breasted Water-hen (*Gallinula phœnicura*, Pennant). 907.
Dalchidi, The Red-headed bunting (*Euspiza luteola*, Sparman). 722.
Darya gajpaon (*i.e.*, Sea-Longshanks), The Oyster-catcher (*Hæmatopus ostralegus*, Linnæus). 862.
Dasari or *Dasarni*, The Bald Coot (*Fulica atra*, Linnæus). 903.
Dashtmāl (*Tera* in Darajat), The Pale Harrier (*Circus Swainsonii*, A. Smith). 51.
Dayāl or *Dayār*, The Magpie-Robin (*Copsychus sanlaris*, Linn.). 475.
Dew-kāo (in Kashmir), The Common Indian Crow (*Corvus splendens*, Viallot). 663.
Dhak, The White Stork (*Ciconia alba*, Belon). 919.
Dhan-Churi, The Malabar Pied Hornbill (*Hydrocissa coronata*, Bodd). 141.
Dhanmar, The Common Grey Hornbill (*Meniceros bicornis*, Scop.). 144.
Dhapri, The White-bellied Drongo (*Dicrurus œrulescens*, Lin.). 281.
Dhar or *Dhal Kowa*, The Indian Corby (*Corvus culminatus*, Sykes). 660.
Dheri-kowa, The Indian Corby (*Corvus culminatus*, Sykes). 660.
Dhobin (*i.e.*, the washerwoman), The White-faced Wagtail (*Motacilla luzoniensis*, Scopoli). 590.
Dhodhar (in the Punjab), The European Raven (*Corvus corax*, Linnæus.) 657.
Dhoti, (the male), The Besra Sparrow-hawk (*Accipiter virgatus*, Tem.). 25.
Dig-dull, The Red-billed Blue Magpie (*Urocissa sinensis*, Linnæus). 671.

[N.S.]

- Diyora*, The Black-bellied Finch-lark (***Pyrrhulanda grisea***, Scopoli). 760.
- Doda*, The European Raven (***Corvus corax***, Linnæus). 657.
- Dokar* or } The Shell Ibis (***Anastomus oscitans***, Boddaert).
Dokhahar } 940.
- Dokh*, The Pelican Ibis (***Tantalus leucocephalus***, Gmelin). 938.
- Dom-kāk*, The European Raven (***Corvus corax***, Linnæus). 657.
- Door*, The Striated Wren-warbler (***Burnesia lepida***, Blyth). 550.
- Doria-bagla*, The Cattle Egret (***Buphus coromandus***, Boddaert). 929.
- Dūbaru*, The Tufted Duck (***Fuligula cristata***, Ray). 971.
- Dukul*, The Bronze-backed Imperial Pigeon (***Carpophega insignis***, Hodgson). 781.
- Dumbak* (in Sindh), The Indian Blue-throat (***Cyaneula suecica***, Linn.). 514.
- Dunkul* or *Doomkul*, The Green Imperial Pigeon (***Carpophega sylvatica***, Tickell). 780.
- Dumri*, The Striated Bush-Babbler (***Chatarrhœa caudata***, Dumeril). 438.
- Duri*, The Black-bellied Finch-lark (***Pyrrhulanda grisea***, Scopoli). 760.
- Dusta*, The Gigantic Stork (***Leptoptilos argala***, Linnæus). 915.

F

- F'akh̄ta* (in the south), The Bar-tailed Tree-dove (***Macropygia tusalia***, ***turtur***, Hodgson). 791.
- „ *Basko* } The Rufous Turtle-dove (***Turtur Meena***, Sykes).
 „ *kulla* } 793.
- „ *Chitroka*, The Spotted Dove (***Turtur suratensis***, Gmelin). 795.
- „ *Dhor*, The Common Ring-dove (***Turtur risoria***, Linnæus). 796.
- „ *Seroti*, The Red Turtle-Dove (***Turtur humilis***, Temminck). 797.
- „ *Tortrū*, or *tortarū*, The Little Brown-Dove (***Turtur cambayensis***, Gmelin). 794.
- Furjbaj*, The Crested Serpent-Eagle (***Spilornis cheelā***, Daud.). 39.

G

- Gadri* (in Sindh), The Night-heron (***Nycticorax griseus***, Linnæus). 937.
- Gaghar*. The Black Partridge (***Francolinus vulgaris***, Stephens). 818. [929.]
- Gā,e-baglā*, The Cattle Egret (***Buphus coromandus***, Boddaert).

- Gāi-kaō* (in Kashmir), The Pheasant-tailed Jacana (**Hydrophasianus chirurgus**, Scopoli). 901.
- Gairiya*, The Small Godwit (**Limosa ægocephala**, Linnæus). 875.
- Gaj-pā,nn*, The Stilt or Long-legs (**Himantopus candidus**, Bonnaterra). 898.
- Gal-chasm*, The Yellow-eyed Babbler (**Pyctorhis sinensis**, Gmelin). 385.
- Gallar*, The Rose-ringed Parrakeet (**Palæornis torquatus**, Bodd.). 148.
- Gandam*, The Black-headed Bunting (**Euspiza melanocephala**, Gmelin). 721.
- „ The Red-headed Bunting (**Euspiza luteola**, Sparrman). 722.
- Gangai*, The Large Grey Babbler (**Malacocircus Malcolmi**, Sykes). 436.
- Ganga Maina*, The Bank-myna (**Acridotheres ginginianus**, Latham). 685.
- Gardan eyengtha*, The Common Wryneck (**Yunx torquilla**, Linnæus). 188.
- Garm-pai*, The Spotted-billed Duck (**Anas pœcilorhyncha**, Pennant). 959.
- Geh-wala*, The Ruff (**Philomachus pugnax**, Linnæus). 880.
- Ghāgar* (in Derajat), The Large Cormorant (**Graculus carbo**, Linnæus). 1005.
- Ghāgas bāter*, The Large Grey Quail (**Coturnix communis**, Bonaterra). 829. [*Ghāgas* means “large”; of birds only.]
- Ghāgrī Kāw* (in Derajat), The Indian Corby (**Corvus culminatus**, Sykes). 660.
- Ghās ka-phutki* } The Rufous Grass-warbler (**Cistocola schæni-**
or } **cola**, Bonaparte). 539.
- Ghās ka pītpitti* }
- Ghoghil* or *pan ghoghil* (A water bird).
- Ghogaī* (*ghughā.ī?*), The Large Grey Babbler (**Malacocircus Malcolmi**, Sykes). 436.
- Ghughū*, *Chhoṭā*, The Short-eared Owl (**Otus brachyotus**, Gmel.). 68.
- Gidh*, Brown Vulture, Common White-backed (**Gyps bengalensis**, Gmelin). 5.
- Gidh Bayā*, Brown Vulture, Long-billed (**Gyps Indicus**, Scop.). 4.
- Gilgilā* or *galgalizā*, The Bank-myna (**Acridotheres ginginianus**, Latham). 685.
- Gilahrī mār* (*i.e.*, Squirrel-killer), The Dwarf Eagle (**Aquila pennata**, Gmelin). 31.
- Gir-chaondia*, The White-capped Redstart (**Chæmorrornis leucocephala**, Vigors). 506.
- Girja* or *Girri*, The White-bodied Goose-teal (**Nettapas coromandelianus**, Gmelin). 951.
- Girza*, The Jungle Bush-quail (**Perdicula cambayensis**, Latham). 826.

- Goar*, The Curlew (**Numenius arquata**, Linnæus). 877.
Godhan, The Water-hen (**Gallinula chloropus**, Linnæus). 905.
 „ *Bara*, The Bald Coot (**Fulica atra**, Linnæus). 903.
Goi (in Kashmir), The Little Bittern of Europe (**Ardetta minuta**, Linnæus). 935
Golābī mainā, The Rose-coloured Starling (**Pastor roseus**, Linnæus). 690.
Gor-besrā, The Crested Goshawk (probably *Tughral* of the “Bāz Nāmas”) [**Astur (Lophospiza) trivirgatus**, Temm.] 22.
Goungh, The Curlew (**Numenius arquata**, Linnæus). 877.
 „ *Ohhoṭā*, The Whimbrel (**Numenius philopus**, Linnæus). 878.
Gourkagu, The Himalayan Snow-cock (**Tetraogallus himalayensis**, Gray). 816.
Gred (in Kashmir), The Ring-tailed Sea-eagle (**Haliæetus fulviventor**, Vieill.). 42.
Gubar, The Rock-Horned Owl (**Urrua Bengalensis**, Franklin). 69.
Gugumbher, The Indian Bustard (**Eupodotis Edwardsii**, Gray). 836.
Gulābīluti, The Spotted-winged Rose-Finch (**Propasser rodopeplus**, Vigors). 739.
 „ The Pink-browed Rose-Finch (**Propasser rhodochrous**, Vigors). 742.
Gulu, The Black-breasted Bustard-Quail (**Turnix taigoor**, Sykes). 832.
Gumbārā (in the Punjab), The Short-eared Owl (**Otus brachyotus**, Gmel.). 68.
Gundlu, The Black-breasted Bustard-Quail (**Turnix taigoor**, Sykes). 832.
Gungla } The Small Ibis (**Anastomus oscitans**, Boddaert).
 or } 940.
Ghongal }
Gurain, or *Guraini* (in some districts), The Indian Houbara Bustard (**Houbara Macquæenii**, Gray). 837.
Gurayin, The Indian Bustard (**Eupodotis Edwardsii**, Gray). 836.
Gutimār, (*i.e.*, Cocoon-destroyer) The Long-legged Eagle (**Aquila hastata**, Less.). 30.

H

- Ham* (the female), The Monaul Pheasant (**Lophophorus Impeyanus**, Latham). 804.
Hammeshā piyānsā (*i.e.*, always thirsty), The Red-headed Trogon (**Harpactes Hodgsonii**, Gould). 116.
Handeri (in the South), The Painted Sand-Grouse (**Pterocles fasciatus**, Scopoli). 800.
Hāns or *hans*, The Grey Goose (**A. cinereus**, Meyer). 945.
Harewā, The Common Green Bulbul (**Phyllornis Jerdoni**, Blyth). 463.

- Hargila* or *Hargeyla*, The Gigantic Stork (*Leptoptilos argala*, Linnæus). 915.
- Hari Lāl* (male) } The Green Wax Bill (*Estrela formosa*, Latham). 705.
 ,, *Muniyā* (female) }
- Hariyal* or *hāriyal Burā*, The Green Imperial Pigeon (*Carpophaga sylvatica*, Tickell). 780.
- Hariyāl* or *Hurril*, The Bengal Green Pigeon (*Crocopus phœnicopterus*, Latham). 772.
- Hariyāl* or *Hurril*, The Southern Pigeon (*Crocopus chlorigaster*, Blyth). 773.
- Hariyal* or 'hāriyal' *Ohhotā*, The Orange-breasted Green Pigeon (*Osmotreron bicincta*, Jerdon). 774.
- Hārwat* (male) } (in Kashmir), The White-eyed Duck
Harwāchi (female) } (*Aythya nyroca*, Guldenstadt). 969.
- Harwaji*, The Rufous-backed Shrike (*Lanius erythronotus* Vigors). 257.
- Hedo*, The Striated Bush-babbler (*Chatarrhœa caudata*, Dumeril). 438.
- Herril*, The Cheer Pheasant (*Phasianus Wallichii*, Hardwicke). 809.
- Hidela*, The Long-tailed Reed-bird (*Eurycercus Burnesii*, Blyth). 443.
- Hudhud*, The European Hoopoe (*Upupa epops*, Linn.). 254.
 ,, The Indian Hoopoe (*Upupa nigripennis*, Gould). 255.
- Huin-wal*, The Himalayan Snow-cock (*Tetraogallus himalayensis*, Gray). 816.
- Hukāra* (in Kuan Valley), The Blue Heron, *Ardea cinera*, Linnæus). 923.
- Huko* (in Dera Ghazi Khan), The Himalayan Wood-Owl (*Syrnium nivicolum*, Hodgson). 66.
- Humā*, The Bearded Vulture (*Gypaetus barbatus*, Lin.). 7.
- Hurrial*, The Common Indian Bee-eater (*Merops viridis*, Linn.). 117.
- Husayni-piddā*, The Indian Blue-throat (*Cyaneula suecica*, Linn.). 514.
- Huwa bil-bil*, The Common Indian Swift (*Cypselus affinis*, Gray). 100.

I

- Ispalandu* (in Chach District), The Curlew (*Numenius arquata*, Linnæus). 877.

J

- Jāh* (in Sialkot District), The Purple Heron (*Ardea purpurea* Linnæus). 924.
- Jahgi*, The Simla Horned Pheasant (*Cerionis melanocephala*, Gray). 806.
- Jal-aggin* (i.e., Water-lark), The Striated Marsh-Babbler (*Megalurus palustris*, Horsf.). 440.

[N.S.]

- Jal-murghī*, The Water-hen (*Gallinula chloropus*, Linnæus). 905.
- Jamjohara*, The Ortolan Bunting (*Emberiza hortulana*, Linnæus). 715.
- Junglī Ghughū*, The Dusky Horned-Owl (*Urrua coromanda*, Latham). 70.
- Junglī-khyr*, The Jungle Babbler (*Malacocircus malabaricus*, Jerdon). 434.
- Junglī Murgh*, The Grey Jungle-Fowl (*Gallus Sonneratii*, Temminck). 813.
- .. *Chhotā*, The Red Spur-fowl (*Galloperdix spadiceus*, Gmelin). 814
- Janguria*, The Snow Partridge (*Lerwa nivicola*, Hodgson). 817.
- Japal Kachit*, The Common Drongo-Shrike, The "King-crow" of Europeans in India (*Dicrurus macrocerus*, Vieillot). 278.
- Janghal* or *Jawghāl*, The Pelican Ibis (*Tantalus leucocephalus*, Gmelin). 938.
- Jer-monāl*, The Himalayan Snow-cock (*Tetraogallus Himalayensis*, Gray). 816.
- Jer-titar*, The Snow Partridge (*Lerwa nivicola*, Hodgson). 817.
- Jewar* or *Jowar*, The Simla Horned Pheasant (*Cerionis melanocephala*, Gray). 806.
- Jhonti maina*, The Hill-myna (*Acridotheres fuscus*, Wagler). 686.
- Jithiri*, The Yellow-wattled Lapwing (*Sarciophorus bilobus*, Gmelin). 856.
- Jiyadha*, The Long-legged Eagle (*Aquila hastata*, Less.). 30.
- Jograbi*, The Little Cormorant (*Graculus javanicus*, Horsf.). 1007.
- Jothauli*, The Black-bellied Finch-Lark (*Pyrrhulanda grisea*, Scopoli). 760.
- Jumiz* or *Jumbiz*, The Imperial Eagle (*Aquila imperialis*, Bechst). 27.
- Jun baglā*, The Yellow Bittern (*Arditta sinensis*, Gmelin). 934.
- Junglī Aggīa*, The Red-winged Bush-lark (*Mirafra erythroptera*, Jerdon). 756.
- Junglī Kasya*, The Black-headed Cuckoo-Shrike (*Volvocivora Sykesii*, Strickland). 268. [437.]
- .. *Khyr*, The Rufous Babbler (*Layardia subrufa*, Jerdon).
- .. *-Murgh*, The Red Jungle-Fowl (*Gallus ferrugineus*, Gmelin). 812.
- .. *-totah*, The Southern Sirkeer (*Taccocua Leschenaultii*, Lesson). 219.
- Jurra* (male) of the Goshawk (in Sindh), *Shahbaz* (*Astur palumbarine*, Lin.). 21.

K

- Kabk*, The Himalayan Snow-cock (*Tetraogallus himalayensis*, Gray). 816.

- Kabūd* (in Haiderabad, Deccan), The Blue Heron (*Ardea cinerea*, Linnæus). 923.
- Kabūtūr*, The Blue Rock-pigeon (*Columba intermedia*, Strickland). 788.
- Kacha-tor* }
or } The White Ibis (*Threskiornis melanocephalus*,
Kachū torī } Linnæus). 941.
- Kāghī*, The Rook (*Corvus frugilegus*, Linnæus). 664.
- Kahīr*, The Cheer Pheasant (*Phasianus Wallichii*, Hardwicke). 809.
- Kainchī hīl* (in Dera Ismail Khan), The Common Pariah Kite, the fork-tailed (*Milvus Govinda*, Sykes). 56.
- Kājālā*, The Red-breasted Parrakeet (*Palæornis javanicus*, Osbeck). 152.
- Kaku* (in Kashmir), The Chukor Partridge, (*Caccabis chukor*, Gray). 820.
- Kālā baglā*, The Ashy Egret (*Demi-egretta asha*, Sykes). 928.
The Black Bittern (*Ardetta flavicollis*, Latham).
932.
- Kālā-phutki*, Stewart's Wren-Warbler (*Prinia Stewartii*, Blyth). 535.
- Kālā pidhā*, The White-winged Black Robin (*Pratincola caprata*, Linn.). 481.
- Kālā tiliyā* (in Derajat), The Common Starling (*Sturnus vulgaris*, Linnæus). 681.
- Kālā-titar*, The Black Partridge (*Francolinus vulgaris*, Stephens). 818.
- Kālā-titar*, The Painted Partridge (*Francolinus pictus*, Jard. & Selby). 819.
- Kalchuri*, The Indian Black Robin (*Thamnobia fulicata*, Linn.). 479.
- Kali*, The White-necked Stork (*Ciconia leucocephala*, Gmelin). 920.
- Kālij* }
" *Murgh* } The White crested Kalij-pheasant (*Gallophasis albocristatus*, Vigors). 810.
- Kalim* or *Kharim*, The Purple Coot (*Porphyrio poliocephalus*, Latham). 902.
- Kaljunga*, The Spotted Eagle (*Aquila nævia*, Gmel.). 28.
- Kaljīt*, The Yellow-billed Whistling Thrush (*Myiophonus Temminckii*, Vigors). 343.
- Kāl-karichhī* (in Derajat), The Common Drongo-shrike, The "King-crow" of Europeans in India (*Dicrurus macrocercus*, Vieillot). 278.
- Kalkola hī*, The Common Drongo-shrike, The "King-crow" of Europeans in India (*Dicrurus macrocercus*, Vieillot). 278.
- Kallank*, The Grey Goose (*A. cinereus*, Meyer). 945.
- Kāl Murgh*, (in Jullandhar), Scavenger Vulture, White 'Shank' of Anglo-Indians (*Neophron percnopterus*, Lin.). 6.
- Kanera Bulbul*, The Red-Whiskered Bulbul (*Otocompsa jocosa*, Lin.). 460.

[N.S.]

- Kancha baglā* } The Little Green Heron (*Butorides javanica*,
or } Horsfield). 931.
Kānā baglā }
- Kani baglā*. The Pond Heron (*Ardeola leucoptera*, Boddaert). 930.
- Kantur* (in Kashmir), Well-sparrow (*Passer indicus*, Jard. & Selby.) 706.
- Kānwalī* (in some parts of the Punjab Frontier). The Warty-headed or Black Ibis (*Geronticus papillosus*, Temminck). 942. [59.]
- Kapasi*, The Black-winged Kite (*Elanus melanopterus*, Daud.).
- Kappra-popya*, The Small Green-billed Malkoha (*Zanclostomus viridirostris*, Jerdon). 216.
- Karākul* } The Warty-headed or Black Ibis (*Gironticus papil-*
or } *losus*, Temminck). 942.
Karānkul }
- Karaya* or *kurail*, The Indian Screech-owl (*Strix javanica*, De Wurb). 60.
- Kārglah* (in Pushtu), The Common Indian Crow (*Corvus splendens*, Vieillot). 663.
- Karhans*, The Grey Goose (*A. cinereus*, Meyer). 945.
- Karjanna* or *Karjoona*, Red-legged Falcon (*Erythropus Vespertinus*, Lin.). 19.
- Karkarra*, *Qargarā* and *Kharkhara*, The Demoiselle Crane (*Anthropoides virgo*, Linnæus). 866.
- Karrail*, The Indian Corby, The Raven of some Europeans in India (*Corvus culminatus*, Sykes). 660.
- Karwānak*, The Stone-plover (*Œdicnemus crepitans*, Temminck). 859.
- Kastūrā*, The Yellow-billed Whistling Thrush (*Myiophonus Temminckii*, Vigors). 343.
- Kastūrī*, The Black-capped Black-bird (*Merula nigripileus*, Lafr.). 359.
- „ The Grey-winged Black-bird (*Merula bouboul*, Lath.). 361.
- „ *Tin rang kā*, The Three-coloured Thrush, The White-winged Ground Thrush (*Geocichla cyanotus*, J. & S.). 354.
- Kasya*, The Large Cuckoo-shrike (*Graucalus macei*, Lesson). 270.
- Katij*, The Kashmere House Merlin (*Chalidon Cashmiriensis*, Gould). 93.
- Kat-khara*, The Crimson-breasted Barbet (*Xantholæma Indica*, Lath.). 197.
- Kat-kuto*, The European Hoopoe (*Upupa epops*, Lin.). 254.
- Kattoi*, The Bronze-winged Jacana (*Metopidius indicus*, Latham). 900.
- Kavin*, The Common Jack-daw (*Colæus Jackdaw*, Linnæus). 665.
- Kawwā* } The Common Indian Crow (*Corvus splendens*,
„ *Pati* } Vieillot). 663.
„ *Desi* }

- Keim* or *kaima*, The Purple Coot (*Porphyrio poliocephalus*, Latham). 902.
- Keroula*, The Common Wood Shrike (*Tephodornis pondiceriana*, Gmel.). 265.
- Kesrāj*, *krishnarāj* } The Hair-crested Drongo (*Chibia hottentota*, Linn.). 286.
or *kishnrāj* }
- „ *Chhotā*. The Bronzed Drongo (*Chaptia ænea*, Vieillot). 282.
- Kewari*, The Glossy Ibis (*Falcinellus igneus*, Gmelin). 943.
- Khanjan*, The Spotted Fork-tail (*Enicurus maculatus*, Vigors). 584.
- Kharkār*, The Purple Heron (*Ardea purpurea*, Linnæus). 924.
- Kharkhār* (in Chach), The Bittern (*Botaurus stellaris*, Linnæus). 936.
- Khar-piddā*, The White-tailed Bush-chat (*Pratincola leucura*, Blyth). 484.
- Kher-ghusa*, The Rufous Grass-Warbler (*Cisticola schænicola*, Bonaparte). 539.
- Khurāsānī chirī*, The Indian Tree-Pipit (*Pipastes agilis*, Sykes). 596.
- Khur-phoothī*, The Streaked Wren-Warbler (*Burnesia lepida*, Blyth). 550.
- Khyr*, The Kyah Partridge (*Ortygornis gularis*, Temminck). 823.
- „ The White-headed Babbler (*Malacocircus griseus*, Gmelin). 433. [923.]
- Khyra* (in Behar), The Blue Heron (*Ardea cinerea*, Linnæus).
- Kilchia* or *kirchia baglā*, The Little Egret (*Herodias garzetta*, Linnæus). 927.
- Kilkila chhotā*, The Common Indian King-fisher (*Alcedo bengalensis*, Gmelin). 134.
- Kilkila*, The White-breasted King-fisher (*Halcyon fuscus*, Bodd.). 129.
- Koel* }
or } The Indian Koel (*Eudynamys orientalis*, Lin.). 214.
Ko,il }
- Kohassa*, The Grey-backed Sea-eagle (*Haliæetus leucogaster*, Gmel.). 43.
- Kohī* or *koelā* (the male), The Shahin Falcon (*Falco peregrinator*, Sundwall). 9.
- Kokai Mainā*, The Southern Hill-myna (*Eulabes religiosa*, Linnæus). 692.
- Kokurāli*, The Pintail Duck (*Dafila acuta*, Linn.). 962.
- Kohia-kak*, The Himalayan Magpie (*Dendrocitta sinensis*, Latham). 676.
- Kokin luwā*, The Painted Bush-Quail (*Pardicula erythrorhyncha*, Sykes). 828.
- Koklā* or *kokilā*, The Kokla Green Pigeon (*Sphenocercus sphenurus*, Vigors). 778.
- Koklah*, The Orange-breasted Green Pigeon (*Osmotreron bicincta*, Jerdon). 774.

[N.S.]

- Koklās** or *kokla*, The Pukras Pheasant (**Pucrasia macrolopha**, Lesson). 808.
- Kolru**, a kind of Coot in Kashmir (**Fulica atra**, Linnæus). 903.
- Kolsa**, The Common Drongo-shrike, The "King-crow" of Europeans in India (**Dicrurus macrocercus**, Vieillot). 278.
- Kolā-tūnch** (in Kashmir), Small King-fisher (**Alcedo bengalensis**, Gmelin). 134.
- Koor-monal**. The Snow Partridge (**Lerwa nivicola**, Hodgson). 817.
- Kora** or *khora* } The Water-cock (**Gallix rex cristatus**, Latham).
or *kongra* } 904.
- Korayala kilkila** (i.e., Spotted King-fisher). The Pied King-fisher (**Ceryle rudis**, Lin.). 136.
- Koreyala** (female) (i.e., Spotted), The Indian Koel (**Endynamys orientalis**, Linn.). 214.
- Kor-quch** (in Kashmir), The Common Reed Warbler (**Acrocephalus brunnescens**, Jerdon). 515.
- Kotri**, The Common Indian Magpie (**Dendrocitta rufa**, Scopoli). 674.
- Kotwāl**, The Common Drongo-shrike, The "King-crow" of Europeans in India (**Dicrurus macrocercus**, Vieillot). 278.
- Kowar** or *kowara* (in Purnea), The Glossy Ibis (**Falcinellus igneus**, Gmelin). 943.
- Krū** (in Kashmir), The Small Marsh Tern (**Hydrochelidon Indica**, Stephens). 984.
- Kudrunga**, The Common Green Barbet (**Megalaima caniceps**, Franklin). 193.
- Kujin churi**, The Malabar Trogon (**Harpactes fasciatus**, Gmelin). 115.
- Kuhar**, The Common Sand-Grouse (**Pterocles exustus**, Temminck). 802.
- Kukera**, The White-crested Kalij-pheasant (**Gallophasis albocristatus**, Vigors). 810.
- Kulang**, The Common Crane (**Grus cinerea**, Bechstein). 865.
- Kulesir**, The Marsh Harrier (**Circus Æruginosus**, Lin.). 54.
- Kul-kā,o** (in Kashmir), The Red-wattled Lapwing (**Lobivanellus goensis**, Gmelin). 855.
- Kumar-tit**, The Common Sand-Grouse (**Pterocles exustus**, Temminck). 802.
- Kummer-kalla**, The Indian Stock-Pigeon (**Palumbona Eversmanni**, Bonaparte). 787.
- Kunich**, The Common Drongo-Shrike, The "King-crow" of Europeans in India (**Dicrurus macrocercus**, Vieillot). 278.
- Kupak** or *Upak*, The Common Hawk-Cuckoo (**Hierococcyx varius**, Vahl). 205.
- Kurayi**, The White-breasted Water-hen (**Gallinula phœniceura**, Pennant). 907.
- Kurl**, The Ring-tailed Sea-Eagle (**Haliæetus fulviventor**, Vieill.). 42.
- Kushandra** or *Kushanbra*, The White-eared Crested Bulbul (**Otocompsa leucotis**, Gould). 459.

- Kusya chāhā*, The Avoset (**Recurvirostra avocetta**, Linnæus). 899.
Kutar, The Marsh Harrier (**Circus æruginosus**, Lin.). 54.
Kutumra, The Common Green Barbet (**Megalaima caniceps**, Franklin). 193.
Kyah or *Kaijah*, The Kyah Partridge (**Ortigonis gularis**, Temminck). 823.
Kyphul-pucka, The Hill-Cuckoo (**Cuculus striatus**, Drapiez). 204.

L

- Lagar* (the female), The Laggar Falcon (**Falco Jugger**, Gray). 11.
Lag-lag or *laq-luq*, The White Stork (**Ciconia alba**, Belon.). 919.
Lailo, The Striated Bush-babbler (**Chatarrhæa caudata**, Dumeril). 438.
Lāl-baglā, The Chestnut Bittern (**Ardetta cinnamomea**, Gmelin). 933.
Lālī, The Bank-myna (**Acridotheres giaginianus**, Latham). 685.
Lālī (in Dera Ismail Khan), The Common Myna (**Acridotheres tristis**, Linnæus). 684.
Lāl-muniyā, Lāl (the male) } The Red Wax-bill (**Estrela**
Munia (the female) } **amandava**, Linnæus). 704.
Lāl-sirō, The Pink-headed Duck (**Anas caryophyllacea**, Latham). 960.
Lambi, The Stone-plover (**Œdicnemus crepitans**, Temminck). 859.
Lamdar, The Common Grey Hornbill (**Meniceros bicornis**, Scop.). 144.
Latorā, *Dudiya* or *Sufeid*, The Indian Grey Shrike (**Lanius lahtora**, Sykes). 256.
,, *kajalu*, The Rufous-backed Shrike (**Lanius erythronotus**, Vigors). 257.
,, *Mattiya* (i.e. Earthen Shrike), (**Lanius erythronotus**, Vigors). 257.
Lawā, The Rock Bush-quail (**Perdica Asiatica**, Latham). 827.
Leepce (in Central India). The Madras Bush-lark (**Mirafra affinis**, Jerdon). 755. [84.
Leishra, The Wire-tailed Swallow (**Hirundo filifera**, Stephens).
Lerwa, The Snow-Partridge (**Lerwa nivicola**, Hodgson). 817.
Libbia, The Button-Quail (**Turnix Sykesii**, A. Smith). 835.
Likh, The Lesser Florikin (**Sypheotides auritus**, Latham). 839.
Loharjung, The Black-necked Stork (**Mycteria australis**, Shaw). 917.
Lont, (the male) The Monaul Pheasant (**Lophophorus Impeyanus**, Latham). 804.
Lungi, The Simla Horned-Pheasant (**Cerionis melanocephala**, Gray). 806.

M

- Macharang* also } (in Kashmir *Gred*) The Ring-tailed Sea-eagle
Machmunga } (*Haliæetus fulviventor*, Vieill). 42.
Machariya also } The Osprey (*Pandion haliæetus*, Linn). 40.
Manchmanga }
- Macharya* (*i.e.*, The Mosquito-catcher), The White-browed Fantail
(*Leucocerca albofrontata*, Frankl.). 292.
- Madangour totā*, The Blue-winged Parrakeet (*Palæornis colum-
boides*, Vigors). 151.
- Madhuya*, The White-tailed Sea-Eagle (*Paliæetus ichthyæetus*,
Horsf.). 41.
- Magh* or *Mangh* (in the Punjab), The Grey-goose (*A. cinereus*,
Meyer). 945.
- Mahā-lāt* (*i.e.*, Large Shrike) The Common Indian Magpie (*Den-
drocitta rufa*, Scopoli). 674.
- Mahoka*, The Common Coucal (*Centropus rufipennis*, Illiger).
217.
- Mainā* } The Common Myna (*Acridotheres tristis*, Lin-
,, *Desi* } næus). 684.
- Malang baglā*, The Large Egret (*Herodias alba*, Linnæus). 925.
- Mamālā*, The Indian Grey-Shrike (*Lanius lahtora*, Sykes).
256.
- Mamālī*, The Rufous-backed Shrike (*Lanius erythronotus*,
Vigors). 257.
- Mamolā* (in Dera Ismail Khan), also *Sheikh Mamolā*, The White-
faced Wagtail (*Motacilla luzoniensis*, Scopoli). 590.
- Mamulā*, The Pied Wagtail (*Motacilla Maderaspatana*, Bris-
son). 589.
- Manik-jor*, The White-necked Stork (*Ciconia leucocephala*,
Gmelin). 920.
- Manjur*, The Common Peacock (*Pavo cristatus*, Linnæus). 803.
- Manmantor* (in the Chach District), The Rail (*Porzana
maruetta*, Brisson). 909.
- Masjid Abābil* (*i.e.*, Mosque Swallow), The Red-rumped Swallow
(*Hirundo daurica*, Lin.). 85.
- Mor*, The Common Peacock (*Pavo cristatus*, Linnæus). 803.
- Morangah* or } (*i.e.*, Peacock-killer) The Crestless Hawk-Eagle
Morangi } (*Nisaetus Bonelli*, Temm.). 33.
- Monal* } The Monal Pheasant (*Lophophorus impeyanus*,
,, *Ghuer* } Latham). 804.
- Mor*, The Common Peacock (*Pavo cristatus*, Linnæus). 803.
- Mulla-gidh*, Black Vulture (*Otogyps calvus*, Scop.). 2.
- Mullala*, The Yellow-eyed Babbler (*Pyctorhis sinensis*, Gmelin).
385.
- Munda*, The White Ibis (*Threskiornis melanocephalus*, Lin-
næus). 941.
- Murgh-i-zarīn* (in Kunan Valley), The Monal Pheasant (*Lo-
phophorus impeyanus*, Latham). 804.
- Musarichi*, The Indian Tree-Pipit (*Pipastes agilis*, Sykes). 596.

N

- Nakal-nor*, The Black-headed Munia (**Munia Malacca**, Linnæus). 697.
- Nakshi tebiyā*, The Common Starling (**Sturnus vulgaris**, Linnæus). 681.
- Nanachara*, The Red-billed Hill-tit (**Leiothrix luteus**, Scopoli). 614.
- Naorung* (*i.e.*, the nine-coloured), The Yellow-breasted Ground-thrush (**Pitta Bengalensis**, Gmel.). 345.
- Narī*, The Purple Heron (**Ardea purpurea**, Linnæus). 924.
- Narzānak* (the male) (in Pusthu *Larzānak*) (*i.e.*, the little vibrator), The Kestrel (**Tinnunculus Alaudarius**, Briss.). 17.
- Narzi* (the female), The Kestrel (**Tinnunculus Alandarues**, Briss.). 17.
- Nilich* (male) } (in Kashmir), The Mallard (**Anas boschas**,
 „ *tuj* (female) } Linnæus). 958.
- Nīlkant* (*i.e.*, Blue-throat) The Indian Roller (**Coracias indica**, Linn.). 123.
- Nīlkunthī*, The Indian Blue-throat (**Cyaneula suecica**, Linn.). 514.
- Nīl-kant*, The Red-billed Blue Magpie (**Urocissa sinensis**, Linnæus). 671.
- Nīraji*, The Shieldrake (**Tadorna vulpanser**, Fleming). 956.
- Nīr-goung*, The Bittern (**Botaurus stillaris**, Linnæus). 936.
- Nīraji* (in Sindh), The Mallard (**Anus boschas**, Linnæus). 958.
- Nukal-pān* (in Dera Ismail Khan), The Indian Courier Plover (**Cursorius coromandelicus**, Gmelin). 840.
- Nukrī*, The Indian Courier Plover (**Cursorius coromandelicus**, Gmelin). 840.
- Nukta*, The Black-backed Goose (**Sarkidiornis melanonotus**, Pennant). 950.

O

- Obarru* for *hubāru*, etc., The Indian Houbara Bustard (**Houbara Macqueenii**, Gray.) 837.

P

- Pachnak*, The Bay-backed Shrike (**Lanius Hardwickii**, Vigors). 260.
- Pahārīā maina*, The Nepal Hill-Myna (**Eulubes intermedia**, A. Hay). 693.
- Pahārī maina*, The Hill-Myna (**Acridotheres fuscus**, Wagler). 686.
- Pahārī tuiya*, The Slaty-headed Parrakeet (**Palæornis schisticeps**, Hodgson). 150.

- Pahārīya hangdhara*, The Black-crested Yellow-bulbul (**Rubigula flaviventris**, Tickell). 456.
- Pahātai*, The Pied Harrier (**Circus melanoleucos**, Gmel.). 53.
- Pandūbī*, 'vide' Churaka.
- Panduk* (in Behar), The Bar-tailed Tree-Dove (**Macropygia Turtur**, Hodgson). 791.
- Pan-kawwā*, The Little Cormorant (**Graculus javanicus**, Horsf.). 1007.
- .. or *Pan-kawwal*, The Large Cormorant (**Graculus carbo**, Linnæus). 1005.
- Pan-lohā, chhoṭā*, The Little Stint (**Tringa minuta**, Leisler). 884.
- Papīhā*, The Pied Crested Cuckoo (**Coccytes melanoleucos**, Gmel.). 212.
- Papīhā*, The Common Hawk-cuckoo (**Hierococyx varius**, Vahl.). 205.
- Papīhā. Maynū* (The Brahmini Myna of the English), The Black-headed Myna (**Temenuchus pagodarum**, Gmelin). 687.
- Patangkhu* }
 or } The Smaller Egret (**H. Egrettoides**, Tem-
Patokha baglā } minck). 926.
- Patan-hil* (in Dera Ismail Khan), The Common Pariah Kite, the square-tailed (**Milvus Govinda**, Sykes). 56.
- Pathar chīrta*, The Crested Black Bunting (**Melophus melanicterus**, Gmelin). 724.
- Patriagu*, The Common Indian Bee-eater (**Merops viridis**, Lin.). 117.
- Pawai*, The Dusky Ground-Thrush (**Geocichla unicolor**, Tickell). 356.
- Pawa,ī*, The Grey-headed Myna (**Temenuchus malabaricus**, Gmelin). 688.
- Peny*, The Striated Bush-babbler (**Chatarrhœa caudata**, Dumeril). 438.
- Penra*, The Black-throated Hill-Partridge (**Arboricola tor-queola**, Valenciennes). 824.
- Phari Bulal-chasm*, The Orange Minivet (**Pericrocotus flammeus**, Forster). 272.
- Phari buchangā*, The White-bellied Drongo (**Dicrurus cœrulescens**, Lin.). 281.
- Phari-bulbul*, The Red-Whiskered Bulbul (**Otocompsa jocosa**, Lin.). 460. [4.]
- Phari-gīdh*, Brown Vulture, Long-billed (**Gyps Indicus**, Scop.).
- Phari Tīsā*, The Long-legged Eagle (**Aquila hastata**, Lin.). 30.
- Phenga Barā*, The Striated Reed-babbler (**Chatarrhœa Earlie**, Blyth). 439.
- .. *Chhoṭā*, The Striated Bush-babbler (**Chatarrhœa caudata**, Dumeril). 438.
- Phokras*, The Black-throated Hill-Partridge (**Arboricola tor-queola**, Valenciennes). 824.

- Phu-phu*, The European Cuckoo (*Cuculus canorus*, Linnæus). 199.
- Phutki*, The Dark-ashy Wren-Warbler (*Prinia Socialis*, Sykes). 534.
- .. The Indian Tailor-bird (*Orthotomus longicauda*, Gmelin). 530.
- Pidri*, The Plain Brown Munia (*Munia malabarica*, Linnæus). 703.
- Piddā*, The White-winged Black Robin (*Pratincola caprata*, Linn.). 481.
- Piho* or *Pihuya*, The Pheasant-tailed Jacana (*Hydrophasianus chirurgus*, Scopoli). 901.
- Pilah*, The Bengal Black-headed Oriole (*Oriolus melanocephalus*, Linnæus). 472.
- Pilak* (i.e. the Yellow-bird), in Kashmir '*Posh-nul*,' The Indian Oriole; The Mango-bird of Europeans in India (*Oriolus kundoo*, Sykes). 470.
- Pilka*, The Indian Field-Wagtail (*Budytes virides*, Gmelin). 593.
- .. *Panika* The Yellow-headed Wagtail (*Budytes citreola*, Pallas). 594.
- Pindī* (in Kashmir), The Little Grebe (*Podiceps Philippensis*, Gmelin). 975.
- Pirola*, The Bengal Black-headed Oriole (*Oriolus melanocephalus*, Linnæus). 472.
- Pit-pitta*, The Dark-ashy Wren-Warbler (*Prinia socialis*, Sykes). 534.
- Podnā*, The Lesser Reed-warbler (*Acrocephalus dumetorum*, Blyth). 516.
- Posh-nul* (in Kashmir), The Common Oriole (*Oriolus Kundoo*, Sykes). 470.
- Puhain*, The Black-headed Myna (*Temenuchus 'pagodarum*, Gmelin). 637.
- Pukras*, The Pukras Pheasant (*Pucrasia macrolopha*, Lesson). 808.
- Putrīngya Barā*, The Blue-tailed Bee-eater (*Merops Philippensis*, Lin.). 118.
- Putta denli*, The Palm-Swift (*Cypselus batassiensis*, Gray). 102.
- Putthur-chirta*, The Grey-headed Bunting (*Emberiza fucata*, Pallas). 719.
- Puttial-dhanes*, The Common Grey Hornbill (*Meniceros bicornis*, Scop.). 144.
- Q
- Qāgh* (in the Murree Hills), The European Raven (*Corvus corax*, Linnæus). 657.
- Qarqarā*, Demoiselle Crane (*Anthropoides Virgo*, Linnæus). 866.
- Quoir-monal*, The Snow Partridge (*Lerwa nivicola*, Hodgson). 817.

R

- Ra-i-totū* (*i.e.*, Royal Parrakeet), The Alexandrine Parrakeet (***Palaornis Alexandri***, Lin.). 147.
- Rājī*, The Yellow-necked Sparrow (***Passer flavicollis***, Franklin). 711.
- Rām-chukor* (in Kashmir), The Himalayan Snow-cock (***Tetrao galus Himalayensis***, Gray). 816.
- Rang-bulbul* (in Kashmir), The Paradise Flycatcher (***Tchitreia paradisi***, Lin.). 288.
- Rang-gidh*, Black-Vulture (***Otogyps calvus***, Scop.). 2.
- Ratcap*, The Monaul Pheasant (***Lophophorus Impeyanus***, Latham). 804.
- Ratnal*, The Monaul Pheasant (***Lophophorus Impeyanus***, Latham). 804.
- Ratlea-kowan*, The Monaul Pheasant (***Lophophorus Impeyanus***, Latham). 804.
- Rawil-kahy*, The White-crested Laughing-Thrush (***Garrulax leucolophus***, Hardwicke). 407.
- Retal* (*i.e.*, Sand-bird), The Indian Sand-lark (***Alaudala raytal***, Buch.-Hamilton). 762.
- Retal*, The Rufous-tailed Finch-lark (***Ammomanes phœnicura***, Franklin). 758.
- Retal Turumti* (in the Punjab), The Merlin (***Hypotriorchis Cæsalon***, Gmel.). 15.
- Rugel*, The Indian Titlark (***Corydalla rufula***, Vieillot). 600

S

- Saa*, The Blue Heron (***Ardea cinera***, Linnaeus). 923.
- Sadal*, The Changeable Hawk-Eagle (***Limnætus nivens***, Temm.). 34.
- Safed-hil* (commonly in the Punjab), White Scavenger Vulture, "Shawk" of Anglo-Indians (in Dera Ismail Khan the Egyptian Vulture is so called), (***Neophron perenopterus***, Lin.). 6.
- San-barado*, The Dusky-grey Heron (***Ardea Sumatrana***, Raffles). 922.
- Sāras* or *Sarhans*, The Sarus Crane (***Grus antigone***, Linnaeus). 863.
- Sarbo-bayā*, The Black-throated Weaver-bird (***Ploceus Bengalensis***, Linnaeus). 696.
- Sahili*, The Large Minivet (***Pericrocotus speciosus***, Latham). 271. [750.]
- Saira*, The Himalayan Siskin (***Chrysomitris spincoides***, Vigors).
- Salui gundru*, The Black-breasted Bustard-Quail (***Turnix taigoor***, Sykes). 832.
- Sampmar*, The Common Serpent Eagle (***Circaetus Gallicus***, Gmel.). 38.

- Sāt-bhā,ī*, The Bengal Babbler (**Malacocircus terricolor**, Hodgson). 432.
- Shāh Bāz*, The Crested Hawk-eagle (**Limnætus Cristatellus**, Tem.). 35.
- Shāhīn*, i.e., The Royal-bird (the female), The Shahin Falcon (**Falco peregrinator**, Sundevall). 9.
- Shāh-murghābī*, The Shieldrake (**Tadorna vulpanser**, Fleming). 956.
- Shahutela*, The Crested Honey Buzzard (**Pernis cristata**, Cuvier). 57.
- Shakar-khōra* (i.e., Sugar-eater), The Little Spider-hunter (**Aruchnothera pusilla**, Blyth). 224.
- Shāmā*, The Blue Rock-Thrush (**Petrocossyphus cyanens**, Lin.). 351.
- „ The Shama (**Kittacincla macroura**, Gmel.). 476.
- Shamchiri*, The White-browed Fantail (**Leucocerea albofrontata**, Frankl.). 292.
- Shapāki* (in Dera Ismail Khan), The Spotted Owlet (**Athene Brama**, Tem.). 76.
- Shārak* (in Dera Ismail Khan), The Black-Myna (**Acridotheres ginginianus**, Latham). 685.
- Shekh Mamolā* (in Dera Ismail Khan), The Whitefaced Wagtail (**Motacilla luzoniensis**, Scopoli). 590.
- Shikra* (the female), The Shikra (**Micronisus badius**, Gmel.). 23.
- Shira* (*Saira* in Kashmir), The Himalayan Gold-finch (**Carduelis caniceps**, Vigors). 749.
- Shonbiga* or *Shonbhigi*, The Black-headed Green Bulbul (*Iora Zeylonica*, Gmelin). 467.
- Shūkan* (in Derajat), The Large Stone-plover (**Esacus recurvirostris**, Cuvier). 858.
- Sili*, The Indian Snake-bird (**Plotus melanogaster**, Gmelin). 1008.
- Silli*, The Whistling Teal (**Dendrocygna awsuree**, Sykes). 952.
- Sim-kukra* (in Kumaon), The Wood-cock (**Scolopax rusticola**, Linnæus). 867.
- Sim-titar*, The wood-cock (**Scolopax rusticola**, Linnæus). 867.
- Singbaz* or *Shin-baz*, The Spotted Munia (**Munia undulata**, Latham). 699.
- Singmonal* (i.e., The Horned Monal), The Simla Horned Pheasant (**Cerionis melanocephala**, Gray). 806.
- Sisi*, The Cinnamon-bellied Nuthatch (**Sitta cinnamomeoventris**, Blyth). 251.
- Sohun*, The Indian Bustard (**Eupodotis Edwardsii**, Gray). 836.
- Sona Kubūtar*, The Green Imperial Pigeon (**Carpophaga sylvatica**, Tickell). 780.
- Soonda*, White Scavenger Vulture (**Neophron percnopterus**, Lin.). 6.
- Soongra*, White Scavenger Vulture (**Neophron percnopterus**, Lin.). 6.

- Sor*, The Striated Bush-babbler (*Chatarrhoea caudata*, Dumeril). 438.
- Subzak* (in Kapurthala), (Greenish bird), The Indian Roller (*Coracias indica*, Linn.). 123.
- Such Gumārā* or *Gubārā*, The Grass Owl (*Strix candida*, Tickell.). 61.
- Sufeid buza*, The White Ibis (*Threskiornis melanocephalus*, Linnæus). 941.
- Sulaymān murghī* (i.e. Solomon's fowl), The Malabar Pied Hornbill (*Hydrocissa coronata*, Bodd.). 141.
- Sūnjrā* (in Dera Ismail Khan), White Scavenger Vulture. "Shawk" of Anglo-Indians (*Neophron percnopterus*, Lin.). 6.
- Surkhāb* (i.e., The Sucker of Water), The Common Snipe (*Gallinago scolopacinus*, Bonap.). 871.
- Surkhāb*, The Ruddy Shieldrake (*Casarca rutila*, Pallas). 954.
- Surmā.ṣi*, The Black Stork (*Ciconia nigra*, Linnæus). 918.

T

- Tal-chatta*, The Palm Swift (*Cypselus batassiensis*, Gray). 102.
- Talur*, The Large Stone-plover (*Esacus recurvirostris*, Cuvier). 858.
- Tambayāt* (i.e. Copper-smith), The Crimson-breasted Barbet (*Xantholæma indica*, Lath.). 197.
- Tarī abābil*, The Palm Swift (*Cypselus batassiensis*, Gray). 102.
- „ (i.e., Palmyra Swallow), The Ashy Swallow-Shrike (*Artamus fuscus*, Vieill.). 287.
- Tarkhān pakhī* (i.e., The Carpenter bird), The European Hoopoe (*Upupa epops*, Lin.). 254.
- „ „ The Indian Hoopoe (*Upupa nigripennis*, Gould). 255.
- Tatu batera*, The Button-Quail (*Turnix Sykesii*, A. Smith). 835.
- Techi*, The Water-hen (*Gallinula chloropus*, Linnæus). 905.
- Teliyā māynā*, The Common Starling (*Sturnus vulgaris*, Linnæus). 681. [699.]
- Teliyā muniyā*, The Spotted Munia (*Munia undulata*, Latham).
- Tera* (in Derajat this is called *Leha*, the Marsh Harrier being called *Teha*), The Pale Harrier (*Circus Swainsonii*, A. Smith). 51.
- Thampal*, The Common Drongo-shrike, The "King-crow" of Europeans in India (*Dicrurus macrocerus*, Vieillot). 278.
- Tharkavi chughd*, The Large Scops Owl (*Ephilates lempigi*, Horsf.). 75.
- Thir-thira* (i.e., Quaker or trembler), The Indian Redstart (*Ruticilla rufiventris*, Vieillot). 497.
- Thirtir-kampla* (i.e. Quaker or trembler), The Indian Redstart (*Ruticilla rufiventris*, Vieillot). 497.

- Tidari*, The Shoveller (***Spatula clypeata***, Linn.). 957.
Tik-tikki, The Lesser Reed-Warbler (***Acrocephalus dumetorum***, Blyth). 516.
Tilār f., The Indian Houbara Bustard (***Houbara Macqueenii***, Gray). 837.
Tilgiri, The Common Starling (***Sturnus vulgaris***, Linnæus). 681.
Tilora, The Common Starling (***Sturnus vulgaris***, Linnæus). 681.
Tilyar, The Red-coloured Starling (***Pastor roseus***, Linnæus). 690.
Timtimma, The Greenshanks (***Totanus glottis***, Linnæus). 894.
Tisā, The White-eyed Buzzard (***Poliornis teesa***, Frankl.). 48.
Titai,) The Red-wattled Lapwing (***Lobivanellus***
Titī, Tituri or Titri } ***goensis***, Gmelin). 855.
Titar, The Grey Partridge (***Ortygornis ponticeriana***, Gmelin). 822.
Togh, The Indian Bustard (***Eupodotis Edwardsii***, Gray). 836.
Torra baglā, The Large Egret (***Herodias alba***, Linnæus). 925.
Tot-rungi, The Allied Wren-warbler (***Drymoipus neglectus***, Jerdon). 546.
Tsoja and tsāra-i (in Pushtu), The Indian Houbara Bustard (***Houbara Macqueenii***, Gray). 837.
Tugh-dār, The Indian Bustard (***Eupodotis Edwardsii***, Gray). 836.
Tuia-tota, The Rose-headed Parrakeet (***Palæornis rosa***, Bodd.). 149.
Tuntuna, The Greenshanks (***Totanus glottis***, Linnæus). 894.
Tuntunia, The Rufous Grass-warbler (***Cisticola schænicola***, Bonaparte). 539.
Turā, The Button-Quail (***Turnix Sykesii***, A. Smith). 835.
Turtura (in Kapurthala), The Little Brown Dove (***Turtur cambeyensis***, Gmelin). 794.
Turumti,)
Turumtari, } (The female), The Red-headed Merlin (***Hypotriorchis chicquera***, Daud). 16.
Tutri nutri }
 ,, *Retul* (*i.e.* Sandy), The Merlin (***Hypotriorchis cesalon***, Gmel.). 15.
Tutatar, The Wood-cock (***Scolopax rusticola***, Linnæus). 867.
Tūti, The Common Rose-finch (***Carpodacus erythrinus***, Pallas). 738.

U

- Ujlī* (*i.e.* White-bird), The White-Stork (***Ciconia alba***, Belon.). 919.
Ulu, The Brown Fish-owl (***Ketupa Ceylonensis***, Gmel.). 72.
 ,, The Spotted Owlet (***Athene Brama***, Tem.). 76.
Upak or Kupak, The Common Hawk-Cuckoo (***Hierococyx varius***, Vahl.). 205.
Uqāb, The Tawny Eagle (***Acquila fulvescens***, Gray). 29.
Utteran, The Small Swallow-Plover (***Glareola lactea***, Temminck). 843.

W

- Wāk*, The Night-Heron (**Nycticorax griseus**, Linnæus). 937.
Wāk-wāk or *wāq-wāq*, The Night-heron (**Nycticorax griseus**,
Linnæus). 937.

Z

- Zakki*, The Southern Brown Flycatcher (**Alseonax latirostris**,
Raffles). 297.
Zardak, The Bengal Black-headed Oriole (**Oriolus melanocephalus**,
Linnæus). 472.
Zirdi, The Yellow-wattled Lapwing (**Sarciophorus bilobus**,
Gmelin). 856.
Zirrea, The Indian Ringed-Plover (**Ægialitis Philippensis**,
Scopoli). 849.
Zur (in Kashmir), The Common Snipe (**Gallinago scolopaci-
nus**, Bonap.). 871.
Zard bulbul, The Black-crested Yellow-bulbul (**Rubigula flavi-
ventris**, Tickell). 456.
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FEBRUARY, 1908.

The Annual Meeting of the Society was held on Wednesday, the 5th February, 1908, at 9-15 P.M.

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA. M.A., D.L., D.Sc., F.R.S.E., President, in the chair.

The following members were present :—

Dr. N. Annandale, Lieut.-Colonel W. J. Buchanan, I.M.S., Mr. I. H. Burkill, Babu Monmohan Chakravarti, Babu Vanamali Chakravarti, The Hon. Mr. E. A. Gait, C.I.E., Dr. Birendra Nath Ghosh, Mr. H. G. Graves, Dr. T. H. Holland, F.R.S., Mr. D. Hooper, Mr. W. W. Hornell, Mr. C. H. Kesteven, Dr. F. Pearse, Lieut.-Colonel D. C. Phillott, Major L. Rogers, I.M.S., Rai Ram Brahma Sanyal, Bahadur, Pandit Yogesa Chandra Sastri-Samkhyaratna-Vedatirtha, Pandit Umapatidatta Sharma, Mr. G. Thibaut, C.I.E., Mahamahopadhyaya Satis Chandra Vidyabhusana, The Rev. A. W. Young.

Visitors :—Babu Atul Chandra Bandopadhyaya, Babu Hem Chandra Das-Gupta, Kumar Kshitindra Dev, Rai Mahasaya, Babu Abhilas Chandra Ganguly, Babu Girindra Nath Mukhopadhyaya, Mr. A. A. Robertson, and Capt. D. Quinlan.

The President ordered the distribution of the voting papers for the election of Officers and Members of Council for 1908, and appointed Messrs. D. Hooper and W. W. Hornell to be scrutineers.

The President announced that two essays had been received in competition for the Elliott Prize for Scientific Research for the year 1907, which were sent to the Director of Public Instruction, Bengal, one of the Trustees, for report, and that the result had not yet been received.

The President called upon the Secretary to read the Annual Report.

ANNUAL REPORT FOR 1907.

The Council of the Society has the honour to submit the following report on the state of the Society's affairs during the year ending 31st December, 1907.

Member List.

There continues to be a steady increase in the roll of Ordinary Members.

During the year under review, 67 Ordinary Members were elected. Out of these, 4 have not yet paid their entrance fees. The election of 4 more has become null and void under Rule 9. The total number of Ordinary Members, therefore, added to the list was 59. On the other hand, 16 withdrew, 7 died (one a Life Member), 7 were struck off under Rule 9, 3 under Rule 38, 9 under Rule 40, while the names of 4 members were removed from the list of Ordinary Members as they are already on the list of Honorary Members. The total number of members at the close of 1907 was, as will be seen from the following table which shows the fluctuations in the number of Ordinary Members during the past six years, 420 against 401 in the preceding year. Of these, 174 were Resident, 175 Non-Resident, 20 Foreign, 20 Life, and 30 absent members from India, and one was a Special Non-Subscribing Member:—

YEAR.	PAYING.				NON-PAYING.				TOTAL.
	Resident.	Non-Resident.	Foreign.	Total.	Life.	Absent.	Special Non-Subscribing.	Total.	
1902... ..	126	126	14	266	21	46	1	68	334
1903... ..	127	126	15	268	21	45	1	67	335
1904... ..	132	130	14	276	21	45	1	67	343
1905... ..	144	133	12	288	20	47	1	68	357
1906... ..	173	147	15	335	20	51	1	72	407
1907... ..	174	175	20	369	20	30	1	51	420

The seven Ordinary Members, whose loss by death during the year we have to regret, were Major David Macbeth Moir, I.M.S., Mr. Patrick Doyle, C.E., Babu Girindra Nath Dutt, Maharaja Pratapa Narain Singh, Lieut-Colonel Herbert Jekyl Dyson, I.M.S., Maulavi Sayid Abdul Alim, and Lieut-General Sir Henry Edward Landor Thuillier, Kt. (a Life Member).

There were two deaths among the Honorary Members, viz, Sir Michael Foster and Lord Kelvin. The number is now 28, leaving two vacancies to be filled.

The number of the Special Centenary Members and Associate Members is unaltered since last year; their numbers are 4 and 12, respectively.

During the year one member, Mr. C. B. N. Cama, compounded for his subscriptions. ;

Indian Museum.

No presentations were made to the Indian Museum.

During the year there has been no change amongst the Trustees. The Trustees who represent the Society are:—G. W. Kuchler, Esq., M.A.; T. H. Holland, Esq., F.G.S., F.R.S.; The Hon. Mr. Justice Asutosh Mukhopadhyaya, M.A., D.L.; R. P. Ashton, Esq.; and Lieut.-Colonel D. C. Phillott.

The Government of India in the Department of Commerce and Industry submitted certain proposals formulated by the Trustees of the Indian Museum, with a view to its re-organization and future development, and the Council agreed to the modifications referred to.

Finance.

The accounts of the Society are shown in the Appendix under the usual heads. Statement No. 11 contains the Balance Sheet of the Society and of the different funds administered through it.

The credit balance of the Society at the close of the year was Rs. 1,81,836-15-6, against Rs. 1,79,519-3-3 at the close of the preceding year.

The Budget for 1907 was estimated at the following figures. Receipts Rs. 22,350 (Ordinary Rs. 21,150 and Extraordinary Rs. 1,200). Expenditure Rs. 24,325 (Ordinary Rs. 20,671 and Extraordinary Rs. 3,650). The budget estimate of receipts excludes entrance fees.

The actual receipts for the year, exclusive of entrance fees and one compounding fee, have amounted to Rs. 24,102-11-6, or about Rs. 1,800 in excess of the estimate. The sum of Rs. 2,096 has been received as entrance fees, and the sum of Rs. 300 as a compounding fee; and the sum of Rs. 2,400 has been credited to the Permanent Reserve Fund, which now stands at Rs. 1,55,350. The receipts have exceeded the estimate under the heads of "Subscriptions," "Sale of Publications," "Interest," the increases being, respectively, Rs. 1,247, Rs. 395 and Rs. 70. The total receipts for the year have been Rs. 26,498-11-6.

In the budget the ordinary expenditure was estimated at Rs. 20,675, the expenditure to be incurred under sixteen heads. Under these heads the expenditure has amounted to Rs. 21,202-15-7, or Rs. 527-15-7 in excess of the estimate. The expenditure on account of the Society's *Journal and Proceedings* and *Memoirs* has exceeded the estimate by the sum of Rs. 375-7-5. In no other case has there been any very considerable expenditure in excess of the estimate.

The extraordinary expenditure was estimated at Rs. 3,650, the expenditure to be incurred under seven heads. The expenditure under six of these heads has amounted to Rs. 1,690-2-9, or Rs. 40-2-9 in excess of the estimate. Under the seventh head, "Library Catalogue," Rs. 2,000, there has been no expenditure.

During the year the Council sanctioned the following items

of expenditure : Grain Compensation Allowance, Rs. 172-14-3 ; Servants' Latrine, Rs. 318-15-6 ; Furniture, Rs. 28-14 ; and Paging of Manuscripts, Rs. 297 : total Rs. 817-11-9. The sum of Rs. 38-1-1 was paid for accrued interest on Government Paper purchased during the year. The total expenditure has amounted to Rs. 23,748-15-2.

The total income, it has been shown, amounted to Rs. 26,498-11-6 and the expenditure to Rs. 23,748-15-2. The financial position is, therefore, somewhat stronger than at the close of the preceding year ; but the improvement would have been slight, had the preparation of the new library catalogue been completed within the year, as it was hoped it would be.

The following sums were held at the close of the year on account of the different funds administered by the Society :—

	Rs.	As.	P.
Oriental Publication Fund, No. 1 ...	5,109	4	3
Oriental Publication Fund, No. 2 ...	2,000	0	0
Arabic and Persian MSS. Fund (less Rs. 675 advanced to the officer in charge)	478	8	9
Bardic Chronicle MSS. Fund ...	2,400	0	0
Sanskrit MSS. Fund (less Rs. 1,000 advanced to the officer in charge) ...	2,271	9	2
Total Rs. ...	12,259	6	2

The liquid assets of the Society at the close of the year, excluding the Permanent Reserve Fund and deducting Rs. 12,259-6-2 belonging to the funds administered by the Society, amounted to Rs. 26,050-11-11. The bulk of this sum is invested in Government paper as a temporary reserve fund.

The Budget estimate of Receipts and Expenditure for 1908 has been fixed as follows :—Receipts Rs. 22,830, Expenditure Rs. 22,760.

The Budget estimate of Receipts is about Rs. 1,600 less than the actuals of 1907. There will be no income from the sale of old building materials, as was the case last year.

The Budget estimate of Expenditure is about Rs. 1,000 less than the actuals of 1907, but only Rs. 70 less than the estimated income for the year. Any expenditure in excess of the provision that has been made will have to be met by drawing on the temporary reserve fund, unless the income should prove larger than is anticipated.

The expenditure on the Royal Society's Catalogue (including subscriptions sent to the Central Bureau) has been Rs. 9,628-1-9, while the receipts under this head from subscriptions received on behalf of the Central Bureau have been Rs. 8,781-9-0. The sum of Rs. 8,867-7-11 has been remitted to the Central Bureau and Rs. 542-9-11 is in hand to be remitted to them.

Mr. J. A. Chapman continued Honorary Treasurer throughout the year.

BUDGET ESTIMATE FOR 1908.

Receipts.

	1907. Estimate.	1907. Actuals.	1908. Estimate.
	Rs.	Rs.	Rs.
Members' subscriptions ...			
Subscriptions for the Society's <i>Journal and Proceedings and Memoirs</i> ...	9,000	10,247	{ 9,000 1,460
Sale of Publications ...	2,000	2,395	2,000
Interest on investments ...	6,450	6,520	6,670
Rent of room ...	600	600	600
Government allowances ...	3,000	3,000	3,000
Sale of books rejected from Library ...	...	46	...
Miscellaneous ...	100	94	100
	<hr/>	<hr/>	
	21,150	22,902	
Sale of old beams and joists	1,200	1,200	
	<hr/>	<hr/>	
	22,350	24,102	
Compounding fee ...	...	300	...
Entrance fees ...	...	2,096	..
	<hr/>	<hr/>	
Total ...	22,350	26,498	22,830
	<hr/>	<hr/>	<hr/>

Expenditure.

Salaries ...	5,200	5,054	5,200
Commission ...	500	496	500
Pension ...	240	240	240
Stationery ...	150	114	125
Light and Fans ...	320	335	320
Municipal Taxes ...	1,465	1,465	1,465
Postage ...	600	560	575
Freight ...	250	390	390
Contingencies ...	500	421	500
Books ...	2,000	2,045	2,000
Binding ...	1,000	1,295	1,000
<i>Journal and Proceedings and Memoirs</i> ...	7,500	7,876	7,600
Printing Circulars, etc. ...	600	594	300
Auditor's fee ...	100	100	100
Petty Repairs ...	50	32	35
Insurance ...	200	188	200
	<hr/>	<hr/>	<hr/>
Carried over. Total ...	20,675	21,205	20,550

	Rs.	Rs.	Rs.
Brought forward ...	20,675	21,205	20,550
Library Catalogue ...	2,000	...	1,500
Magic Lantern Installation ...	235	235	...
Arches ...	450	454	...
Iron pipes, bends, etc. ...	670	666	...
Boundary Wall ...	70	70	...
Unfiltered Water-supply ...	65	108	...
Donation ...	160	158	...
	<hr/>	<hr/>	
Total ...	24,325	22,896	...
Servants' Latrine ...	...	319	...
Furniture ...	...	29	...
Grain Compensation Allowances ...	...	173	200
Paging of manuscripts ...	...	297	200
Interest on Government paper purchased ...	...	38	...
Tibetan Catalogue ...	...	...	310
	<hr/>	<hr/>	<hr/>
Total ...	24,325	23,752	22,760

Agencies.

Mr. Bernard Quaritch and Mr. Otto Harrassowitz continued to act as the Society's agents.

The number of the copies of the *Journal and Proceedings*, and the *Memoirs* sent to Mr. Quaritch, during the year 1907, was 534 valued at £69-2, and of the *Bibliotheca Indica* 462, valued at Rs. 411-10; of these copies to the value of £38-6-8 and Rs. 79-8 have been sold.

Nineteen invoices of books purchased, and of publications of various Societies sent in exchange, have been received during the year, the value of the books purchased amounting to £78-18-2.

The number of copies of the *Journal and Proceedings* and the *Memoirs* sent for sale to Mr. Harrassowitz, during 1907, was 213 valued at £30-1-6, and of the *Bibliotheca Indica* 460 valued at Rs. 435-14; the sale proceeds have been £53-1-3 and Rs. 717-1-7, respectively.

Library.

The total number of volumes and parts of magazines added to the Library during the year was 1,890, of which 192 were purchased and 1,698 were presented or received in exchange.

The Library Catalogue has not yet issued from the press. Print order has been given on 14 formes: the remainder has been revised three times and is still under revision.

The Council has sanctioned the preparation of a Catalogue of the Tibetan Xylographs and MSS. in the Library, and the work has been entrusted to Rai Sarat Chandra Das, Bahadur.

Owing to the increased accommodation required for Sanskrit

books and MSS., the Sanskrit Library has been separated from that of the Arabic and Persian, and the two libraries are now located in different rooms.

Mr. J. H. Elliott has continued Assistant Secretary throughout the year.

Babu Surendranath Kumar was appointed Librarian on 1st January, 1907.

International Catalogue of Scientific Literature.

Work in the Regional Bureau during the past year has been uninterruptedly carried on. It is increasing as one would expect *pari passu* with the increase of scientific staffs in India, and the increasing energy of scientific investigators. The Regional Bureau prepared and sent 1,189 index slips to the Central Office in London; this number of slips has never been approached before. The slips were prepared in chief part by the Bureau's clerk, and checked or corrected by one or other of the following gentlemen, most of them members of the Society who have given freely their services for this good work:—

N. Annandale, Esq., D.Sc.	Capt. J. W. D. Megaw, I.M.S.
I. H. Burkill, Esq.	H. Maxwell-Lefroy, Esq.
Prof. J. A. Cunningham.	B. B. Osmaston, Esq.
L. L. Fermor, Esq.	Capt. W. S. Patton, I.M.S.
Rev. Fr. E. Francotte, S.J.	C. W. Peake, Esq.
Capt. A. T. Gage, I.M.S.	Major L. Rogers, I.M.S.
D. Hooper, Esq.	E. Thurston, Esq.
C. Little, Esq.	G. H. Tipper, Esq.
Capt. R. E. Lloyd, I.M.S.	E. Vredenburg, Esq.
Capt. A. C. MacGilchrist, I.M.S.	Capt. F. W. Wall, I.M.S.

The expenses of maintaining the bureau for the year have been:—

	Rs.	As.	P.
Staff	506	8	0
Postage, freight, etc. ...	220	1	10
Stationery	34	0	0
Total	760	9	10

They were met out of the grants made by the Government of India for the purpose.

During the year we have distributed in India for the Central Office no less than 554 volumes, being parts of the 3rd, 4th and 5th annual issues. We much regret the loss of two or three subscribers, and think it a pity that the teaching centres whither the volumes went should, henceforward, be without these reference volumes. Moreover, the financial aid that the subscriptions meant to the undertaking was valuable.

Subscriptions to the extent of Rs. 8,781-9 have been collected in India and forwarded to London.

Lieut.-Colonel D. Prain, C.I.E., F.R.S., was so kind as to represent the Society, upon its request, at a meeting of delegates held in London on July 29th and 30th. The financial position of the Central Bureau was then considered, and it was decided to submit copies of the accounts to the Regional Bureaus for publication in any authorised journal.

Elliott Prize for Scientific Research.

The subject selected for the Elliott Gold Medal for the year 1907 was Chemistry. Only two essays have been received in competition; these have been referred to the Trustees for report.

At the request of the Director of Public Instruction, Bengal, paragraph 2 of the Notification of August 2nd, 1907, regarding the Elliott Prize, was amended so as to include those districts of Bengal that have been transferred to Eastern Bengal and Assam, and the revised Notification now reads as follows:—

“Any native of Bengal or of the districts of Dacca, Mymensingh, Backerganj, Faridpur, Rajshahi, Rangpur, Dinajpur, Jalpaiguri, Bogra, Pabna, Malda, Chittagong (including Chittagong Hill Tracts), Noakhali and Tippera (including Hill Tippera), or any Eurasian or domiciled European residing in Bengal or the aforesaid districts, may compete for the prize.”

Barclay Memorial Medal.

In connection with the Barclay Memorial Medal, the Council awarded the medal for 1907 to Lieut.-Colonel Alfred William Alcock, M.B., LL.D., C.I.E., F.R.S., in recognition of his biological researches.

Society's Premises and Property.

The cracks in the walls of the main building caused by changing the beams have been repaired. The boundary wall has been plastered and whitewashed.

To provide sufficient water for the garden a tap has been fitted up on the Corporation unfiltered water system.

The question of fixing picture-rods has been abandoned.

On the recommendation of Lieut.-Colonel F. P. Maynard, two microscopical lamps at Rs. 30 each, for the use of the Medical Section, have been ordered.

An electric installation has been fitted up for working the lantern at the General Meetings.

Exchange of Publications.

During 1907, the Council accepted six applications for exchange of publications. *viz*:—(1) From the Agricultural Research

Institute and Agricultural College, Pusa : the Society's *Journal and Proceedings* and *Memoirs* in exchange for the publications of the Institute. (2) From the Physikalisch-Medizinische Sozietät in Erlangen: the Society's *Journal and Proceedings* and *Memoirs* for their *Sitzungs-Berichte*. (3) From the Birmingham Natural History and Philosophical Society: the Society's *Journal and Proceedings* and *Memoirs* for their *Proceedings*. (4) From the Deutsche Entomologische Gesellschaft, Berlin: the Society's *Journal and Proceedings* and *Memoirs* for the publications of the Society. (5) From the Museum für Völkerkunde zu Leipzig: the Society's *Journal and Proceedings* and scientific papers of the *Memoirs* for the publications of the Museum. (6) From the Commissioner of Fisheries, Washington: the Society's *Journal and Proceedings* and *Memoirs* for his publications.

At the request of Dr. N. Annandale, the Council agreed to exchange the Society's *Journal and Proceedings* and *Memoirs* for those of the Marine Biological Stations at Naples, and the Director has been written to regarding the proposal.

In addition to these exchanges, the Library of the Board of Examiners has been placed on the free distribution list of the Society's publications.

Publications.

There were published during the year ten numbers of the *Journal and Proceedings* (Vol. III., Nos. 1-10) containing 774 pages and 10 plates.

Of the *Memoirs*, six numbers were published (Vol. I., Supplement No. 2, and Vol. II., Nos. 1-5) containing 123 pages and 1 plate.

The Numismatic Supplements, No. 7 and 8, have been published in the *Journal and Proceedings*, Vol. II., Nos. 1 and 8, under the editorship of Mr. R. Burn and Lieut.-Colonel W. Vost, I.M.S.

There were also published the Index to the *Journal*, Part I for 1904, the Index to the *Journal and Proceedings*, Vol. II., and the Index to the *Memoirs*, Vol. I.

There were only two short reviews published in the *Journal and Proceedings*, Vol. III., No. 7; and the Council decided not to publish further reviews.

Lieut.-Colonel D. C. Phillott continued General Secretary and Philological Secretary, and edited the *Proceedings* and the Philological Section of the *Journal* throughout the year, except for six weeks when Captain C. P. Peart, of the 106th Hazara Pioneers, officiated for him. The Natural History Section of the *Journal* was edited by Mr. I. H. Burkill, the Natural History Secretary, and the Anthropological Section of the *Journal* by Dr. N. Annandale, the Anthropological Secretary, except for three months when Captain R. E. Lloyd, I.M.S., officiated for the latter. Mahamahopadhaya Satis Chandra Vidyabhusana carried on the duties of Joint Philological Secretary, and was in charge of the *Bibliotheca Indica*; while Mahamahopadhaya Haraprasad Shastri continued the work of collecting Sanskrit manuscripts. In February, 1907, Dr. Ross

left India, and Lieut.-Colonel D. C. Phillott took charge of the Search for Arabic and Persian manuscripts. Lieut.-Colonel F. P. Maynard, I.M.S., continued Medical Secretary till November, 1907, when he resigned, and Major L. Rogers, I.M.S., was appointed. The Coin Cabinet was in charge of Lieut.-Colonel W. Vost, I.M.S., who also reported on all Treasure Trove coins sent to the Society.

Philology, &c.

During the year under review the contributions have been varied and fairly numerous. To *History*, Babu Jadu Nath Sarkar has contributed two papers, one on the "Conquest of Chatgaon, 1666 A.D.," by Shaista Khan, and the other "the Feringi Pirates of Chatgaon, 1665 A.D.;" both are translations from the '*Ālamgīr-Nāmā* and are a supplement to his article on the same subject, published in the *Journal* for June, 1906. Under *Antiquities*, mention may be made of Mr. G. Yazdani's two papers on the ancient history of the town and buildings of Narnaul, south of Delhi. Mr. Hari Nath De's "Tārikh-i-Nuṣrutjungī," an important memoir, is still in the press. Maulavi Muḥammad Kāzim Shirāzī, Persian Instructor to the Board of Examiners, has published a collection of 138 European words, culled from modern Persian newspapers. This list is of philological interest inasmuch as it indicates, in some measure, the extent of European influence on the current literature of Persia. The Rev. F. J. Hoffman's paper on "Mundari Poetry, Music and Dances" is a valuable contribution both to *Philology* and *Ethnology*. Major T. W. Haig has given the Armenian inscriptions with English translations of some epitaphs, ranging in date from A.D. 1645 to 1807, discovered by him in a Christian cemetery in Haidarabad, Deccan. Mr. D. Donald has contributed "Some Pushto Folk-tales," with their Persian translations: they are of interest to the students of folklore. Lieut.-Colonel D. C. Phillott, the Secretary, and Mr. R. F. Azoo, the Arabic Instructor of the Board of Examiners, have contributed "Seven Stories from the *Nuṣhat* 'l-Yaman," "The Birds' Complaint before Solomon" from the "*Kitāb* 'l-Jamharah fī 'Ilm' 'l-Buṣṣarah" and "Some Folk-tales from Hazramaut": Arabic texts and English translations. Portions of these papers are of anthropological and historical interest. In papers of minor interest are "Description of a *Jām-i-chihīl kalīl*, such as that referred to in Lane's *Modern Egyptians*," and a "Note on Sign-, Gesture-, Code-, and Secret-Language, etc., amongst the Persians" by Lieutenant-Colonel Phillott.

The impetus given to Tibetan studies by the Tibet Mission of 1903-04 still continues, as is evident from several of the papers published this year. The *Memoir* on "The Coinage of Tibet" is interesting, as it contains facsimiles of silver coins minted in Nepal and Tibet. Mr. E. H. C. Walsh, I.C.S., the author, observes that the oldest coin at present available in Tibet is dated 1696 A.D., though coins are reported to have been used there as early as the 12th century A.D. The characters on the official seal of the Dalai

Lama of Lhasa are supposed to be in the old Uigur form of the Mongolian character, derived from the Syriac, and introduced by Nestorian Missionaries. The Rev. H. Francke, in his papers on "The Paladins of the Kesar Saga," narrates several folk-tales from Tibetan sources, current in Lower Ladakh, or in Western Tibet. Rai Sarat Chandra Das, Bahadur, C I.E., in his paper on "A Written Language in Mongolia," shows that writing was introduced into Mongolia in the 13th century A.D., by Sakya Pandita of Western Tibet, during the reign of Gutan, the grandson of Chinghis Khan; and in his "Notices of Orissa in the Early Records of Tibet" the Rai Bahadur mentions several Buddhist authors that flourished in Orissa. Mahamahopadhyaya Satis Chandra Vidya-bhusana, in his three papers on "Indian Logic as preserved in Tibet," notices the Tibetan versions of seventy-eight Buddhist works on logic, written in Sanskrit; these, with two exceptions, no longer exist in India nor in Nepal. The Mahamahopadhyaya, during his recent visit to the Tibetan monasteries of Labrang and Phodang, in Sikkim, examined a few valuable historical works on Indian Philosophy, a short account of which is embodied in his paper on "The Samkhya Philosophy in the land of the Lamas." In his paper on "Sanskrit Works on Literature, etc., as Preserved in Tibet," the same writer brings to light a small treatise on comparative grammar by Subhāṣita Kīrti, called *Sarva-bhāṣā-Pravartana-Vyākaraṇa*, or "An Introductory Grammar to all Languages."

The influence of Indian thought and art in another direction is indicated in the paper "Clay tablets from the Malay Peninsula," by Babu Rakhai Das Banerji. The paper gives an account of five seals containing impressions of Buddha, Lokeshvara, Avalokitesvara, and Tara, with the well-known formula "Ye dharma," etc. Dr. Annandale, who brought these seals from the Malay Peninsula, adds an Introductory Note, in which he remarks that a long-continued intercourse existed between the western ports of the Peninsula and the southern coast of India, especially through the commercial activity of the "Labbies" and their ancestors.

There is also a series of interesting papers on India proper. Babu Bhaves Chandra Banerji, in his "Notes on the Vedic Sacrifices," observes that sacrifice was the only religious rite practised by the Vedic Aryans. He divides sacrifices into several classes, and holds that in the earliest times the Aryans used to sacrifice human beings, and that subsequently they abandoned the practice, substituting horses, cattle, sheep, goats; while later, the majority preferred the sacrifice of corn and milk, etc. Mr. A. Venis, in his "Notes on the Maurya Inscription at Sarnath," discusses the meanings of certain words in the inscription as deciphered by Dr. Vogel, and says that the number 256, in the inscriptions at Rupnath, Sahasram, and Brahmagiri, may be the date of Asoka's Coronation reckoned from the year of Buddha's Illumination. Mr. C. A. Silberrad, in his paper on "Rock-drawings in the Banda District," gives a brief account of several drawings in red ochre on bare surfaces of the Vindhyan sandstone; their origin is

not known. A fairly satisfactory explanation of the origin of innumerable sub-castes out of the four original castes is given by Mr. Jackson, I.C.S., in his "Note on the history of the Caste-system." He says that India, before the arrival of the Muslims, was divided into numerous distinct kingdoms governed by kings, who followed divergent customs. A caste that lived in an area so extensive as to be subject to more than one political jurisdiction, naturally split up into sections, the customs of which differed in detail, owing to the divergent decisions of the kings to whom they were subject. The Kanaujiya, Maithil, and other sections of the Brahmans are said to have arisen in this way. "Chronology of Indian authors," by Babu Nilmani Chakravarti, is a useful paper, adding numerous important dates to Mabel Duff's Chronology of India; it is compiled from an examination of many volumes of recently published Reports and Catalogues of Sanskrit MSS.

A research into the origin and development of Arithmetical Notation is made by Mr. Kaye in his "Notes on Indian Mathematics." From a comparison of the Hindu, Arabic, and Greek systems of Arithmetic, it is concluded that the modern arithmetical notation is not of Indian origin, and that the 10th century A.D. is the earliest period when Indian inscriptions were dated in the figures of the modern (place-value) notation.

Mathematics and the Natural Sciences.

The Society has reason to be satisfied with its work in the Natural Sciences. Its *Journal*, for 1907, contained 38 papers—almost all from members—and it issued two memoirs. The papers are almost of the same number as in 1906, but the contributors are more, being 23 against 18. Many of the papers have been illustrated by means of plates and figures in the text such as Calcutta is now easily able to produce. The Council would like members to recognise that the Society's publications are really prompt and that the circulation of the *Journal* is growing wider and wider. They earnestly desire that a greater number of members should become contributors.

In Mathematics, the Society has published Professor D. N. Mallik's *Magnetic Induction in Spheroids*, and Mr. G. R. Kaye's *Studies in the Origin of the Arithmetic Notation* as mentioned above.

In Physical Chemistry the Society has published Dr. Morris Travers' paper *On the Absorption of Gases, Vapours and Substances in solution by Solids and Amorphous Substances*, and also a suggestive "preliminary paper" by Professor J. A. Cunningham and Babu Satis Chandra Mukerjee on the *Electric State of Nascent Gases*.

In Inorganic Chemistry, the Society has published notes by Professor P. C. Ray, Babu Bidhu Bhusan Dutta and Babu Panchanan Neogi. In Applied Chemistry, the Society has published a memoir by Mr. E. R. Watson on the *Fastness of the Indigenous Dyes of Bengal*.

To Geology is perhaps to be reckoned Mr. D. Hooper's account of the composition of *Well Waters in the Hadhramahut*.

Zoology has been well represented in the pages of the *Journal*. On the invertebrate fauna of India have appeared papers by Dr. N. Annandale describing Freshwater sponges, Hydra and a Medusa found in brackish water in the Ganges delta, and on the Polyzoa of the fresh waters of India. Major A. R. S. Anderson has described a sea-urchin of exceptional interest on account of the occurrence of the genus as a fossil. In a memoir Dr. A. Gravel, of Bordeaux, has described several new barnacles from the collections of the Indian Museum. And there has also appeared in the *Journal* a note on a parasitic worm by Dr. O. von Linstow. The papers on vertebrate animals include seven on the habits of birds by Lieutenant-Colonel D. C. Phillott, one on the distribution of the monkey, *Macacus arctoides*, by Rai Ram Brahma Sanyal, Bahadur, and one on the rare cat, *Felis tristis*, by Dr. N. Annandale.

Dr. H. H. Mann's physiological paper on the *Diet of Tea Garden Coolies in Upper Assam* is of great interest.

In Botany, the *Journal* for the year has contained eleven papers, all dealing with the higher plants or Phanerogams of India. Five of them are systematic: one adds a new genus of the order Cruciferae—*Anguillicarpus*—to the flora of the country; others contain descriptions of varieties of *Gentiana coronata*, *Suertia purpurascens*, and *Ducrosia anethifolia*. Messrs. R. S. Finlow and C. J. Bergtheil discuss the *Hardness of the Seeds of Wild Fibre plants*; Mr. I. H. Burkill details observations on the Pollination of Cotton flowers; Captain A. T. Gage describes an abnormal pineapple; Messrs. Burkill and G. C. Bose describe an abnormal mango branch; and Mr. D. Hooper reports on the oils contained in the seeds of species of *Garcinia*. And concurrent with the volume containing these has been part of the issue of vol. 74 of the old series of the *Journal*. Vol. 74, and vol. 75 to follow it, are reserved for the publication of Sir George King's and Mr. J. S. Gamble's *Flora of the Malay Peninsula*. Three parts of vol. 74 containing 730 pages were issued during the year under review.

Further, it is to be mentioned that in the *Proceedings* may be found accounts of interesting exhibits by Mr. E. Vredenburg, Dr. N. Annandale and Dr. E. J. Butler. Mr. Vredenburg's exhibit was of the fossil sea-urchin mentioned above; Dr. Annandale's of certain small Indian aquatic animals; and Dr. Butler's of a case of double parasitism in mistletoes from the district of Almora.

Medical Section.

The Medical Section of the Society was started in 1906, and held its first meeting in August of that year. With the exception of the vacation during September and October, it has met regularly each month since its foundation. A large number of medical men have joined the Society as ordinary members during this period, so that at the end of 1907 there are 61 medical

members. The meetings have been well and regularly attended by the members resident in Calcutta, the number present having averaged 18. The most noteworthy and satisfactory feature of the meetings has been the great interest shown by members in the papers and the interesting discussions which have followed them which, on two occasions, was so well sustained that they had to be concluded at a subsequent meeting. One of these related to the difficult and important subject of the differentiation of tropical fevers, and the other arose on a paper on Cerebro-spinal meningitis by Lieut.-Colonel E. H. Brown. Other papers of special interest were on smallpox in Calcutta by Major Vaughan; injuries to the knee-joint by Dr. Adrian Caddy; metabolism in Bengalis and on blackwater fever by Captain D. McCay; and on Tropical hepatitis and the prevention of liver abscess by Captain J. G. Murray. In addition to the formal papers many of rare and interesting clinical cases have been shown, including a number of surgical affection, a branch of medical science which has not yet contributed its full share of papers.

The above brief summary of the work done will suffice to show that the medical branch has more than justified its existence, and has met a long-felt want, so that a lengthy and prosperous career may confidently be looked forward to. The rules relating to the meetings of the Medical Section, which were sanctioned by the Council, have worked very well. Some inconvenience has occasionally arisen owing to the absence of either a vice-president or a member of council to take the chair, which has necessitated waiting for a quarter of an hour after the proper meeting time before a chairman could be elected under the rules. The Council have, however, already taken steps to obviate this difficulty. The papers read before the section have been published in the "Indian Medical Gazette" with the sanction of the Council. The greatest need of the section is a reference medical library, which is very badly wanted in India and would doubtless lead to many additional medical members living beyond Calcutta joining the Society. This matter is engaging the attention of the Council. Major Maynard, I.M.S., was Secretary of the Medical Section from its inception up to November 1907, when he resigned, and Major L. Rogers was appointed in his place. The Section owes a debt of gratitude to Major Maynard for his valuable work during the critical early period of its existence.

Anthropology, etc.

There is very little to be said about anthropology this year. Three papers have been published in the *Memoirs*, as well as several shorter ones in the *Journal*. The most important is probably the Rev. Father Hoffmann's account of Mundari songs and poetry; only the first part of this valuable work, which has been interrupted by the ill-health of its author, has as yet been issued. In accordance with the wish of the retiring President, a scheme for the establishment of a bureau for the supply of

anthropological information in connection with the Society was submitted to the Government of Bengal, but no order on the subject has as yet been issued.

Coins.

During 1907 the number of coins presented to the Society was 2 gold, 70 silver, and 43 copper, which may be classified as shown below :—

	A	₹	₹
Ancient India—			
Apollodotus II	...	5	
Nahapāna	...	22	
Shaka	...	1	
Sita	...	1	
Mediæval India—			
Madana Pāla Deva	...		1
Somésvarā Deva	...		1
Chāhāḍa Deva	...		1
Samanta Deva	...		2
Gadhaiya	...	1	
Chhatrpati	...		1
Muḥammadan States—			
Sind—			
Banū 'Amrwiya	...	1	
Banū 'Aliwiya	...	1	
Saif-ud-din Ḥasan Qarlagh	...		
Bengal—			
'Ala-ud-din Husain Shāh	...	1	
Kulbarga—			
Firoz Shāh Bahmani	...		1
Aḥmad Shāh I	...		2
Aḥmad Shāh II	...		6
Humāyūn Shāh	...		2
Nizām Shāh (Aḥmad)	...		3
Muḥammad Shāh	...		4
Delhi—			
Shams-ud-dīn Altāmsh	...		1
Ghiyās-ud-din Tughlaq	...		1
Bahlol Shāh	...		8
Sikandar Lodī	...		5
Akbar	...	2	
Jahāngīr	...	1	
Carried over	2	34	40

	Brought forward	...	2	34	40
Shāh Jahān ...	...	...		12	
Murād Bakshsh	...	...		1	
Aurangzeb ...	...	...		4	
Ahmad Shāh ...	...	...		3	
Shāh 'Ālam II	...	...		4	
Miscellaneous —					
Wire money ...	...	...		5	
Indo-French	...	...			2
Sikh—Gobind Singh	...	...		6	
Modern Native States	...	...		1	1
			2	70	43

A few of the coins of Apollodotus II have, for that king, unpublished monograms. The coins of Nahapāna have been published in the *Journal* of the Royal Asiatic Society of Bombay.

The post of Numismatic Secretary was held for the first six weeks of the year by Mr. Richard Burn, and, for the remainder, by Lieut.-Col. W. Vost, I.M.S. The number of coins examined as Treasure Trove was 2,995. Notes have been kept of the more important finds, and will be published in the Numismatic Supplement to the *Journal*.

Bibliotheca Indica.

Of the 22 fasciculi of texts published in the Bibliotheca Indica Series during the year under review, 15 belong to Brahmanic Sanskrit literature, 3 to Jaina Sanskrit, 1 to Buddhist Sanskrit, 1 to Hindi, 1 to Persian, and the remaining 1 to Tibetan. These fasciculi include Mr. Beveridge's translation of the Akbar-nama, Pandit Ganga Nath Jha's translation of the *Slokavartika*, and Mahamahopadhyaya Chandra Kanta Tarkalankara's second edition of the *Grihya Sutra*. Of the new works taken in hand only two fasciculi have been published this year, *viz*, one fasciculus of the *Yoga-sastra* and another of the *Atma-tattva-viveka*, under the editorship of Munimaharaja Dharmavijaya and Pandit Vindhyaesvari Prasad Dvivedin respectively. The *Yoga-sastra* is an authoritative work on the Jaina religion and morality, by the celebrated Jaina philosopher Hem Chandra Suri, better known as Kalikāla Sarvajña, who flourished during 1088-1172 A.D. The *Atma-tattva-viveka*, otherwise known as *Bauddhadhikara*, was composed by the famous Hindu logician Udayanacharya in 984 A.D., to refute the philosophical doctrines of the Buddhists; it is an abstruse work bearing testimony to the wordy war that existed between the Brahmans and Buddhists during the last stage of their struggle with each other. There exists, too, a Tibetan version of this work; but it is not more approachable than its Sanskrit original. Referring to the Tibetan version, His Serenity the Tashi Lama of Tibet, while visiting the Benares College in

December 1905, observed that, though he knew every word of the book, he could not properly grasp the meaning of a single sentence. It is hoped that some scholar will find leisure to unravel the intricacies of this work by the help of the four commentaries which are published along with the text.

The Government grant of Rs. 9,000 for the Bibliotheca Indica has been raised to Rs. 12,000 for five years, for affording facilities for publishing a larger number of Arabic and Persian texts. A few changes have been made in the rules for remunerating editors and translators. Works will henceforth be issued in fasciculi of about 200 pages. The supervision of the Bibliotheca Indica publication was in the hands of Mahamahopadhyaya Satis Chandra Vidyabhusana, Joint Philological Secretary of the Society.

Report on the Search for Sanskrit MSS.

During the year under review, Mahamahopādhyāya Haraprasād Sāstri went to Nepal to examine manuscripts in the Durbar Library collected since his visit in 1898. This collection was commenced by the late Mahārājā Sir Vir Shamsher Jung Rānā and continued by his able brother, Sir Chandra Shamsher Jung Rānā, the present Maharaja. It contains about four hundred manuscripts, nearly half written on palm leaves. Some of the palm-leaf manuscripts bear dates of the 10th century, and very few are later than the 15th. Most are works on Tantra, both Hindu and Buddhist. One of the Tantrik works entitled **कौलभगवान्विनियय** is attributed to Macchendra Nāth. The Hindu Tantras are all attributed to Siva, and they are supposed to have been brought down to Earth from Kailāsa by nine Nāthas, one of whom was Macchendra Nāth. This is one of the earliest Tantra known. The MS. is written in Gupta character of the transition period. Another work, entitled *Kīran Tantra* and written in the same character, is dated N.S. 44, i.e. 924 A.D. There are many works in the Vajrayān School of Buddhism, which is the origin of that obscene and mystic worship popularly known as the Sabaja School. The modern Sabaja Vaishnavism of Bengal is a mere adaptation of that Buddhist School to Hinduism: the doctrine and the dogmas are very much the same, there being but a slight difference in name and form.

The *Aṣṭasāhasrikā Prajñāpāramitā* is the ancient and original work on *Prajñāpāramitā*. About the sixth century, Maitreya Nāth laid down the doctrines of the Mahāyān School in the form of *Karikās*, and divided them into eight chapters, called the *Abhisamaya Sāstra*. Later, the *Prajñāpāramitā* was amplified into a work of 25 thousand verses and called the *Panchavinsati Sāhasrikā Prajñāpāramitā*; it embodied the ideas of Maitreya Nāth. Again, in the reign of Dharma Pāl of Magadha, a similar commentary, called the *Abhisamayālaṅkāra Sāstra*, was written on the *Aṣṭa Sāhasrikā*.

But the most important discovery of local interest is the collection of Bengali songs of the Vajrayān School of Buddhism.

written long before the Muslim conquest of Bengal. Professor Bendall, in his Cambridge Catalogue, describes a manuscript of Hevajra (हेवज) Tantra by Krishnāchārya or Kāhnu Pāda. The particular manuscript he mentions was copied in 1198. He gives a photograph of one page. In a work entitled Charyācharyavinīśchaya, the palaeography of which is undoubtedly 50 to 100 years older, are found some Bengali songs by the same Krishnāchārya or Kāhnu Pāda with a Sanskrit commentary. This places Krishnāchārya a hundred to two hundred years before 1198. In the Sanskrit commentary of Charyācharyavinīśchaya there are again found Dohas by Krishnāchārya quoted here and there. On enquiry, Mahāmahopādhyāya Śāstri found a copy of a Doha-Koṣa by Krishnāchārya in the private collection of a Buddhist priest. It contains 32 Dohas by Krishnāchārya. The Buddhist priest assured him that the Dohas are still sung, but as their doctrines are secret they refused to sing them before him. He has, however, procured a copy of the Doha-Koṣa with a Sanskrit commentary. The Charyācharyavinīśchaya contains songs by several Bengali poets—Lui, Dwarka, Bhusukm, Sarabha, Womvi and others. This takes back the history of Bengali literature by several centuries.

The wide prevalence of Buddhism in Bengal is proved by a manuscript of the Bodhicharyāvatāra, copied in A.D. 1436 at Venugrām in Sanchuriā, or Sanchala, in Southern Burdwan, by a Buddhist Bhikshu for the benefit of a Kāyastha Mahattama or Zamindar and his son; it was collated and corrected by another Bhikshu **दास पराशर** i.e., for the use of himself and of others. *Ādikarma* is another work which throws light on the early history of Bengal. It was written by Yatakara Gupta at the request of his friend, Prabhākara Gupta, and deals with the reformed doctrines of Subhākara Gupta. There is a quotation in this book embodying some of the ideas of the Sammatiya School, which, according to Hiuēn Tsang, prevailed in Eastern India. The Śāstri has had this work copied, as it is likely to throw light on the state of Buddhism in Bengal, perhaps even before the reformation effected by Dharma Pāl in the 9th century. The book is entirely free from the obscenities that disfigure the work of the Vajrayān School. It is possible that it belongs to the short-lived Mantrayan School which followed the Mahāyān and preceded the Vajrayān.

Another important discovery of general interest is a Buddhist poem entitled Saundarananda by Asvaghosha, a twin brother of his Buddhacharita. It has 18 sargas, and in style and arrangement appears similar to the other well-known work. Asvaghosha is here described as a Sāketaka, a Bhadanta and an Āchārya, and the son of **सुवर्णाक्षी**. The ideas of the Mahāyān school are given more fully here than in the Buddhacharita. The curious thing, however, about this work is that it is nowhere mentioned among the works of Asvaghosha by Chinese and Japanese authorities.

There is a dilapidated copy of Buddhacharita in the Durbar Library, which seems to have been overlooked by Amritānanda,

while preparing the copy of the work which Cowell used for his edition of the work. A comparison of this manuscript with the printed edition has filled up several small lacunæ and supplied one important lacuna of 11 verses. The first twenty-five verses of the printed edition seem to be Amritānanda's own composition.

A new and older version of the *Dākārnava* has been obtained, which contains more matter in a curious vernacular, perhaps the mother of Bengali, than is usually found in ordinary manuscript copies of that work. In fact, the few Sanskrit verses in each section simply introduce the vernacular matter. The manuscript is written in the 11th century Newari on thick paper, which has grown brown with age. This paper is not of Mahomedan manufacture and is, perhaps, the old paper called *Vausapatra* paper by the Nepalese and *Dafue* paper by Europeans, of which many fragments have been obtained from Central Asia.

The *Mahārājā* is extremely unwilling to allow the old palm-leaf manuscripts to be removed from Nepal. This is one of the reasons why no old palm-leaf manuscripts have been procured by the *Sāstri*. The *Mahārājā*, however, freely allows copies to be made of these old manuscripts, and many have been copied by the *Sāstri*'s assistants under his own immediate supervision or by Nepalese scribes.

The printed edition of the *Aṣṭasāhasikā Prajñāpāramitā*, and in fact all the manuscripts hitherto known of that work, commence with 21 verses which have previously been regarded as part and parcel of the *Prajñāpāramitā* itself. It is interesting, however, to note that in a dilapidated palm-leaf copy of the work, the first leaf of which is lost, the second leaf begins with सुविहिता कतिरियम् राउलभद्रस्य । एवं मयाव्रतमेकस्मिन् समये भगवान्, etc. On comparing this with other manuscripts it was found that सुविहिता is the last word of the 20th verse. Hence twenty of the twenty-one verses, which are now regarded as forming a part of the *Prajñāpāramitā*, are really a *Prāśasti* or *Māhātmya* of the *Prajñāpāramitā* by *Rāhula Bhadra*, the 21st being only फलश्रुति or the merit of repeating the *Māhātmya*. The real *Prajñāpāramitā* begins and ends in prose. Thus we get a genuine work by *Rāhula Bhadra*, a well-known writer of the 6th century, imbedded in the *Prajñāpāramitā*.

Haramekhalā is a medical work in *Prākṛit*. It was written by *Māluka*, a *Brahman* of *Srimāla*, who boasts of his relationship with the great poet *Māgha* who was the grandson of the Prime minister of the *Rājā* of *Srimāla*. The *Haramekhalā* has a "Chhāyā" or Sanskrit translation in verse. It also has a commentary in Sanskrit. *Rājā Pratāp Malla* of *Kāthmandu*, a contemporary of *Aurangzeb*, made a careful copy of *Haramekhalā*. The "Chhāyā" and the commentary on palm leaf are enclosed in gilded and beautifully decorated boards.

In the 9th and 10th centuries during the early years of the reign of *Pāla* kings in Eastern India, when Buddhism and Hinduism were struggling for supremacy, various polemical works were written on both sides, only one of which (on the Hindu

side) has up to now been known. This is the *Ātmatattvaviveka* or *Bauddhadhikkara*, by Udayana, written about 984 A.D. Five works on the Buddhist side have now been discovered, *viz.*, 1. *Apoahasiddhi* by Ratnakirtti (there was a dilapidated copy of this MS. already in the Asiatic Society's collection); 2 and 3. *Kṣanabhangasiddhi* by the same author; 4. *Dūṣṇadikprakāśikā* by Pandit Asoka; 5. *Antarvyāptisamarthana*, by Ratnākar Śāntipāda, in Newari and Gupta character. Copies of all these MSS. have been made and brought down to Calcutta.

The Rājās of Kanauj belonging to the Rathora or Gāhārwar family were staunch Hindus. Among them Govinda Chandra was specially famous for his orthodoxy. It was at his court that Lakshmidhara made the first great compilation of Smṛiti yet known. Govinda Chandra, however, had a Buddhist wife, and she presented a copy of *Astasāhasrikā*, which is to be found in the Durbar Library, to a Buddhist Vihāra.

Bodhicharyāvatāra is a work written by Śāntideva in the 7th century A.D. It is a philosophic work of the highest importance to Buddhist. In the Durbar Library, however, there is a work entitled *Bodhicharyāvatāramimāṃsā*. It is *Bodhicharyāvatāra* itself, with a few verses added both in the beginning and at the end. The object of the added verses is to show that it is an interlocution between Asoka and Upa Gupta. This is the way in which History has been perverted by ignorant monks of later times.

Works on Dhanurveda are very rare. Hence the discovery of *Kodanda Śāstra* attributed to Dilipa may be considered an important one. It treats of how a bow is to be made, how arrows are to be aimed, etc. Greater reliance, however, is placed on mantras and incantations than on actual skill in archery.

A manuscript of the *Yogasataka* (योगसूक्त) is attributed to Nāgārjuna. The commentator, Dhruvapada, says that the author in one sloka hints that he is also the author of the Uttara Yantra of the Sushruta Samhitā.

In a MS. of the work entitled *प्रज्ञोपायविनिश्चय* are to be found short works by Nāgārjuna, Āryadeva, Dingnāga, Padma-vajra and Anangavajra. Nāgārjuna's work is entitled *योगवतार*. Āryadeva's work is entitled *साधितानप्रभेद*. This MS. also has been copied and brought down to Calcutta.

Search for Arabic and Persian MSS.

In February 1907 Lieutenant-Colonel Phillott took over charge from Dr. E. Denison Ross. During the year under review, some valuable additions have been made to the collection. Special attention was paid to gathering information about various private libraries, and for this reason the travelling Maulavis had to travel more than previously. Libraries unknown before were discovered in Ahmadabad, Bombay, Hyderabad, and Madras, places hitherto unvisited by the Maulavis.

In Hyderabad, the libraries of Sir Salar Jung, and of the *Afsar*^u 'l-*Aḡibbā*^s Muhib Ḥusayn were found to be of special interest. Amongst many rare and valuable manuscripts in the library of the latter, a Persian translation was discovered of the *Kitāb*^u 'l-*Ḥashā'ish wa'n-Nabātāt*,¹ the Arabic translation of Dioscorides' work in Greek (a work on the *Materia Medica*); this had good coloured figures of medicinal herbs: probably, too, the later Arabic re-translation from the Persian was based upon this very manuscript. *Shams*^u 'l-*Ulamā*^s *Nawāb* 'Aziz Jang Bahādur, of Hyderabad, after consultation with Maulavi Hidāyat Ḥusayn, generously presented to the Society, with the sanction of the Government of India, 502 Arabic and Persian MSS. and printed works, which had formed part of his library; subsequently 100 additional volumes were so made over by him to the Library of the Board of Examiners, Calcutta. During the year, various manuscripts were offered for sale from Agra, Delhi, Lahore, Ajmere, and Hyderabad. An Arab traveller also sent, for inspection, 102 manuscripts, among which were the following:—

(1) The *Ḥaqā'iq*^u 'l-*Tafsīr* by Abū 'Abd^l 'r-Raḥmān Muḥammad ibn^u 'l-Ḥusayn ibn Mūsā as-Sulaymī an-Naysābūrī (who died in A.H. 412, A.D. 1021), and the *Anwār*^u 'l-*Qur'ān* by 'Alī ibn Sulṭān Muḥammad al-Qārī al-Harawī (who died in A.H. 1014, A.D. 1605): these are of special interest. Up to the present, however, no definite settlement for purchase has been made with the Arab. The total number of manuscripts already purchased during the year is 150. This includes almost every branch of Arabic literature. In date, the manuscripts range from 900 A.H. to 1100 A.H. The following deserve notice:—

- (1) The *Qurāzāt*^u 'z-Zahab al-Jāmi' li *anwā'*ⁱ 'l-*Adab*, a treatise on literature that was written by order of *Saif*^u 'd *Dawlah* (ruled A.H. 333-356; A.D. 944-967). This M.S. is dated 1051 A.H.
- (2) The *Kitāb*^u 'l-*Irshād* by *Sharaf*^u 'd-*Dīn* Ismā'il ibn Abi Bakr al Muqrī al-Yamanī (who died in A.H. 837; A.D. 1433). This is an abridgement of the *al-Ḥāwī 's-Saghīr*, of Najm^u 'd-dīn 'Abd^u 'l-Ghaffār ibn 'Abd^l 'l-Karīm al-Qazwīnī (who died in A.H. 665; A.D. 1266). This abridgement is considered to be an authoritative treatise on Shāfi'i jurisprudence and many Shāfi'i scholars such as Muḥammad ibn Abi Sharīf al-Muqdisī (who died in A.H. 903; A.D. 1497), Muḥammad ibn 'Abd^l 'l-Mun'im al-Jawjūrī (who died in A.H. 889; A.D. 1484), Ibn Ḥajr al-Hayṡamī (who died in A.H. 973; A.D. 1565) wrote commentaries on it. The manuscript was transcribed some time after the death of the author, and is dated A.H. 869.

¹ This work was translated from the Greek into Arabic and from the Arabic into Persian. The original Arabic translation got lost, and the work was re-translated into Arabic from the Persian translation.

- (3) The *An-Najm*^u 'l-*Wahhāj fī Sharḥ*ⁱ 'l-*Minhāj*. The author of this manuscript is *Kamāl*^u 'd-*dīn* Muḥammad ibn Mūsā 'd-Damiri (who died in A.H. 745; A.D. 1324). This is also a trustworthy book on Shāfi'i jurisprudence. Only one other copy exists; it is in the Bodleian Library. This MS. is dated A.H. 869.

Other interesting manuscripts will be noted in a later and detailed report. In conclusion the Officer-in-charge of the Search wishes to express his satisfaction with the continuous and scholarly assistance rendered by Maulavi Hidāyat Ḥusayn.

Search for Bardic Chronicles.

The scheme has been brought to the notice of the principal chiefs in Rajputana and Gujerat, who have kindly consented to afford every facility for carrying out the Search. Unfortunately no qualified Pandit has yet been found to execute the work; but a commencement has been made in the States of Meywar and Marwar. In the former State, with the permission of H.H. the Maharana, Pandit Gauri Shankar Harichand Ojha has kindly undertaken to start the work, and in the latter H.H. the Maharajah has been so good as to place the services of Munshi Debi Prasad at the disposal of Major Baldock for the same purpose. Both these gentlemen are rendering valuable assistance.

A catalogue of over 230 manuscripts existing in the different libraries in Marwar has been submitted by Munshi Debi Prasad, who is still engaged in completing the list. It is probable that on examination many of these will be found hardly to come within the definition of "Bardic Chronicles"; but it is hoped that a considerable number will prove of historical interest.

A list of 43 manuscripts, deposited in Watson Museum of Antiquities at Rajkot, has been received from the Librarian and a genealogical table of the Sanjheli State from the Political Agent, Rewa Kantha. This latter is written in Marwari, in the Gujrati character, and has not yet been examined.



The Report having been read and some copies having been distributed, the Hon. Mr. Justice Asutosh Mukhopadhyaya, President of the Society, delivered an address.

Annual Address, 1907.

Gentlemen,—It is not incumbent on your President to deliver an address at the end of the first year of his term of office, and if I had kept silent on the present occasion, I would have followed weighty precedents. I have been unwilling, however, to meet you this evening without supplementing the annual report which has been laid on the table and making some reference to the

researches in which members of our Society have been engaged during the past twelve months. I do not propose to enter into any elaborate review of the work of the Society, nor of the progress of the different branches of research with which our Society deals; such a review may more fittingly be made at the next annual meeting, when we shall complete the first quarter of the second century of our existence. But before I deal with the subjects which have engaged the attention of our members during the last year, I would like to make a brief reference to more homely matters. The report which has been laid on the table shows, as you have all been gratified to find, that the number of our members has been steadily increasing in recent years. In fact, in the course of the last five years, our members have increased by very nearly one hundred. This is a matter for congratulation, and our thanks are due principally to the members of the medical profession who have joined our ranks and swelled our numbers. During the last twelve months, however, we have lost from our ranks seven Ordinary Members, two of whom deserve special mention.

Lieutenant-General Sir Henry Edward Landor Thullier joined the Society so far back as 1847, and at the time of his death, had been a member for over 60 years. At one time, before his retirement from the country, he took considerable interest in our work, and contributed to our *Journal and Proceedings* a number of valuable papers on "Meteorology" and the "Survey of India." The present generation of members of the Society, however, would hardly recollect that he filled successively the offices of Vice-President and President long before some of us were born. It is not too much to say that his services to this country will not be readily forgotten, and his name will remain indissolubly connected with the great survey operations of India.

Babu Girindranath Dutt, who was cut off in the prime of life, joined the Society about 15 years ago. During the years preceding his death, he was engaged in a series of interesting researches upon the tribes and castes of Bengal, and his papers on the Brahmins and Kayesthas of Bengal treated of a subject of a highly controversial character and covered so much ground that, as Mr. Beveridge once remarked, it would require a syndicate of learned men to review it properly.

Amongst our Honorary Members, we have lost two very distinguished names: Lord Kelvin and Sir Michael Foster. It is unnecessary for me here to dwell at length on the intrinsic value of their scientific work; it is enough to observe that a career of unexampled usefulness and intellectual activity has been closed by the death of Lord Kelvin, while the loss to physiological science, by the death of Sir Michael Foster, cannot easily be repaired. The places of these two eminent men in our list of Honorary Members has not yet been filled, and it is safe to affirm that, whoever may be nominated to fill the vacancies, we can hardly obtain any of the reputation of Lord Kelvin.

I shall now turn for a moment to the field of oriental

research, in which some notable contributions have been made by our members in the course of last year. When I had the honour to address you from this chair two years ago, I dwelt upon the importance of the exploration of Tibet and of the results which were likely to follow from an examination of the large number of valuable manuscripts and books which were brought from Tibet by the then recent Tibet Mission. I pointed out that, by reason of the influence which had been undoubtedly exercised at one time by the literature of India upon the literature of Tibet, considerable light might be thrown upon some of the darkest corners of Indian history and antiquities by an examination of the materials thus revealed to us. It now appears that our hopes are about to be realized, and that the secluded monks of Tibet will be able to reflect back to India the light which they borrowed centuries ago and which has now disappeared from amongst ourselves. One of our members, Mahamahopadhyay Satis Chandra Vidyabhusan, who has devoted himself to these studies, has recently given us a series of papers on "Indian logic as preserved in Tibet." He has noticed numerous valuable Buddhist works on logic, composed during the period which intervened between the 5th and the 13th centuries, which have been regarded as lost in this country for many centuries, and which exist apparently only in Tibetan versions. In this list must be included the works of Dingnag, one of the foremost Indian logicians, who is said to have flourished near Madras about 1,400 years ago; as also those of Binitadeva, the distinguished scholar of *Nalanda* who flourished in the beginning of the 8th century; of Chandragomin, the first grammarian and logician of Bengal, who lived on the banks of the Padma in Rajshahi about the same time; of Rabi Gupta, the famous poet and logician of Kashmir, who wrote about the middle of the 8th century; of Santarakshit of Johour in Bengal, who visited Tibet about the same period; and Sankaranda who was possibly the last of the logicians of Kashmir and flourished about the middle of the 11th century. By a singular irony of fate, the works of these eminent scholars are no longer traceable in their original form, as with the downfall of Buddhism they gradually fell into disuse and ultimately disappeared completely; nor did they find a shelter in Nepal, as they probably might have done, if they had been books of a religious character. But we can hardly treat it as a matter of surprise that these works have been so carefully and successfully preserved in Tibet in faithful translations. The art of printing, which is rightly regarded as one of the most powerful agencies of modern civilization, appears to have been known to the Chinese many centuries before it was discovered in Europe, and was certainly familiar to the people of China towards the close of the 6th century. When, therefore, intercourse prevailed with Tibet between India on the one hand and China on the other, the monks of that secluded country got a splendid literature from the former which they were enabled to preserve by means of the agency of the art of printing which they borrowed from the latter. Under royal patronage,

especially in the reign of Ralpacan in the 9th century, innumerable Indian Pandits and Tibetan Lamas were engaged on the translation of Sanskrit books into Tibetan. The versions thus elaborately prepared were perpetuated in wooden blocks from which impressions could be taken at any moment. The majority of the works on logic so preserved in Tibet have been found to form part of the Hodgson Collection now deposited in the India Office as also of the vast Tibetan Collection brought down by the British Mission three years ago. Mahamahopadhyay Satis Chandra Vidyabhusan has further found traces of these works in the Tibetan Xylographs in the monasteries of Labrang and Phodang in Sikkim, which he visited last summer. It is obvious that we have in this direction a wide field for research, and I would urge upon the younger members of the Society who have any aptitude for the acquisition of languages, to turn their attention to Tibetan and to master the intricacies of that language, not so much for the purpose of elucidating the sacred writings of the Lamas of Tibet, as for the purpose of restoring to India, from Tibetan sources, that rich harvest of Sanskrit books, Buddhistic as well as non-Buddhistic, religious, scientific, literary and philosophical, which are now known to us only by name, and the originals of which have been completely lost to the people of this country for many centuries. It may be stated with some degree of confidence that the works recovered from Tibet will form, so far, at any rate, as Hindu Logic of ancient and modern schools is concerned, a valuable addition to the literature at our disposal; and it is interesting to observe that they throw a good deal of light on the antiquity of Indian Philosophy, which dates from a pre-Christian, and not improbably from a pre-Buddhistic age. Philosophy was widely cultivated in India during her intercourse with Greece, but though there is considerable similarity between the Indian and Greek systems of Philosophy, there is nevertheless no solid foundation for the suggestion that our system was derived from theirs though it is conceivable that some of the representatives of our school might have profited from a study of theirs, as is evident from a well-known anecdote which is familiar to all readers of the Indian Travels of Apolonius.

Of the other papers on the side of Philology and Antiquities, one by Mr. Kaye on Indian Mathematics deserves special mention. It has been hitherto held by Orientalists of repute that the modern arithmetical notation is of Indian origin. In support of this theory, reliance has been placed upon numerous inscriptions, specially some from Southern India, such as the Kalobhabi inscriptions of 339 A.D., which are dated in figures of the place-value notation. Appeal has also been made to the fact that the rule for the extraction of the square root, given by the famous astronomer Aryabhata, who is said to have lived in the early part of the fifth century, pre-supposes a knowledge of the now prevalent form of notation where each figure has a place-value. Mr. Kaye controverts this position, and has recourse to the hypothesis that all the inscriptions before the 10th century that have been supposed to be dated in figures of the modern place-value

notation are spurious; he further contends that the rule of Aryabhata applies to all possible notations, and is really algebraic in character. His theory is, with regard to this last point, that there is absolutely nothing in the rule to indicate that it was intended to apply specially to a notation with place-values and a zero. In another paper which was communicated later on, Mr. Kaye maintains that Aryabhata was indebted in the matter of arithmetical notation to the Greek astronomers of Alexandria. It may be pointed out, however, that our knowledge of early Indian mathematics is somewhat limited and fragmentary. There is no exhaustive collection of Sanskrit manuscripts on astronomy and arithmetic, and the works which have been published or rendered into English form a very small proportion of what is known to have existed at one time. Under such circumstances, it is somewhat difficult to make a definite pronouncement on the subject of the indebtedness of Indian Mathematics to foreign sources. Some light, so far as Indian Astronomy is concerned, will be thrown by the brilliant lectures of Dr. Thibaut, which are now in the course of delivery. Dr. Thibaut has established in his classical paper on the *Sulvasutras* the antiquity of Indian mathematics, and, even if it be assumed that Aryabhata was indebted to the Alexandrian astronomers, he gave back to the world the light he borrowed from Alexandria in a brighter and more useful form, for as one of our great Sanskrit poets says:

"The sparkling gem gives back the glorious radiance,
It drinks from other light, but the dull earth
Absorbs the blaze and yields no gleam again."

Amongst the historical papers which have been contributed to the Society during the last year, those of Prof. Jadunath Sarkar on the "Conquest of Chatgaon by Sayestha *Khān*" and on the "Fringhee Pirates of Chatgaon" are of special interest, and throw considerable light upon a somewhat obscure period of history. They are founded on translations from the "Alamgir-namah" and indicate amply that a version of other portions of that great work would be equally useful.

Mention must also be made of the papers of Mr. Yazdani, in which he deals with the ancient history of the town and buildings of Narnaul, south of Delhi. Our enthusiastic Secretary, Col. Phillott, has given us a number of papers, some of them conjointly with Mr. Azoo, which are of considerable interest—not only from the point of view of history, but of anthropology as well; and the paper by Mr. Hoffman on Mundari poetry, music and dances, give us valuable information as to the habits, customs and manners, as also the language of that interesting tribe.

Rai Sarat Chandra Das, Bahadur, that distinguished Tibetan traveller, holds, in his paper on "A written language in Mongolia," that the Mongolian character was designed after the Tibetan in the 13th century. About the same time, we had a paper from Mr. Walsh on "The Coinage of Tibet," in which he urges the conclusion that the Uigur form of the Mongolian character, which

appears on the official seal of the Dalai Lama, was borrowed from the Syriac, through the agency of Nestorian missionaries. I do not feel competent to pronounce upon the respective merits of these theories, nor am I in a position to reconcile them; but it does seem to me that the question is worth investigation, whether Mongolia may not have got her art of writing from at least two independent sources, namely, Syria and Tibet.

Babu Rakkhal Das Banerjee deals, in his paper on "Clay tablets from the Malay Peninsula," with the external influence of Indian thought and art. These seals were brought from the Malay Peninsula by Dr. Annandale, who, in his introductory note, dwells on the long intercourse which existed between the western parts of the Peninsula and the southern coast of India. This affords a confirmation of previous evidence on the subject, which had established, beyond controversy, the influence of Indian religion and art in some of the islands of the Indian Archipelago. I cannot pass in silence over the interesting paper of Mr. Jackson on the history of the caste system, in which he attempts an explanation of the origin of innumerable sub-castes out of the four original castes. Mr. Jackson seeks to establish the theory that, before the advent of the Mahomedans, India was divided into numerous distinct kingdoms governed by kings, who followed divergent customs, with the result that, if a caste lived in an area so extensive as to be subject to more than one political jurisdiction, it became naturally split up into sections whose customs differed in detail, based, as these were, on the divergent decisions of the kings to whom they were subject. The matter, it must be conceded, is of a highly controversial character, and the theory, however ingenious it may be, can hardly be treated as conclusively founded upon a substantial basis of evidence. At any rate even if it be admitted that in a particular locality a cause of the description mentioned led to a sub-division of the castes, it would be a mistake to suppose that the same cause was in operation everywhere, and that every sub-caste is traceable to the existence of similar circumstances.

Two of our younger members, Babu Bhabesh Chandra Banerjee and Babu Nilmony Chuckerbutty, have given us interesting papers, which show a creditable spirit of research. The former deals with the subject of Vedic sacrifices, and endeavours to establish that the Aryans, at one time, used to sacrifice human beings and subsequently abandoned the practice, substituting the lower animals, and gradually corn, milk, etc. The latter treats of the chronology of Indian authors, and gives us some important dates supplemental to those contained in Duff's *Chronology of India*.

In the domain of the Natural and Physical Sciences, our *Journal and Proceedings* and *Memoirs* exhibit unabated activity. Prof. Mullick's brief but important paper on Magnetic Induction of Spheroids has been, with the permission of the Society, subsequently republished in the *Philosophical Magazine*. In *Physical Chemistry* we had a stimulating paper from Dr. Travers on the

absorption of gases, vapours and substances in solution by solids and amorphous substances; while the memoir of Prof. Watson, on the fastness of the indigenous dyes of Bengal, treats, with thoroughness and minuteness, of a question of great practical interest to the industries of this country. We had also a very suggestive paper by Prof. Cunningham and Babu Satis Chandra Mukherjee on the electric state of nascent gases. These were followed by notes from Prof. Roy and Babu Bidhu Bhusan Dutt and Babu Panchanon Neogy. All these bear testimony in unmistakable terms to the first-rate work which is now carried on by some of our professors and by their advanced students, and I am assured that the research work done here would be deemed creditable even in more advanced centres of learning.

We are indebted to Mr. Hooper for his interesting paper on the composition of well waters in Hadramaut, which has been claimed by chemists as a research within their domain, and by geologists as a paper which, undoubtedly, throws light on their special subject. In Zoology we had a series of papers from Dr. Annandale, in which he describes freshwater sponges in brackish water in the Gangetic delta. There are also other papers by Dr. Annandale, Dr. Gruvel and Dr. Linstow, which are of a highly technical character. But I must not omit all mention of Dr. Mann's paper on the diet of tea-garden coolies in Upper Assam, which deals with a question of great interest and practical importance, and must be regarded as the first important contribution on a subject which requires careful attention.

I stated at the outset that there has been, in recent years, a considerable addition to our strength by the enrolment of medical members, and the formation of a medical section of the Society. I may be permitted to add that I welcome the presence of the members of the medical profession, not merely from the point of view of the important contributions relating to medical topics which may be expected from them, but also from the point of view of researches into the history of Indian medicine. It must be conceded with some regret that the Society, in the past, has not done quite as much towards the investigation of the history and progress of Indian medicine as it has done in other directions. By an accident, which is somewhat unfortunate and inexplicable, the energies of our members, who have devoted themselves to philology and antiquities, have been steadily kept away from the history of Indian medicine. It is true that, more than 70 years ago, the Society published an accurate edition of the great Sanskrit work on Indian medicine known as the *Susrûta*. It is also true that in our own generation attempts were made twice to publish a reliable English version of the same work, but, although the undertaking was begun on each occasion by a distinguished scholar, the attempt was unsuccessful, and no progress worthy of any mention was made. It is obvious, however, that the whole subject deserves and affords ample field for investigation. I am forcibly reminded of the truth of this observation by the publication of an extremely valuable work on the medicine of

ancient India, by Dr. Rudolph Hoernle, one of our past presidents. The first portion of the work of Dr. Hoernle, which has been recently published, deals with the subject of Osteology, and makes manifest the surprising extent and accuracy of the knowledge of the subject possessed by the earliest medical writers in India, whose work has been traced undoubtedly to the 6th century before Christ. I have no desire, on the present occasion, to enter into an examination of this interesting work, but it is quite clear that it marks a new epoch in our knowledge of the history of medicine. The drugs in use, and the more practical parts of the medicine of Eastern nations, have long been familiar to investigators; but, of the more scientific branches of the subject, we have had hitherto very imperfect knowledge. Considerable light may also be thrown on a comparative study of the subject by a valuable monograph on the surgical instruments in Greek and Roman times by Dr. Milne, who submitted it as a thesis to the University of Aberdeen for the Degree of Doctor of Medicine. An examination of the works of Dr. Hoernle and Dr. Milne makes it obvious, even to a layman like myself, that Indian writers on medicine possessed an extensive and accurate knowledge, based, undoubtedly, upon dissections and experiments, in no way inferior to the knowledge possessed by Greek and Roman physicians. Interesting questions may arise as to the relation of the medicine of the Indians to that of the ancient Greeks and Romans, and it may be a matter of considerable difficulty to ascertain, with any approach to precision, how far either system was indebted to the other. Questions of some difficulty, again, may arise as to the time when the great writers on Indian Medicine flourished, as is amply indicated in a very instructive discussion on the subject between Dr. Hoernle on the one hand, and Prof. Jolly on the other, in recent communications to the Royal Asiatic Society of London. It is by no means surprising to find that considerable light may be thrown upon these and allied topics from even incidental references in the writings of the great Buddhist travellers. I commend with confidence this field of enquiry, as a promising one, to the attention of our members, and it would be a matter for genuine regret, if a subject which is so peculiarly Indian, should be left altogether untouched and unilluminated by the medical members of our Society.

There is one other topic to which I would like to invite your attention for a moment, before I bring this address to a close. During the last year, the search for Sanskrit, Arabic and Persian manuscripts has been conducted with commendable zeal, and with some noticeable results. Last summer, Mahamahopadhyaya Haraprasad Sastri paid his third visit to Nepal, and the account of the collection which he made there, as stated in the Report laid on the table, is of considerable interest. It would be unfair to expect the same amount of interesting discoveries in the present visit as attended the labours of the Sastri on two previous occasions. We cannot legitimately expect on every occasion to discover grammatical works, now lost in India, or to recover iusti-

tutes of law or treatises on medicine or chemistry, of unique value and importance; but the results of the last research are sufficiently interesting. The Nepal climate, as is well known, is specially favourable for the preservation of manuscripts, and it is not an unusual thing in Nepal to come across palm leaves of the 12th and 13th centuries which have not yet decayed. The Sastri has been able to discover manuscripts of works which establish the undoubted antiquity of the Bengali language; he also found at least one work written in a language which may have prevailed here before Bengali became current. We have also ample indication of the extent to which Buddhism flourished in Bengal. Mention may also be made of an important medical work, *Haramekhala*, written in *Prakrit* with a Sanskrit version attached, and it is interesting to note, further, that works have been discovered on Buddhistic Philosophy representing the counterpart of the great work known as the *Bauddhasthikara of Udayanacharyya* composed about the end of the 10th century. One can obtain a faint glimmer of the continuous and persistent struggle, which must have prevailed about that time between Hinduism and Buddhism and which terminated later on in the complete victory of the former and absorption of the latter. We must, however, patiently wait for further results till the manuscripts have been carefully catalogued and their contents examined. Meanwhile the gratitude of Oriental scholars is due to the Maharaja of Nepal for the liberality with which he allowed access to the manuscripts, and permitted copies to be made. On the Arabic and Persian side, our inquiries have been prosecuted vigorously, and libraries unknown before have been discovered in Ahmedabad, Bombay, Hyderabad and Madras. I am assured that of the large number of manuscripts collected, some are of considerable antiquity and of great value, including one on jurisprudence, composed by Kamaluddin Mohamed in the early part of the 14th century, the only other copy of which known to be extant is deposited in the Bodleian Library. It must be noted, however, that the Arabic and Persian manuscripts, which have been hitherto collected with the money placed at our disposal by the Government, have not yet been catalogued. Under the terms of the grant, it is incumbent on us to catalogue the manuscripts, and I do express the hope that this work will now be undertaken, so that the treasures, which we have collected, may be brought within the reach of scholars in all parts of the world.

I trust, gentlemen, that the imperfect account which I have given of the work of the Society, during the last twelve months, will convince the most captious critic that our members have not been idle, and that they have made substantial contributions to the progress of the researches for the promotion of which the Society exists. It is perfectly true that there are no sensational discoveries to announce, but with the progress of time, discoveries of this description have a tendency to grow rarer and rarer, and we can afford to be content, for the present at any rate, with solid work done steadily and without ostentation.

The President announced the result of the election of Officers and Members of Council for 1908 to be as follows :—

President.

The Hon. Mr. Justice Asutosh Mukhopadhyaya, M.A., D.L., D.Sc., F.R.S.E.

Vice-Presidents.

T. H. Holland, Esq., D.Sc., F.G.S., F.R.S.
G. Thibaut, Esq., D.Sc., Ph.D., C.I.E.
Mahamahopadhyaya Haraprasad Shastri, M.A.

Secretary and Treasurer.

Honorary General Secretary :—Lieut.-Colonel D. C. Phillott.
Treasurer :—J. A. Chapman, Esq.

Additional Secretaries.

Philological Secretary :—Lieut.-Colonel D. C. Phillott.
Natural History Secretary :—I. H. Burkill, Esq., M.A.
Anthropological Secretary :—N. Annandale, Esq., D.Sc., C.M.Z.S.
Joint Philological Secretary :—Mahamahopadhyaya Satis Chandra Vidyabhusana, M.A.
Medical Secretary :—Major L. Rogers, M.D., B.Sc., I.M.S.

Other Members of Council.

T. H. D. La Touche, Esq., B.A.
Harinath De, Esq., M.A.
J. A. Cunningham, Esq., B.A.
Lieut.-Colonel W. J. Buchanan, M.D., I.M.S.
H. G. Graves, Esq.
Lieut.-Colonel G. F. A. Harris, M.D., F.R.C.P., I.M.S.
Babu Monmohan Chakravarti, M.A., B.L.
Abdulla al-Mamun Suhrawarday, Esq., M.A., LL.D.

The Meeting was then resolved into the Ordinary General Meeting.

THE HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L., D.Sc., F.R.S.E., President, in the chair.

The minutes of the last meeting were read and confirmed.

Fifty-one presentations were announced.

The General Secretary announced that Lieut.-Colonel D. Prain, Lieut.-Colonel J. H. Tull Walsh, Mr. C. W. Bolton, and Mr. K. G. Gupta had expressed a wish to withdraw from the Society.

The General Secretary also announced the death of Maharaja Sir Jotindra Mohan Tagore, K.C.S.I., an Ordinary Member of the Society.

The President announced that in accordance with Rule 38 of the Society's Rules, the names of Babu Parmeshwar Narain

Mahatha and Babu Bhupendra Sri Ghosh had been posted as defaulting members since the last General Meeting, and are now removed from the Member List.

The following thirteen gentlemen were ballotted for as Ordinary Members:—

The Hon. Mr. W. W. Drew, Additional Member of the Legislative Council, proposed by Lieut.-Colonel D. C. Phillott, seconded by Dr. N. Annandale; *Mr. E. V. Russell*, I.C.S., Supdt. Gazetteer, Nagpur, proposed by Mr. R. Burn, seconded by Lieut.-Colonel D. C. Phillott; *Mr. Gerald Gardner-Brown*, proposed by Mr. A. Venis, seconded by Mr. G. Thibaut, C.I.E.; *Mr. H. N. Randle*, Indian Educational Service, proposed by Lieut.-Colonel D. C. Phillott, seconded by Mr. I. H. Burkill; *Mr. Alce te Rigo de Righi*, Explorer, Woodlands, Darjeeling, proposed by Mr. James Luke, seconded by Mr. D. R. Wallace; *Dr. Girindra Nath Mookerjee*, B.A., M.B., Medical Practitioner, proposed by the Hon. Mr. Justice Asutosh Mukhopadhyaya, seconded by Mahamahopadhyaya Satis Chandra Vidyabhusana; *Dr. Gopal Chandra Chatterjee*, M.B., proposed by Major L. Rogers, seconded by Lieut.-Colonel W. J. Buchanan; *Mr. B. G. Horniman*, proposed by Mr. J. A. Cunningham, seconded by Mr. Harinath De; *Lieut.-Colonel A. H. Nott*, M.B., I.M.S., proposed by Lieut.-Colonel F. P. Maynard, seconded by Major L. Rogers; *Major V. E. H. Lindesay*, M.B., I.M.S., proposed by Major L. Rogers, seconded by Lieut.-Colonel W. J. Buchanan; *Captain George King*, M.B., I.M.S., proposed by Major L. Rogers, seconded by Lieut.-Colonel W. J. Buchanan; *Captain V. B. Ne-field*, F.R.C.S., I.M.S., proposed by Major L. Rogers, seconded by Lieut.-Colonel W. J. Buchanan; *Dr. Harinath Ghosh*, M.B., proposed by Lieut.-Colonel G. F. A. Harris, seconded by Major L. Rogers.

The proposed changes in Rules 4 and 44 (g) of the Society's Rules, of which intimation had been sent in accordance with Rule 64A, were brought up for discussion.

The following papers were read:—

1. *Hindustani English Vocabulary of Indian Birds.*—By LIEUT.-COLONEL D. C. PHILLOTT and PANDIT GOBIN LAL BONNERJEE.

2. *Translation of one of the Tardiyat or poems on Sport, of Abū Nu'ās, the Poet-Jester of the Court of Hārūn 'r-Rashid.*—By D. PETRIE and LIEUT.-COLONEL D. C. PHILLOTT.

3. *A short note on the Qadam Rasul Building at Balasore.*—By MAULAVI ABDUS SALAM.

4. *Note on the Pollination of Flowers in India. Note No. 5.*—*Some Autumn Observations in the Sikkim, Himalaya. Note No. 6.*—*The Spring Flora in the Simla Hills.*—By I. H. BURKILL.

These papers will be published in a subsequent number of the *Journal*.

5. *Fat of the Himalayan Bear.*—By D. HOOPER.

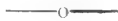
6. *Monograph of Sea Snakes.*—By CAPTAIN F. WALL. Communicated by the Natural History Secretary.

This paper will be published in the *Memoirs*.

7. *A note on the Calm Region in the Atmosphere, which in the neighbourhood of Calcutta, during the cold season, is at a height of 3,000 to 4,000 feet.*—By C. LITTLE.

8. *The Builders of the Taj.*—By HARINATH DE.

This paper will be published in a subsequent number of the *Journal*.



The Adjourned Meeting of the Medical Section was held at the Society's Rooms on Wednesday, February 12th, 1908, at 9-15 P.M.

LIEUT.-COLONEL F. J. DRURY, I.M.S., in the chair.

The following members were present :—

Dr. Adrian Caddy, Dr. G. C. Chatterjee, Captain F. P. Connor, I.M.S.; Dr. H. M. Crake, Dr. H. Fink, Dr. B. N. Ghose, Dr. W. C. Hossack, Dr. E. A. Houseman, Captain D. M. McCay, I.M.S.; Dr. G. N. Mukherjee, Major J. Mulvany, I.M.S.; Dr. J. E. Panioty, Dr. F. J. Pearse, Lieut. A. D. White, I.M.S.; Major L. Rogers, I.M.S., Honorary Secretary.

Visitor :—Captain F. A. F. Barnardo, I.M.S.

The minutes of the last meeting were read and confirmed.

A suggestion of the Medical Secretary for founding a reference medical library was referred by the Council for discussion by the section.

The proposal was carried unanimously.

A vote of thanks to Lieut.-Colonel Buchanan, I.M.S., the Editor of the "Indian Medical Gazette," for his generous offer was also unanimously carried.

A proposition of Dr. Arnold Caddy, regarding the publication and criticism by the lay press of papers read before the Medical Section, was laid before the section by order of the Council.

The motion was withdrawn by Dr. Caddy.

A doubtful case of skin disease was shown on behalf of Lieut.-Col. Harris, I.M.S., and a case of multiple fibroma was shown by Captain Connor, I.M.S.

The following paper was read :—

"On a new method of differentiating bacilli of the Typhoid group" by Dr. G. C. Chatterjee. (Postponed from the last meeting.) The following members took part in the discussion : Lt. Colonel Drury, Dr. Hossack, Major Rogers, Dr. Pearse; and Dr. Chatterjee replied.

Captain F. A. F. Barnardo's paper on "Some cases of puerperal eclampsia, with suggestions for the treatment," postponed until the next meeting.

LIST OF MEMBERS
OF THE
ASIATIC SOCIETY OF BENGAL.
ON THE 31ST DECEMBER, 1907.

LIST OF OFFICERS AND MEMBERS OF COUNCIL
OF THE ASIATIC SOCIETY OF BENGAL
FOR THE YEAR 1907.

President :

The Hon'ble Mr. Justice Asutosh Mukhopadhyaya,
M.A., D.L., F.R.S.E.

Vice-Presidents :

T. H. Holland, Esq., F.G.S., F.R.S.
G. Thibaut, Esq., Ph.D., C.I.E.
Mahāmāhopādhyāya Haraprasād Shastri, M.A.

Secretary and Treasurer.

Honorary General Secretary : Lieut. Colonel D. C.
Phillott.
J. A. Chapman, Esq.

Additional Secretaries.

Philological Secretary : Lieut. Colonel D. C. Phillott.
Natural History Secretary : I. H. Burkill, Esq., M.A.
Anthropological Secretary : N. Annandale, Esq.,
D.Sc., C.M.Z.S.
Joint Philological Secretary : Mahāmāhopādhyāya
Satis Chandra Vidyabhusana, M.A.
Medical Secretary : Lieut. Colonel F. P. Maynard,
I.M.S., succeeded by Major L. Rogers, I.M.S.

Other Members of Council.

W. K. Dods, Esq.
T. H. D. La Touche, Esq., B.A., F.G.S.
C. Little, Esq., M.A.
Harinath De, Esq., M.A.
J. A. Cunningham, Esq., B.A.
Lieut. Colonel W. J. Buchanan, I.M.S.
H. G. Graves, Esq.
Lieut. Colonel G. F. A. Harris, M.D., F.R.C.P., I.M.S.
Babu Monmohan Chakravarti, M.A., B.L.

LIST OF ORDINARY MEMBERS.

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R. = Resident. N.R. = Non-Resident. A. = Absent. N.S. = Non-Subscribing.  
L.M. = Life Member. F.M. = Foreign Member.

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N.B.—Members who have changed their residence since the list was drawn up are requested to give intimation of such a change to the Honorary General Secretary, in order that the necessary alteration may be made in the subsequent edition. Errors or omissions in the following list should also be communicated to the Honorary General Secretary.

Members who are about to leave India and do not intend to return are particularly requested to notify to the Honorary General Secretary whether it is their desire to continue Members of the Society; otherwise, in accordance with Rule 40 of the rules, their names will be removed from the list at the expiration of three years from the time of their leaving India.

Date of Election.		
1907 April 3.	N.R.	Abdul Ali, A. F. M., Deputy Magistrate. <i>Patnakhali, Backergunge.</i>
1907 June 5.	R.	Abdulla al-Mamun Suhrawardy, M.A., D.LITT., LL.D. 34, <i>Elliott Road, Calcutta.</i>
1894 Sept. 27.	N.R.	Abdul Wali, Maulavi, District Sub-Registrar. <i>Purulia.</i>
1895 May 1.	R.	Abdus Salam, Maulavi. M.A., Presidency Magistrate. <i>Calcutta.</i>
1901 April 3.	N.R.	Abhaya Sankar Guha, Extra Assistant Commissioner. <i>Nowgong.</i>
1903 April 1.	N.R.	Abul Aas, Maulavi Sayid, Raees and Zemindar. <i>Langar Toli, Bankipore.</i>
1904 Sept. 28.	N.R.	Ahmad Hasain Khan, Munshi. <i>Jhelum.</i>
1888 April 4.	R.	Ahmud, Shams-ul-Ulama Maulavi. 3. <i>Maulavi's Lane, Calcutta.</i>
1898 Nov. 2.	N.R.	Akshaya Kumar Maitra, B.A., B.L. <i>Rajshahi.</i>
1885 Mar. 4.	L.M.	Ali Bilgrani, Sayid, B.A., A.R.S.M., F.G.S. <i>Chudderghaut, Hyderabad.</i>
1899 Jan. 4.	N.R.	Ali Hussain Khan, Nawab. <i>Lucknow.</i>
1903 Oct. 28.	R.	Allan, Dr. A. S., M.B. 9. <i>Dalhousie Square, Calcutta.</i>
1902 Feb. 5.	R.	Ambica Churan Sen, I.C.S. (retired). 57, <i>Lansdowne Road, Calcutta.</i>
1898 Feb. 2.	R.	Amrita Lal Bose, Dramatist. 9-2, <i>Ram Chundra Maitra's Lane, Calcutta.</i>
1897 Jan. 6.	R.	Amrita Lal Sircar, Dr., F.C.S. 51. <i>Sankaritolla Lane, Calcutta.</i>
1905 July 5.	R.	Amulya Charan Ghosh Vidyabhusana. 66, <i>Manicktolla Street, Calcutta.</i>

Date of Election.			
1893 Aug. 31.	N.R.	Anderson, Major Adam Rivers Steele, B.A., M.B., D.P.H., C.M.Z.S. I.M.S., Civil Surgeon. <i>Rajshahi.</i>	
1884 Sept. 3.	R.	Anderson, J. A. 22, <i>Strand Road, Calcutta.</i>	
1897 June 2.	R.	Annada Prasad Bose, M.A., Deputy Magistrate and Deputy Collector. <i>Serampore.</i>	
1904 Sept. 28.	R.	Annandale, Nelson, D.Sc., C.M.Z.S., Superintendent, Indian Museum. <i>Calcutta.</i>	
1904 Jan. 6.	R.	Ashton, R. P. 4, <i>Fairlie Place, Calcutta.</i>	
1902 Aug. 27.	R.	Ashutosh Chaudhuri, Barrister-at-Law. 16. <i>Store Road, Calcutta.</i>	
1886 May 5.	R.	Asutosh Mukhopadhyaya, The Hon'ble Mr. Justice, M.A., D.L., F.R.A.S., F.R.S.E., Judge, High Court. <i>Calcutta.</i>	
1904 July 6.	N.R.	Aulad Hasan, Khan Bahadur, Sayid, Inspector of Registration. <i>Dacca.</i>	
1870 Feb. 2.	L.M.	Baden-Powell, Baden Henry, M.A., C.I.E. <i>Ferlys Lodge, 29, Banbury Road, Oxford, England.</i>	
1891 Mar. 4.	N.R.	Baillie, Duncan Colvin, I.C.S., Commissioner. <i>Benares.</i>	
1900 Aug. 29.	R.	Baker, The Hon. Mr. Edward Norman, C.S.I., I.C.S., Finance Member, Government of India. <i>Calcutta.</i>	
1893 Sept. 28.	R.	Banawari Lala Chaudhuri, B.Sc., Edin. 120. <i>Lower Circular Road, Calcutta.</i>	
1891 Feb. 4.	N.R.	Ban Behari Kapur, Raja, C.S.I. <i>Burdwan.</i>	
1869 Dec. 1.	L.M.	Barker, Robert Arnold, M.D., F.G.S. <i>Fairfield, Oxford Road, Reading, Berkshire, England.</i>	
1898 Mar. 2.	N.R.	Barnes, Herbert Charles, M.A., I.C.S., Magistrate and Collector. <i>Shillong.</i>	
1907 Feb. 6.	N.R.	Barrow, John Rothney, Inspector of Schools. <i>Jorhat, Assam.</i>	
1902 May 7.	A.	Bartlett, E. W. J. <i>Europe.</i>	
1907 April 3.	N.R.	Bate, Lieut. Ronald Elwood. 27th <i>Punjabis, Multan.</i>	
1895 July 3.	L.M.	Beatson-Bell, Nicholas Dodd. B.A., C.I.E., I.C.S. <i>Europe.</i>	
1907 Feb. 6.	R.	Bell, Charles Alfred, I.C.S. 30, <i>Theatre Road, Calcutta.</i> [<i>Cuttack.</i>]	
1898 June 1.	N.R.	Bepin Behari Gupta. <i>Ravenshaw College.</i>	
1880 April 7.	N.R.	Bepin Chandra Rai. <i>Giridih, Chota Nagpur.</i>	
1906 Nov. 7.	F.M.	Bergtheil, Cyril J. C/o Messrs. H. S. King & Co. 65, <i>Cornhill, London.</i>	
1876 Nov. 15.	F.M.	Beveridge, Henry, I.C.S. (retired). <i>Pitfold, Shottermill, Haslemere, Surrey, England.</i>	
1903 Feb. 4.	N.R.	Bhagawan Das, Rai Bahadur, M.A., Revenue Minister, Jammu and Kashmir State. <i>Srinagar, Kashmir.</i>	

Date of Election.			
1893 Mar. 1.	N.R.	Bharat Singh, Maharaja Kumara Sirdar, I.C.S. (retired). <i>Allahabad.</i>	
1902 Mar. 5.	R.	Binoy Krishna Deb, Raja Bahadur. 106-1, <i>Grey Street, Calcutta.</i>	
1907 Oct. 30.	R.	Birendra Nath Ghosh, Dr., L.M.S., Medical Practitioner. 109, <i>College Street, Calcutta.</i>	
1897 Feb. 3.	R.	Bloch, Theodor, PH.D., Archæological Surveyor, Eastern Circle. 27. <i>Chowringhee, Calcutta.</i>	
1893 Feb. 1.	N.R.	Bodding, The Revd. P. O. <i>Mahalpahari, viii Rampore Haut. Sonthal Parganas.</i>	
1895 July 3.	N.R.	Bonham-Carter, Norman. I.C.S., Inspector-General of Police, Eastern Bengal and Assam. <i>Shillong.</i>	
1906 Sept. 19.	A.	Bradley-Birt, Francis Bradley, I.C.S. <i>Europe.</i>	
1904 July 6.	R.	Brajendra Nath De, M.A., I.C.S., Offg. Commissioner, Burdwan Division. <i>Chinsura.</i>	
1906 Nov. 7.	N.R.	Bramley, Percy. Superintendent of Police. <i>Agra.</i>	
1860 Mar. 7.	L.M.	Brandis, Sir Dietrich, K.C.I.E., PH.D., F.L.S., F.R.S. 21, <i>Kaiserstrasse, Bonn, Germany.</i> [<i>Europe.</i>]	
1906 July 4.	A.	Brown, Lieut.-Col. Edwin Harold, M.D., I.M.S.	
1907 July 3.	R.	Brown, John Coggin, B.Sc., F.G.S., F.C.S., Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>	
1905 Mar. 1.	N.R.	Brown, William Barclay, I.C.S., District and Session Judge. <i>Kamrup.</i>	
1907 June 5.	N.R.	Browning, Colin Harington. M.A., Principal. <i>Dacca College. Dacca.</i>	
1901 Sept. 25.	R.	Buchanan, Lieut.-Col. Walter James, I.M.S., Inspector-General of Jails. 19. <i>Writers' Buildings, Calcutta.</i>	
1901 June 5.	R.	Burkill, Isaac Henry, M.A., Reporter on Economic Products to the Government of India. <i>Calcutta.</i>	
1896 Jan. 8.	N.R.	Burn, Richard, I.C.S. <i>Gonda, Oude.</i>	
1900 May 2.	F.M.	Butcher, Flora, M.D. <i>Asylum, Springfield. Cupar Fife, Scotland.</i>	
1904 Aug. 3.	A.	Bythell, Lieut.-Col. William John, R.E. <i>Europe.</i>	
1898 Sept. 30.	R.	Cable, Sir Ernest, Kt. 101-1, <i>Olive Street. Calcutta.</i>	
1906 Dec. 5.	R.	Caddy, Dr. Adrian, M.D. (Lond.), F.R.C.S. (Eng.), D.P.H., R.C.P.S. (Lond.). 2-2, <i>Harrington Street, Calcutta.</i>	
1906 July 4.	R.	Caddy, Dr. Arnold, M.D., F.R.C.S. 2-2, <i>Harrington Street, Calcutta.</i>	
1907 Apl. 3.	N.R.	Calvert, Major John Telfer, M.B., M.B.C.P. I.M.S. <i>Darjeeling.</i>	

Date of Election.		
1907 Mar. 6.	L.M.	Camaji Byramji Navroji Cama, B.A., LL.B. I.C.S. <i>Bilaspur, Central Provinces.</i>
1901 Mar. 6.	N.R.	Campbell, William Edgar Marmaduke, I.C.S., Magistrate and Collector. <i>Hamirpur.</i>
1895 July 3.	R.	Carlyle, Robert Warrand, C.I.E., I.C.S., Secretary to the Government of India, Revenue and Agriculture Department. <i>Calcutta.</i>
1899 June 7.	N.R.	Chandra Kumar Sarkar. <i>Kawkank, Moulmsein.</i>
1901 Aug. 7.	R.	Chandra Narayan Singh, Rai Bahadur. 16, <i>Theatre Road, Calcutta.</i>
1901 June 5.	A.	Chapman, Edmund Pelly, I.C.S. <i>Europe.</i>
1906 Jan. 3.	R.	Chapman, John Alexander, Calcutta Madrasah. <i>Calcutta.</i>
1904 July 6.	N.R.	Charles, Albert Pendrill, B.A., I.C.S., Registrar, Court of Judicial Commissioner. <i>Lucknow.</i>
1903 Sep. 23.	N.R.	Chinta Ito, Professor Dr. <i>Engineering College, Tokyo, Japan.</i>
1907 July 3.	R.	Christie, William Alexander Kynock, B.Sc., Ph.D., Chemist, Geological Survey of India. <i>Calcutta.</i>
1906 Nov. 7.	R.	Clarke, Geoffrey Roth, I.C.S. 16, <i>London Street, Calcutta.</i>
1906 July 4.	R.	Connor, Captain Frank Powell, F.R.C.S. (Eng.), L.R.C.P. (Lond.), I.M.S., Medical College. <i>Calcutta.</i>
1903 Aug. 26.	R.	Copleston, The Most Revd. Dr. Reginald Stephen, D.D. <i>Lord Bishop of Calcutta.</i>
1898 June 1.	F.M.	Cordier, Dr. Palmyr. 2, <i>Boulevard Gambetta, Hanoi (Tonkin), French Indo-China.</i>
1907 July 3.	R.	Cotter, G. deP., Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>
1901 June 5.	R.	Crawford, Lieut.-Col. Dirom Grey, I.M.S., Civil Surgeon. <i>Hughli, Chinsura.</i>
1876 Mar. 1.	F.M.	Crawford, James, B.A., I.C.S. (retired). <i>Thornwood, Uddington, Lanarkshire, Scotland.</i>
1887 Aug. 25.	R.	Criper, William Risdon, F.C.S., F.I.C., A.R.S.M. <i>Konnayar.</i>
1895 July 3.	R.	Cumming, John Ghest, I.C.S. <i>Alipore.</i>
1905 July 5.	R.	Cunningham, John Arthur, B.A. <i>Alipur Observatory, Calcutta.</i>
1873 Dec. 3.	F.M.	Dames, Mansel Longworth, I.C.S. (retired). <i>Algeria, Enfield, Middlesex, England.</i>
1885 Nov. 4.	R.	Damodar Das Barman. 55, <i>Olive Street, Calcutta.</i>
1905 July 5.	N.R.	Das, J. N. <i>Daulatpur P.O., Khulna.</i>
1906 Dec. 5.	N.R.	Deare, Major Benjamin Hobbs, M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. (Canb.), I.M.S. <i>Hazaribagh.</i>
1904 Sept. 28.	N.R.	DeCourcy, W. B. <i>Silcari P.O., Cachar.</i>

Date of Election.			
1895	Dec. 4.	N.R.	Delmerick, Charles Swift, Sub-Deputy Opium Agent. <i>Bareilly.</i>
1906	Dec. 5.	R.	Dentith, Arthur William, I.C.S., Assistant Comptroller of India Treasuries. <i>Calcutta.</i>
1898	Jan. 5.	R.	Dods, W. K., Agent, Hongkong and Shanghai Banking Corporation. <i>Calcutta.</i>
1906	Dec. 5.	R.	Donnan, Major William, Indian Army, Examiner of Ordnance Factory Accounts in India. <i>Calcutta.</i>
1902	July 2.	R.	Doxey, F. 12, <i>Store Road, Ballygunge, Calcutta.</i>
1902	Jan. 8.	A.	Drummond, James R., I.C.S. (retired). <i>Europe.</i>
1892	Sept. 22.	R.	Drury, Lieut.-Col. Francis James. I.M.S., Medical College: <i>Calcutta.</i>
1889	Jan. 2.	A.	Dudgeon, Gerald Cecil. <i>Europe.</i>
1905	April 5.	N.R.	Dunnett, James Macdonald, I.C.S., Assistant Settlement Officer. <i>Rawalpindi.</i>
1879	Feb. 5.	F.M.	Duthie, John F. B.A., F.L.S. <i>Royal Botanic Gardens, Kew, Surrey, England.</i>
1905	May 3.	R.	Dwarkanath Chakravarti. M.A., B.L., Vakil, High Court. <i>Calcutta.</i>
1906	Nov. 7.	F.M.	Eadie, Lieut. John Inglis, c/o Messrs. Grindlay & Co. <i>Westminster, London.</i>
1907	Sept. 25.	R.	Eakins, Dr. Olin, M.D., Chief Medical Officer: New York Life Assurance. 8, <i>Old Court House Street, Calcutta.</i>
1900	July 4.	R.	Earle, Archdale, I.C.S., Director of Public Instruction, Bengal. <i>Calcutta.</i>
1903	Oct. 28.	R.	Edelston, T. D. I, <i>New China Bazar Street, Calcutta.</i>
1903	May 6.	N.R.	Edwards, Walter Noel. <i>Sootea P.O., Tezpur, Assam.</i>
1900	Mar. 7.	A.	Fanshawe, Sir Arthur Upton, C.S.I., K.C.I.E., I.C.S. <i>Europe.</i>
1901	Mar. 6.	A.	Fergusson, J. C. <i>Europe.</i>
1904	Aug. 3.	R.	Fermor, Lewis Leigh, A.R.S.M., B.Sc., F.G.S., Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>
1906	Dec. 5.	R.	Finck, Dr. H., M.D., Surgeon to the Consulate-General for Germany. <i>Calcutta.</i>
1906	Oct. 31.	N.R.	Finlow, Robert Steel, Fibre Expert to the Govt. of Eastern Bengal and Assam. <i>Pusa, Tirhoot.</i>
1907	Mar. 6.	R.	Firminger, Revd. Walter Kelly, M.A., B.D., F.R.G.S. Chaplain, St. Stephen's Church. <i>Kidderpore, Calcutta.</i>
1906	Dec. 5.	R.	Foster, Captain Henry Bertram, I.M.S., Civil Surgeon. <i>Burdwan.</i>
1904	May 4.	N.R.	Framjee Jamasjee Thanawala. 90, <i>Caranjee Patel Street, Fort, Bombay.</i>

Date of Election.			
1905	Jan. 4.	R.	Fraser, His Honour Sir Andrew Henderson Leith, M.A., LL.D., K.C.S.I., Lieutenant-Governor of Bengal. <i>Calcutta.</i>
1902	April 2.	A.	Fuller, Sir Joseph Bampfylde, K.C.S.I. <i>Europe.</i>
1903	Mar. 4.	R.	Gage, Captain Andrew Thomas, M.A., M.B., B.Sc., F.L.S., I.M.S. <i>Royal Botanic Garden, Sibpur, Howrah.</i>
1893	Jan. 11.	R.	Gait, The Hon'ble Mr. Edward Albert, C.I.E., I.C.S., Chief Secretary, Government of Bengal. <i>Calcutta.</i>
1899	Aug. 30.	R.	Garth, Dr. H. C. 4, <i>Little Russell Street, Calcutta.</i>
1902	June 4.	N.R.	Ghuznavi, A. A. <i>Delduar, Mymensingh.</i>
1907	Sept. 25.	N.R.	Gibbon, Captain, C. M., 89, <i>Royal Irish Fusiliers. United Service Club, Simla.</i>
1906	Feb. 7.	R.	Girindra Kumar Sen. <i>Presidency College, Calcutta.</i>
1902	Feb. 5.	R.	Girish Chandra Ghosh, Dramatist. 13, <i>Bosepara Lane, Calcutta.</i>
1889	June 5.	N.R.	Girjanath Roy, Maharaja. <i>Dinagapore.</i>
1861	Feb. 5.	N.S.	Godwin-Austen, Lieut.-Colonel Henry Haversham, F.R.S., F.Z.S., F.R.G.S. <i>Nore, Godalming, Surrey, England.</i>
1905	Aug. 2.	N.R.	Gourlay, Captain Charles Aikman, I.M.S., Offg. Deputy Sanitary Commissioner, Eastern Bengal and Assam. <i>Shillong.</i>
1901	Aug. 28.	N.R.	Govinda Das. <i>Durgakund, Benares City.</i>
1897	July 7.	A.	Grant, Major John Wemyss, I.M.S. <i>Europe.</i>
1905	May 3.	R.	Graves, H. G., A.R.S.M. <i>United Service Club, Calcutta.</i>
1907	June 5.	R.	Green, Lieut.-Col. Charles Robert Mortimer, M.D., F.R.C.S., I.M.S., 6, <i>Harrington Street, Calcutta.</i>
1900	Dec. 5.	L.M.	Grieve, J. W. A., Deputy Conservator of Forests. <i>Chaibassa.</i>
1904	Jan. 6.	N.R.	Gulab Shanker Dev Sharmar, F.T.S. <i>Futtehpore, Agra District, U.P.</i>
1901	Mar. 6.	N.R.	Habibur Rahman Khan, Maulavi. Raees. <i>Bhikanpur, Dt. Aligarh.</i>
1892	Jan. 6.	N.R.	Haig, Major Wolseley, Indian Army, 1st Asstt. to the Resident. <i>Alwar, Rajputana.</i>
1907	Aug. 7.	F.M.	Haines, Henry Haselfoot, F.C.S., F.L.S. <i>Borham House, Haverstock Hill, Hampstead, London, N.W.</i>
1904	Sept. 28.	R.	Hallward, Norman Leslie. 3, <i>Harrington Street, Calcutta.</i>
1889	Mar. 6.	N.R.	Hanuman Prasad, Raees and Zemindar. <i>Chunar.</i>

Date of Election.			
1885	Feb. 4.	R.	Haraprasad Shastri, Mahamahopadhyaya, M.A., Principal, Sanskrit College. <i>Calcutta.</i>
1899	April 5.	A.	Hare, Lieut.-Col. Edward Christian, I.M.S. <i>Europe.</i>
1907	Feb. 6.	N.R.	Hare, The Hon'ble Sir Lancelot, K.C.S.I., Lieutenant-Governor of Eastern Bengal and Assam. <i>Shillong.</i>
1904	Jan. 6.	R.	Harendra Krishna Mukerjee, M.A. 54, <i>Sankaripara Road, Calcutta.</i>
1903	June 3.	R.	Harinath De, M.A., Librarian, Imperial Library. <i>Calcutta.</i>
1902	Dec. 3.	N.R.	Harnarain Shastri, Goswami. <i>Hindu College, Delhi.</i>
1906	Dec. 5.	N.R.	Harris, Lieut. G. 56 <i>Infantry, F.F., Hanqu.</i>
1906	July 4.	R.	Harris, Lt.-Col. George Francis Angelo, M.D., F.R.C.P., I.M.S. 14, <i>Russell Street, Calcutta.</i>
1907	June 5.	R.	Harwood, Col. J. G., F.R.C.S., R.A.M.C. Principal Medical Officer, Presidency and Assam Brigades. <i>United Service Club, Calcutta.</i>
1884	Mar. 5.	L.M.	Hassan Ali Mirza, Sir Wala Qadr Sayid, G.C.I.E. <i>Murshidabad.</i>
1897	Feb. 3.	A.	Hayden, Henry Herbert, B.A., B.E., F.G.S. <i>Europe.</i>
1906	Dec. 5.	R.	Hayward, Major William Davey, M.B., I.M.S. 9, <i>Russell Street, Calcutta.</i>
1905	July 5.	N.R.	Hemchandra Gossain. Extra Assistant Commissioner. <i>Tezpur.</i>
1905	May 3.	N.R.	Hemendra Prasad Ghose, Zemindar and Litterateur. <i>Prasad Lodge, Changanbha P.O., Jessore.</i>
1907	Nov. 6.	N.R.	Hepper, Captain Lionel Lees. <i>Royal Artillery, Maymyo, Burma.</i>
1904	June 1.	F.M.	Hewett, J. F., I.C.S. (retired). <i>Holton Cottage, Oxford, England.</i>
1904	Dec. 7.	N.R.	Hill, Ernest George. <i>Muir Central College, Allahabad.</i>
1906	Dec. 5.	N.R.	Hirst, Reginald John, District Superintendent of Police. <i>Purneah.</i>
1891	July 1.	R.	Holland, Thomas Henry, A.R.C.S., F.G.S., F.R.S., Director, Geological Survey of India. <i>Calcutta.</i>
1898	Feb. 2.	R.	Hooper, David, F.C.S. 1, <i>Sulder Street, Calcutta.</i>
1906	Oct. 31.	R.	Hornell, William Woodward, B.A., Assistant Director of Public Instruction, Bengal. <i>Calcutta.</i>
1901	Dec. 4.	R.	Hossack, Dr. William Cardiff. 47, <i>Park Street, Calcutta.</i>
1907	Feb. 6.	R.	Houseman, Dr. Edward A., B.A., M.B., B.C. (Cantab.), Medical Officer. <i>Lillooah, E.I.Ry.</i>

Date of Election.			
1873	Jan. 2.	L.M.	Houstoun, George L., F.G.S., <i>Johnstone Castle, Renfrewshire, Scotland.</i>
1906	May 2.	N.R.	Howell, Evelyn Berkeley. B.A., I.C.S. <i>Peshawar.</i>
1905	July 5.	N.R.	Humphries, Edgar de Montfort, B.A., I.C.S.. Settlement Officer. <i>Banda.</i>
1866	Mar. 7.	F.M.	Irvine, William, I.C.S. (retired). <i>Hollescroft, Castelnuu, Barnes, London, S.W.</i>
1906	Dec. 5.	N.R.	Jack, James Charles, I.C.S., Settlement Officer, Eastern Bengal and Assam. <i>Faridpur.</i>
1905	Nov. 1.	N.R.	Jackson, A. M. T., I.C.S. <i>C/o Messrs. Grindlay Groom & Co., Bombay.</i>
1904	Jan. 6.	N.R.	Jackson, Victor Herbert, M.A. <i>Patna College, Bankipur.</i>
1885	April 1.	R.	Jadoonath Sen, Civil Engineer. 35, <i>Sib Narain Das' Lane, Calcutta.</i>
1898	Mar. 2.	N.R.	Jadunath Sarkar. <i>Patna College, Bankipur.</i>
1903	July 1.	R.	Jagadindranath Roy, Maharaja Bahadur. <i>Lansdowne Road, Calcutta.</i>
1895	Mar. 6.	A.	Jagadis Chandra Bose, M.A., D.Sc., C.I.E. <i>Europe.</i>
1905	July 5.	N.R.	Jain Vaidya. <i>Jahari Bazar, Jaipur.</i>
1907	Dec. 4.	R.	James Henry Rosher, M.A., Bengal Education Service, Principal, Presidency College. <i>Calcutta.</i>
1895	Aug. 29.	N.R.	Jatindranath Rai Chaudhuri, MA., B.L., Zemin- dar. <i>Taki, Jessore.</i>
1907	Sept. 25.	N.R.	Jenkins, Owen Francis, I.C.S., Offg. Joint Magistrate. <i>Budaon, U.P.</i>
1889	Jan. 2.	R.	Jogendra Chandra Ghose, The Hon. Mr., M.A., B.L., Pleader, High Court. 25, <i>Hurrish Chunder Mookerjee Road, Bhowanipore.</i>
1896	Mar. 4.	R.	Jogendra Nath Das-Gupta, B.A. (Oxon.), Barrister-at-Law. <i>Hughli College, Chan- surah.</i>
1902	May 7.	R.	Jogendra Nath Sen Vidyabhusana, M.A. 347, <i>Upper Chitpur Road, Calcutta.</i>
1906	July 4.	R.	Jones, Lieut.-Col. John Lloyd, M.B. (Dub.), M.R.C.S. (Lond.), D.P.H. (Cantab.), F.C.A., I.M.S. <i>United Service Club, Calcutta.</i>
1868	June 3.	R.	Jotindramohan Tagore, Bahadur, Maharaja Sir, K.C.S.I. <i>Pathuriaghatta, Calcutta.</i>
1899	Sep. 29.	R.	Jotindra Nath Mukharji, B.A., Solicitor. 3, <i>Old Post Office Street, Calcutta.</i>
1907	Mar. 6.	N.R.	Jwala Sahai Munshi, Retired Nazim of Dig, Bharatpur State. <i>Sohua, Gurgaon District.</i>
1904	Mar. 4.	N.R.	Kamlanand Singh, Kumar. <i>Srinagar Raj, Srinagar P.O., Purneah District.</i>

Date of Election.		
1905 May 3.	N.R.	Kashi Prasad Jayaswal. <i>Narghat, Mirzapur.</i>
1901 Jan. 2.	A.	Kavasjee Jamasjee Badshah, B.A., I.C.S. <i>Europe.</i>
1906 Dec. 5.	N.R.	Kaye, George Rusby, Bureau Assistant to the Director General of Education. <i>Simla.</i>
1877 Aug. 30.	R.	Kedar Nath Dutt. 1, <i>Sikdarpara Lane, Calcutta.</i>
1882 Mar. 1.	N.R.	Kennedy, Pringle, M.A., B.L., Vakil. <i>Mozafferpore.</i>
1906 Aug. 1.	R.	Kennedy, Dr. W. W., M.A., M.D., M.R.C.S., I.R.C.P., D.P.H. 9, <i>Russell Street, Calcutta.</i>
1906 Sept. 19.	R.	Kesteven, Charles Henry, Solicitor to Government. 26, <i>Dalhousie Square, Calcutta.</i>
1895 Sept. 19.	N.R.	Kiran Chandra De, B.A., I.C.S., Registrar of Co-operative Credit Societies, Eastern Bengal and Assam. <i>Shillong.</i>
1904 May 4.	N.R.	Knox, Kenneth Neville. I.C.S., Magistrate and Collector. <i>Banda.</i>
1896 July 1.	R.	Küchler, George William, M.A., Inspector of Schools, Presidency Division. <i>Calcutta.</i>
1894 July 4.	N.R.	Kushal Pal Singh, Raja, M.A. <i>Narki.</i>
1895 Aug. 29.	R.	Lachmi Narayan Singh, M.A., B.L., Pleader, High Court. <i>Calcutta.</i>
1901 June 5.	N.R.	Lajpat Rai, Lala, Pleader, Chief Court. <i>Lahore.</i>
1887 May 4.	L.M.	Lanman, Charles Rockwell, 9, <i>Farrar Street, Cambridge, Massachusetts, U.S. America.</i>
1889 Mar. 6.	A.	La Touche, Thomas Henry Digges. B.A., F.G.S. <i>Europe.</i>
1900 Sep. 19.	A.	Law, Sir Edward FitzGerald, K.C.M.G., C.S.I. <i>Europe.</i>
1902 July 2.	N.R.	Leake, Henry Martin, M.A., F.L.S., Economic Botanist to the Government of United Provinces. <i>Cawnpur.</i> [<i>Calcutta.</i>]
1889 Nov. 6.	R.	Lee, William A., F.R.M.S. 38, <i>Strand Road.</i>
1903 July 1.	N.R.	Lefroy, Harold Maxwell, M.A., F.E.S., Imperial Entomologist. <i>Mozafferpore.</i>
1902 Oct. 29.	A.	Lewes, A. H. <i>Europe.</i>
1907 Dec. 4.	N.R.	Lindsay, James Hamilton M.A., I.C.S. <i>Sewan.</i>
1889 Feb. 6.	R.	Little, Charles, M.A. 1, <i>Camac Street, Calcutta.</i>
1907 Dec. 4.	N.R.	Little, James H., Assistant Master, Victoria School. <i>Kurseony.</i>
1907 Mar. 6.	R.	Lloyd, Captain Richard Ernest, M.B., B.Sc., I.M.S. 27, <i>Chowringhee Road, Calcutta.</i>
1906 Feb. 7.	A.	Lógan, A. C., I.C.S. <i>Europe.</i>
1906 Oct. 31.	F.M.	Luard, Captain Charles Eckford, M.A. (Oxon.). 20, <i>Elm Tree Road, London.</i>
1902 July 2.	R.	Luke, James, Journalist. 98, <i>Clive Street, Calcutta.</i>

Date of Election.		
1905 Aug. 2.	R.	Lukis, Lt.-Col. Charles Pardey, M.B., F.R.C.S., I.M.S. <i>Medical College, Calcutta.</i>
1870 April 7.	L.M.	Lyman, B. Smith. 708, <i>Locust Street, Philadelphia, U.S. America.</i>
1896 Mar. 4.	N.R.	MacBlaine. Frederick, I.C.S., District and Sessions Judge. <i>Saran.</i>
1906 Nov. 7.	R.	MacCabe, William Bernard, M.INST.C.E., F.I.C., Chief Engineer to the Corporation. <i>Calcutta.</i>
1905 Aug. 2.	R.	McCay, Captain David, M.B., I.M.S., Professor of Physiology. <i>Medical College, Calcutta.</i>
1902 July 2.	A.	Macdonald, Dr. William Roy. <i>Europe.</i>
1907 April 3.	R.	Mackelvie, Captain Maxwell, I.M.S., Resident Physician. <i>Medical College, Calcutta.</i>
1906 April 4.	N.R.	Mackenzie, Evan, Church of Scotland Mission. <i>Kalimpong, via Siliguri.</i>
1893 Jan. 11.	L.M.	Maclagan, The Hon. Mr. Edward Douglas, M.A., I.C.S., Chief Secretary to the Government of the Punjab. <i>Lahore.</i>
1907 Aug. 7.	N.R.	McIntosh, William, Agent, Bank of Bengal. <i>Hyderabad.</i>
1899 Feb. 1.	N.R.	McMahon, Lieut.-Col. Sir Arthur Henry, K.C.I.E., C.S.I., C.I.E., Indian Army, Agent to the Governor-General and Chief Commissioner in Baluchistan. <i>Quetta.</i>
1899 Mar. 1.	F.M.	McMinn, Charles W., B.A., I.C.S. (retired). C/o Messrs. Grindlay & Co., 55, <i>Parliament Street, London.</i>
1891 Feb. 4.	N.R.	Macpherson, Duncan James, M.A., C.I.E., I.C.S., Commissioner. <i>Bhagulpur.</i>
1902 April 2.	A.	Maddox, Major Ralph Henry, I.M.S. <i>Europe.</i>
1893 Jan. 11.	L.M.	Madho Rao Scindia Alijah, Bahadur, Colonel, His Highness Maharajah Sir, G.C.S.I., G.C.V.O., A.D.C., LL.D., Maharajah of Gwalior. <i>Jai Bilas, Gwalior.</i>
1907 July 3.	R.	Mahendra Nath De, M.A., B.Sc., Professor, Bengal National College. <i>Calcutta.</i>
1895 Aug. 29.	R.	Mahmud Gilani, Shams-ul-Ulama Shaikh. 23, <i>Lower Chitpur Road, Calcutta.</i>
1907 Mar. 6.	N.R.	Maekshaw Jamshedi Kelawala, Lt.-Col. I.M.S. 88, <i>Carnatic Infantry, St. Thomas Mount, Madras.</i>
1906 June 6.	R.	Manmatha Nath Mitra, Kumar. 34, <i>Shampukur Street, Calcutta.</i>
1901 June 5.	N.R.	Mann, Dr. Harold Hart, D.Sc., M.Sc., F.L.S., Principal, Agricultural College. <i>Poona.</i>
1899 Aug. 30.	N.R.	Mannu Lal, Dr., Civil Surgeon. <i>Banda.</i>
1905 Dec. 6.	F.M.	Marsden, Edmund, B.A., F.B.G.S. <i>Pembroke House, Bath Road, Cheltenham, England.</i>

Date of Election.		
1902 May 7.	N.R.	Marshall, John Hubert, Director-General of Archaeology. <i>Simla</i> .
1892 April 6.	R.	Maynard, Lieut. Col. Frederic Pinsent, M.B., D.P.H., F.R.C.S., I.M.S., Professor of Ophthalmic Surgery, Medical College. <i>Calcutta</i> .
1903 Aug. 5.	R.	Meerza Mohammad Masoom, Dr. 8, <i>Peter's Lane, Calcutta</i> .
1905 Feb. 1.	R.	Megaw, Captain John Wallace Dick, I.M.S. <i>Medical College, Calcutta</i> .
1895 July 3.	F.M.	Melitus, Paul Gregory, C.I.E., I.C.S. 44, <i>Holland Park, Notting Hill, London</i> .
1900 Jan. 19.	R.	Machie, Charles. 8, <i>Mission Row, Calcutta</i> .
1884 Nov. 5.	R.	Middlemiss, Charles Stewart, B.A., F.G.S., Superintendent Geological Survey of India. <i>Calcutta</i> .
1905 Dec. 6.	R.	Midhut Mohamed Hossain Khan. 8, <i>Golan Sobhan's Lane, Calcutta</i> . [cutta.
1884 Sep. 3.	R.	Miles, William Harry. 7, <i>Church Lane, Calcutta</i> .
1904 April 6.	R.	Miller, The Hon. Mr. John Ontario, C.S.I., I.C.S., Revenue & Agriculture and P. W. D. Member, Government of India. <i>Calcutta</i> .
1898 April 6.	N.R.	Milne, Major Charles John Robertson, M.B., I.M.S. <i>Berhampur</i> .
1906 Mar. 7.	N.R.	Milsted, W. P. S. <i>Boys' High School, Allahabad</i> .
1885 June 3.	N.R.	Mohammad Naemullah, Maulavi. <i>Bijnor</i> .
1880 Aug. 4.	L.M.	Mohanlall Vishnulall Pandia, Pandit, P.T.S. <i>Muttra</i> . [wan.
1906 Mar. 7.	N.R.	Mohinimohan Mitra, M.A., B.L., Pleader. <i>Burdwan</i> .
1901 Aug. 7.	N.R.	Molony, Edmund Alexander, I.C.S. <i>Government Farm, Cawnpur</i> .
1890 June 4.	R.	Monmohan Chakravarti, M.A., B.L., Provincial Civil Service, Bengal. 14, <i>Palmer's Bazaar Road, Balliaghatta, Calcutta</i> .
1895 July 3.	N.R.	Monohan, Francis John, I.C.S., Commissioner, Assam Valley District. <i>Shillong</i> .
1906 Dec. 5.	N.R.	More, Lieut. James Carmichael, 51st Sikhs, F.F. <i>Bannu</i> .
1907 June 5.	N.R.	Morgan, Captain John Henry, Indian Army, Supply & Transport Corps. <i>Rawalpindi</i> .
1906 Dec. 5.	N.R.	Morton, Captain Sidney. 24th Punjabis, <i>Dilkhusha, Lucknow</i> .
1905 Jan. 4.	R.	Muksoodan Das. 13, <i>Shumbhoo Nath Mullick's Lane, Calcutta</i> .
1906 July 4.	N.R.	Mulvany, Major John, I.M.S. <i>Rockwood, Darjeeling</i> .
1905 Mar. 1.	R.	Muralidhar Banerjee. <i>Sanskrit College, Calcutta</i> .
1906 Dec. 5.	R.	Murphy, Captain C. C. R., <i>The Suffolk Regiment</i> . 42, <i>Chowringhee Road, Calcutta</i> .

Date of Election .		
1906 Dec. 5.	R.	Murray, Captain John George Patrick, I.M.S.; <i>Presidency General Hospital, Calcutta.</i>
1894 Sep. 27.	R.	Nagendra Nath Basu. 20, <i>Kentapuker Lane, Bagbazaar, Calcutta.</i>
1907 Jan. 2.	N.R.	Nasir Ali, Khan Bahadur, Mir, Superintendent, North India Salt Revenue. <i>Sultanpur Salt Works, Farrakhnagar, Gurgaon.</i>
1907 Jan. 2.	R.	Nasir Hosein Khan, S., Landholder. 32, <i>Ezra Street, Calcutta.</i>
1904 Dec. 7.	N.R.	Nathan, Robert, I.C.S., Commissioner, Dacca Division. <i>Dacca.</i>
1901 Mar. 6.	N.R.	Nevill, Henry Rivers, I.C.S., Editor, District Gazetteers, United Provinces. <i>Allahabad.</i>
1889 Aug. 29.	L.M.	Nimmo, John Duncan, c/o Messrs. Walter Duncan & Co. 137, <i>West George Street, Glasgow.</i>
1887 May 4.	R.	Nobinchand Bural, Solicitor. 10, <i>Old Post Office Street, Calcutta.</i>
1906 Dec. 5.	N.R.	Norman, Henry Campbell, M.A. <i>Queen's College, Benares.</i>
1901 June 5.	N.R.	Nundolal Dey, Subordinate Judge. <i>Bhagulpur.</i>
1900 Dec. 5.	N.R.	O'Connor, Captain, William Frederick Travers, C.I.E., B.A. <i>Gyantse, Tibet.</i>
1906 Dec. 5.	R.	O'Kinealy, Major Frederick, M.R.C.S. (Eng.); L.R.C.P. (Lond.), I.M.S. <i>Medical College, Calcutta.</i>
1905 May 3.	N.R.	Ollenbach, A. J., B.A., I.C.S. <i>Khondmals, Phulbani, Orissa.</i>
1905 Nov. 1.	N.R.	O'Malley, Lewis Sydney Steward, B.A., I.C.S., Superintendent, Imperial Gazetteer, Bengal. <i>Darjeeling.</i>
1892 Mar. 2.	L.M.	Ooday Pratab Singh, Raja, C.S.I., Raja of Bhinga. <i>Bhinga.</i>
1906 Aug. 1.	A.	Osburn, Captain, Arthur C., M.R.C.S., L.R.C.P. (Lond.), B.A.M.C. <i>Europe.</i>
1907 July 3.	R.	Page, W. W. K., Solicitor. 10, <i>Old Post Office Street, Calcutta.</i>
1892 Dec. 7.	R.	Panchanan Mukhopadhyaya. 45, <i>Bechoo Chatterji's Street, Calcutta.</i>
1907 Feb. 6.	R.	Panioty, Dr. John Emanuel, L.R.C.P. (Lond.), L.R.C.P. & S. (Ed.) 19, <i>Royd Street, Calcutta.</i>
1904 Jan. 6.	A.	Panna Lal, M.A., B.Sc. <i>Europe.</i>
1901 Aug. 28.	R.	Panton, Edward Brooks Henderson, B.A., I.C.S., District and Sessions Judge. 24- <i>Parganas.</i>
1904 Aug. 3.	N.R.	Parasmis, D. B. <i>Satara.</i>
1902 Jan. 8.	A.	Parmeshwara Lall. <i>Europe.</i>

Date of Election.			
1899	Aug. 2.	R.	Peake, Charles William M.A., Meteorological Reporter to the Government of Bengal. <i>Calcutta.</i>
1907	Dec. 4.	N.R.	Pearse, Thomas Frederick, M.D., F.R.C.S., M.R.C.P., D.P.H., Health Officer. <i>Calcutta.</i>
1906	Dec. 5.	N.R.	Pearl, Captain Charles Lubé. 106th <i>Hazara Pioneers, Quetta.</i> [Europe.]
1906	July 4.	A.	Peck, Lieut.-Col. Francis Samuel, I.M.S.
1888	June 6.	L.M.	Pennell, Aubray Percival, B.A., Barrister-at-Law. <i>Rangoon.</i>
1881	Aug. 25.	R.	Percival, Hugh Melville, M.A. 14, <i>Park Street, Calcutta.</i>
1877	Aug. 1.	N.R.	Peters, Lieut.-Col. Charles Thomas, M.B., I.M.S. (retired.) <i>Dinajpur.</i>
1906	April 4.	R.	Petrocochino, Leonidar. 231, <i>Lower Circular Road, Calcutta.</i>
1907	Feb. 6.	R.	Petrie, David. Assistant Superintendent, Punjab Police. <i>Hangu.</i>
1900	May 2.	R.	Phani Bhusan Mukerji, B.Sc. 57, <i>Jhowtola Road, Ballygunge, Calcutta.</i>
1906	April 4.	R.	Phillips, Rev. Alfred Henry, <i>Church Missionary Society.</i> 10, <i>Mission Row, Calcutta.</i>
1889	Nov. 6.	R.	Phillott, Lieut.-Colonel Douglas Craven, 23rd Cavalry, F.F., Secretary, Board of Examiners. 4, <i>Park Street, Calcutta.</i>
1906	Mar. 7.	N.R.	Phra Maha Chandima. 40, <i>Green Hall, Penang.</i>
1904	June 1.	R.	Pilgrim, G. Elcock, Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>
1904	Mar. 4.	A.	Pim, Arthur W., I.C.S. <i>Europe.</i>
1906	May 2.	N.R.	Prabhat Chandra Borua, Raja. <i>Gauripur, Assam.</i>
1899	Aug. 29.	N.R.	Prabhu Narain Singh, Bahadur, H.H. The Maharaja Sir, G.C.I.E., Maharaja of Benares. <i>Ramnagar Fort, Benares.</i>
1907	Mar. 6.	R.	Prafulla Chandra Ghosh, M.A. 27/3, <i>Boitakhana Bazar Road, Calcutta.</i>
1890	Mar. 5.	R.	Prafulla Chandra Ray, D.S.C., Professor, Presidency College. <i>Calcutta.</i>
1880	Nov. 3.	R.	Pramatha Nath Bose, B.S.C., F.G.S. 8/2, <i>Loudon Street, Calcutta.</i>
1901	April 3.	R.	Pramatha Nath Mullick, Zemindar. 7, <i>Prasanno Kumar Tagore's Street, Calcutta.</i>
1887	May 4.	R.	Prasanna Kumar Ray, D.S.C. (Lond. and Edin.). 7, <i>Ballygunge Circular Road, Calcutta.</i>
1869	Feb. 3.	N.R.	Pratapa Chandra Ghosha, B.A. <i>Vindychal.</i>
1906	Aug. 1.	N.R.	Price, Charles Stanley. <i>Victoria Boy's School, Kurseong.</i>
1898	April 6.	R.	Prodyat Coomar Tagore, Maharaj Coomar Sir, Kt. <i>Pathuriaghatta, Calcutta.</i>

Date of Election.		
1907 Sept. 25.	R.	Promode Prakas Chatterjee. 8, Dixon Lane Calcutta.
1907 Jan. 2.	N.R.	Pulley, Lieut. Henry Cuthbert. 12th Pioneers, Jhansi. [bad.]
1906 Mar. 7.	N.R.	Puran Chand Nahar. Azimgunj, Murshida-
1877 Jan. 17.	N.R.	Radhakishor Dev Barman, H. H. The Maharaja. Tipperah.
1902 April 2.	R.	Rajchunder Chunder, Attorney-at-Law. 2, Old Post Office Street, Calcutta.
1902 Mar. 5.	R.	Rajendra Chandra Sastri, Rai Bahadur, M.A., Bengali Translator to the Government of Bengal. Calcutta.
1898 May 4.	R.	Rajendra Nath Mookerjee. 20, Beadon Street, Calcutta.
1907 Jan. 2.	R.	Rakhal Das Banerjee. 45/4, Simla Street, Calcutta.
1900 April 4.	A.	Raleigh, Sir Thomas, K.C.S.I. Europe.
1901 Jan. 2.	N.R.	Ramavatar Pande, B.A., I.C.S., District Judge. Azimgarh.
1893 May 3.	N.R.	Ram Chandra Bhanj Deb, Maharaja Sri, Chief of Maurbhanj. Baripada P.O., Balasore.
1889 Nov. 6.	N.R.	Rameshwara Singh Bahadur, H. H. The Hon. Maharaja, K.C.I.E. Durbhanga.
1889 Jan. 2.	R.	Ramessur Maliah, Kumar. 6, Cullen Place, Howrah.
1879 April 7.	N.R.	Ram Saran Das, Rai Bahadur, M.A., Manager, Oudh Commercial Bank, Ltd. Fyzabad.
1905 Jan. 4.	N.R.	Rankin, James Thomas, I.C.S., Secy., Board of Revenue, Eastern Bengal and Assam. Shillong.
1907 Aug. 7.	N.R.	Ranking, Lieut James. 46th Punjabis, Sehore.
1904 Mar. 4.	F.M.	Rapson, E. J. British Museum, London.
1905 May 3.	F.M.	Richardson, Thomas William, I.C.S. C/o Messrs. Grindley & Co., 54, Parliament Street, London.
1884 Mar. 5.	R.	Risley, Sir Herbert Hope, B.A., C.I.E., K.C.I.E., I.C.S., Secretary, Government of India, Home Department. Calcutta.
1907 Feb. 6.	N.R.	Robertson, Major George Alan, Indian Army, 15th Lancers, Army Supply Department, Government of India Simla.
1903 Mar. 4.	N.R.	Rogers, Charles Gilbert, F.L.S., F.C.H., Forest Department. Port Blair, Andamans.
1900 April 4.	R.	Rogers, Major Leonard, M.D., B.S., F.R.C.P., F.R.C.S., I.M.S. 47, Park Street, Calcutta.
1907 Mar. 6.	R.	Roomall Goenka 57, Burtolla Street, Calcutta.
1900 Aug. 29.	N.R.	Rose, Horace Arthur, I.C.S., Superintendent, Gazetteer Revision, Punjab. Multan.

Date of Election.			
1901 Dec. 4.	A.	Ross, Dr. Edward Denison, PH.D.	<i>Europe.</i>
1906 Feb. 7.	N.R.	Russell, Charles, M.A.	<i>Patna College, Banki- pore.</i>
1886 Mar. 3.	L.M.	Rustomjee Dhunjeebhoy Mehta. C.I.E.	55, <i>Canning Street, Calcutta.</i>
1906 May 2.	N.R.	Sakhawat Hosain, Maulavi, B.A.	Inspector of Schools. <i>Meerut.</i>
1896 Aug. 27.	N.R.	Samman, Herbert Frederick, I.C.S.,	Offg. De- puty Commissioner, Sonthal Pargana. <i>Monghyr.</i>
1905 Mar. 1.	R.	Sanjib Chandra Sanial. I.	<i>Dihl Road, Cal- cutta.</i>
1897 Nov. 3.	R.	Sarada Charan Mitra, The Hon. Mr. Justice,	M.A., B.L., Judge, High Court. <i>Calcutta.</i>
1905 Mar. 1.	N.R.	Sasi Bhusan Bose, M.A.	<i>Ravenshaw College, Cuttack.</i>
1902 June 4.	R.	Satis Chandra Vidyabhusana, Mahamahopadhyaya, M.A.	<i>Presidency College, Calcutta.</i>
1896 Mar. 4.	N.R.	Satish Chandra Banerji, Dr., M.A., LL.D.,	Advocate, High Court. <i>Allahabad.</i>
1897 Nov. 3.	R.	Saunders, C.	35, <i>Chouringhee Road, Calcutta.</i>
1902 Feb. 5.	R.	Schulten, Dr. C.	13, <i>Olive Row, Calcutta.</i>
1900 Dec. 5.	N.R.	Schwaiger, Imre George, Expert in Indian	Art. <i>Kashmir Gate, Delhi.</i>
1897 Dec. 1.	N.R.	Seth, Mesrovb J.	<i>Bombay.</i>
1907 Aug. 7.	N.R.	Shah Munir Alam, B.A., LL.B.	<i>Mainpura, Ghazipore.</i>
1906 Dec. 5.	N.R.	Sharp, Henry, M.A., Director of Public In-	struction, Eastern Bengal and Assam. <i>Shillong.</i>
1903 April 1.	A.	Shaun, Montague Churchill.	<i>Europe.</i>
1894 June 6.	N.R.	Shibli Nomani, Shams-ul-Ulama Maulavi.	<i>Aligarh.</i>
1900 May 2.	R.	Shrager, Adolphe. 4.	<i>Auckland Square, Raw- don Street, Calcutta.</i>
1906 Mar. 7.	R.	Shyama Kumar Tagore, Kumar, Zemindar.	65, <i>Pathuriaghutta Street, Calcutta.</i>
1902 Feb. 5.	N.R.	Shyam Lal, Lala, M.A., LL.B., Deputy Col-	lector. <i>Allahabad.</i>
1894 Aug. 30.	R.	Sibnarayan Mukerjee.	<i>Uttarpara, Bally.</i>
1899 May 3.	F.M.	Silberrad, Charles A., B.A., B.Sc., I.C.S.	C/o <i>Messrs. R Silberrad & Sons, 25, Savage Gar- dens, Crutched Friars, London, E.C.</i>
1903 Aug. 26.	N.R.	Simpson, John Hope, I.C.S., Registrar of Co-	operative Credit Societies, Upper Pro- vinces. <i>Allahabad.</i>
1904 June 1.	R.	Simpson, Robert Rowell, B.Sc.,	<i>Department of Mines. Calcutta.</i>
1898 Aug. 3.	N.R.	Sita Ram, B.A., Depy. Magistrate.	<i>Dehra Dun.</i>

Date of Election.			
1872	Aug. 5.	N.R.	Skrefsrud, Revd. Laurentius Olavi, Secretary and Treasurer, Indian Home Mission to the Sonthals. <i>Benagerio, via Rampore Haut.</i>
1907	Dec. 4.	N.R.	Smith, Major John Manners, Indian Army, V.C., C.I.E., Resident in Nepal. <i>Katmandu.</i>
1907	Mar. 6.	N.R.	Sofulla Saifududdin Ahmed, Maulavi, Sub-Deputy Collector. <i>Dibrugarh, Assam.</i>
1905	Mar. 1.	R.	Sorabji, Cornelia, Court of Wards. 6, <i>Camac Street, Calcutta.</i>
1901	Dec. 4.	N.R.	Spooner, D. Brainerd, Archæological Surveyor, North-West Frontier Province. <i>Peshawar.</i>
1907	Oct. 30.	N.R.	Sri Ram Dixit, Pandit, B.A., Secretary, Pratapgarh State. <i>Pratapgarh.</i>
1904	Sept. 28.	N.R.	Stapleton, Henry Ernest, B.A., B.Sc., Inspector of Schools. <i>Dacca.</i>
1898	April 6.	N.R.	Stark, Herbert A., B.A., Inspector of Schools. <i>Ranchi.</i>
1901	Mar. 6.	N.R.	Stebbing, Edward Percy, F.E.S., F.Z.S., Imperial Forest Zoologist. <i>Dehra Dun.</i>
1891	Aug. 27.	A.	Stein, Dr. Mark Aurel, Ph.D. <i>Europe.</i>
1904	June 1.	R.	Stephen, The Hon'ble Mr. Justice Harry Lushington, Judge, High Court. <i>Calcutta.</i>
1899	Aug. 30.	R.	Stephen, St. John, B.A., LL.B., Barrister-at-Law. 7, <i>Russell Street, Calcutta.</i>
1900	Aug. 29.	N.R.	Stephenson, Major John, I.M.S., Civil Surgeon. <i>Umballa City.</i>
1907	April 3.	N.R.	Stewart, Captain Hugh, Indian Army, Assistant Political Agent. <i>Loralai, Baluchistan.</i>
1907	June 5.	N.R.	Stewart, Capt. J. H., I.M.S., Medical Officer. <i>Gyantse, Tibet.</i>
1906	Dec. 5.	F.M.	Stokes, Captain Claude Bayfield, Military Attaché. <i>Teheran, Persia.</i>
1904	July 6.	N.R.	Streatfield, Claude Arthur Cecil, I.C.S. <i>Jaunpur.</i>
1904	Jan. 6.	N.R.	Stuart, Louis, I.C.S. <i>Meerut.</i>
1906	Dec. 5.	R.	Subodh Chandra Mahalanobis, B.Sc., F.R.S.E., F.R.M.S. 210, <i>Cornwallis Street, Calcutta.</i>
1907	Aug. 7.	N.R.	Subramania Iyer, V., Instructor, Imperial Forest School. <i>Dehra Dun.</i>
1905	Jan. 4.	N.R.	Sukumar Sen. <i>Kamptee.</i>
1906	June 6.	N.R.	Surendra Prasad Sanial, Sri, M.A., F.C.S., Private Secretary to Raja Bahadur. <i>Majhauri.</i>
1907	June 5.	N.R.	Swinhoe, Rodway Charles John, Solicitor. <i>Mandalay, Upper Burma.</i>
1900	July 4.	N.R.	Syam Sunder Das, B.A. <i>Benares City.</i>
1904	July 6.	N.R.	Talbot, Walter Stanley, I.C.S., Revenue Commissioner. <i>Kashmir, Srinagar.</i>
1893	Aug. 31.	N.R.	Tate, George Passman, Assistant Superintendent, Survey of India. <i>Dehra Dun.</i>

Date of Election.			
1907	June 5.	N.R.	Taylor, Dr. G. Orissa. <i>Chandraghona, Chittagong Hill Tracts, Chittagong.</i>
1878	June 5.	N.R.	Temple, Colonel Sir Richard Carnac, Bart., Indian Army, C.I.E. <i>C/o Messrs. King, King & Co., Bombay.</i>
1906	Dec. 5.	N.R.	Tek Chand. Dewan, B.A., M.R.A.S., I.C.S., Deputy Commissioner. <i>Ludhiana.</i>
1875	June 2.	R.	Thibaut, G., PH.D., C.I.E., Registrar, Calcutta University. <i>46, Wellesley Street, Calcutta.</i>
1898	Nov. 2.	R.	Thornton, Edward, F.R.I.B.A. <i>6, Clive Street, Calcutta.</i>
1904	June 1.	R.	Tipper, George Howlett, B.A., Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>
1907	Feb. 6.	N.R.	Travers, Morris W., D.S.C., F.R.S., Director of Indian Institute of Science. <i>Bangalore.</i>
1861	June 5.	L.M.	Tremlett, James Dyer, M.A., I.C.S. (retired). <i>Dedham, Essex, England.</i>
1899	Aug. 30.	N.R.	Tribhuban Deb, Raja S., Feudatory Chief of Bamra. <i>Deogarh, Bamra.</i>
1897	Jan. 6.	N.R.	Tulsi Ram Misra, M.A. <i>Awagarh.</i>
1905	Jan. 4.	N.R.	Turner, Frank, B.A. <i>Dacca Club, Dacca.</i>
1906	June 6.	R.	Umapati Datta Sharma, Pandeya. <i>Hare School, Calcutta.</i>
1905	Aug. 2.	A.	Urwin, Captain John Johnson, M.B., I.M.S. <i>Europe.</i>
1905	July 5.	R.	Vanamali Chakravarti. <i>Sanskrit College, Calcutta.</i>
1900	Aug. 29.	R.	Vaughan, Major Joseph Charles Stoelke, I.M.S., Superintendent, Campbell Medical School and Hospital. <i>Calcutta.</i>
1890	Feb. 5.	N.R.	Venis, Arthur, M.A., Principal, Sanskrit College. <i>Benares.</i>
1894	Feb. 7.	N.R.	Vishwa Nath Singh, H. H. The Raja Bahadur. <i>Chhatturpur, Bundelkhand.</i>
1901	Mar. 6.	N.R.	Vogel, Jean Philippe, LITT. D., Archæological Surveyor, Punjab. <i>Lahore.</i>
1894	Sept. 27.	L.M.	Vost, Lieut.-Col. William, I.M.S., Civil Surgeon. <i>Muttra.</i>
1902	Oct. 29.	R.	Vredenburg, E., B.L., B.S.C., A.R.S.M., A.R.C.S., F.G.S., Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>
1907	July 3	R.	Walker, Harold, A.R.C.S., F.G.S., A.M.INST.M., Assistant Superintendent, Geological Survey of India. <i>Calcutta.</i>
1900	Jan. 19.	R.	Wallace, David Robb. <i>9, Clive Row, Calcutta.</i>

Date of Election.		
1901 June 5.	F.M.	Walsh, Ernest Herbert Cooper, I.C.S. <i>C/o Messrs. H. S. King & Co., Pall Mall, London.</i>
1900 April 4	N.R.	Walton, Captain Herbert James, M.B., F.R.C.S., I.M.S. <i>Bulandshahr.</i>
1905 Dec 6.	R.	Watson, Edwin Roy, M.A., B.Sc. <i>Civil Engineering College, Sibpur, Howrah.</i>
1902 April 2.	R.	Wheeler, Henry, I.C.S., Secretary, Board of Revenue, L.P. <i>Calcutta.</i>
1907 April 3.	R.	White, Lieut. Arthur Denham, M.B., B.S. (Lond.), I.M.S., Medical Officer. <i>13th Rajputs, Alipur.</i>
1907 Feb. 6.	N.R.	White, Captain J. R., D.S.O. <i>Gordon Highlanders, Peshawar.</i>
1906 Sept. 19.	N.R.	Whitehead, Richard Bertram, I.C.S., Assistant Commissioner. <i>Delhi.</i>
1905 Dec. 6.	R.	Wilson, James, M.A., C.S.I., I.C.S. <i>United Service Club, Calcutta.</i>
1904 Mar. 4.	R.	Wood, William Henry Arden, M.A., F.C.S., F.R.G.S., Principal, La Martiniere. <i>Calcutta.</i>
1906 July 4.	R.	Woodley, Rev. E. C., M.A., Principal, London Missionary Society's College. <i>Calcutta.</i>
1900 Dec. 5.	N.R.	Woodman, Henry Charles, I.C.S., Offg. Magistrate and Collector. <i>Mozufferpore.</i>
1906 Mar. 7.	N.R.	Woolner, Alfred Cooper, M.A., Principal, Oriental College. <i>Lahore.</i>
1907 June 5.	R.	Wright, Harold, A.M.I.C.E. <i>E. I. R. House, Calcutta.</i>
1894 Aug. 30.	N.R.	Wright, Henry Nelson, B.A., I.C.S. <i>Allahabad.</i>
1898 July 6.	R.	Wyness, James, C.E. 14, <i>Clive Street, Calcutta.</i>
1900 Mar. 7.	R.	Yogesa Chandra Sastri-Samkhyaratna-Vedatirtha, Pandit. 59/3, <i>Harrison Road, Calcutta.</i>
1905 Mar. 1.	R.	Young, Rev. A. Willifer. 23, <i>Chowringhee Road, Calcutta.</i>
1906 June 6.	N.R.	Young, Mansel Charles Gambier, Offg. District Engineer, East Indian Railway. <i>Gaya.</i>

SPECIAL HONORARY CENTENARY MEMBERS.

Date of Election.	
1884 Jan. 15.	Dr. Ernst Hæckel, Professor in the University of Jena. <i>Prussia.</i>
1884 Jan. 15.	Charles Meldrum, Esq., C.M.G., M.A., LL.D., F.R.A.S., F.R.S. <i>Mauritius.</i>
1884 Jan. 15.	Revd. Professor A. H. Sayce, Professor of Assyriology, Queen's College. <i>Oxford, England.</i>
1884 Jan. 15.	Monsieur Émile Senart. 18, <i>Rue François Ier, Paris, France.</i>

HONORARY MEMBERS.

Date of Election.	
1848 Feb. 2.	Sir Joseph Dalton Hooker, G.C.S.I., C.B., M.D., F.R.S., D.C.L., LL.D., F.L.S., F.G.S., F.R.G.S. <i>Sunningdale, Berkshire, England.</i>
1879 June 4.	Dr. Albert Günther, M.A., M.D., PH.D., F.Z.S., F.R.S. 23, <i>Lichfield Road, Kew, Surrey, England.</i>
1879 June 4.	Dr. Jules Janssen. <i>Observatoire d'Astronomie Physique de Paris, France.</i>
1879 June 4.	Professor P. Reynaud. <i>La Faculté des Lettres, Lyons, France.</i>
1883 Feb. 7.	Dr. Alfred Russell Wallace, LL.D., D.C.L., F.L.S., F.Z.S., F.R.S. <i>Curfe View, Parkstone, Dorset, England.</i>
1894 Mar. 7.	Mahāmāhopadhyāya Chandra Kanta Tarkalankara. 26, <i>Baranushee Ghose's Street, Calcutta.</i>
1894 Mar. 7.	Professor Theodor Noeldeke. <i>C/o Mr. Karl T. Trübner, Strassburg, Germany.</i>
1895 June 5.	Lord Rayleigh, M.A., D.C.L., D.S.C., LL.D., PH.D., F.R.A.S., F.R.S. <i>Ferling Place, Witham, Essex, England.</i>
1895 June 5.	Lieut.-Genl. Sir Richard Strachey, R.E., G.C.S.I., LL.D., F.R.G.S., F.G.S., F.L.S., F.R.S. 69, <i>Lankaster Gate, London, W.</i>
1895 June 5.	Charles H. Tawney, Esq., M.A., C.I.E. <i>C/o India Office, London.</i>
1896 Feb. 5.	Lord Lister, F.R.C.S., D.C.L., M.D., LL.D., D.S.C., F.R.S., 12, <i>Park Crescent, Portland Place, London.</i>
1896 Feb. 5.	Professor F. Kielhorn, PH.D., D.LITT., LL.D., C.I.E. <i>The University, Göttingen, Prussia.</i>
1896 Feb. 5.	Professor Charles Rockwell Lanman. 9, <i>Farrar Street, Cambridge, Massachusetts, U.S. America.</i>
1899 Feb. 1.	Dr. Augustus Frederick Rudolf Hearnle, PH.D., C.I.E. 8, <i>Northmoor Road, Oxford, England.</i>
1899 Dec. 6.	Professor Edwin Ray Lankester, M.A., LL.D., F.R.S. <i>British Museum (Nat. Hist.), Cromwell Road, London, S.W.</i>

Date of Election.	
1899 Dec. 6.	Sir George King, M.B., K.C.I.E., LL.D., F.L.S., F.R.S. I.M.S. (retired). <i>Of Messrs. Grindlay & Co., 55, Parliament Street, London, S.W.</i>
1899 Dec. 6.	Professor Edward Burnett Tylor, D.C.L., LL.D., F.R.S. Keeper, University Museum. <i>Oxford, England.</i>
1899 Dec. 6.	Professor Edward Suess, PH.D., Professor of Geology in the University of Vienna.
1901 Mar. 6.	Professor John Wesley Judd, C.B., LL.D., F.R.S., F.G.S., Late Prof. of the Royal College of Science. <i>30, Cumberland Road, Kew, England.</i>
1902 Nov. 5.	Monsieur René Zeiller. <i>Ingénieur en chef des Mines. École supérieur des Mines, Paris.</i>
1904 Mar. 2.	Professor Hendrick Kern. <i>Utrecht, Holland.</i>
1904 Mar. 2.	Professor Ramkrishna Gopal Bhandarkar, C.I.E. <i>Poona.</i>
1904 Mar. 2.	Professor M. J. DeGoeje. <i>Leide, Holland.</i>
1904 Mar. 2.	Professor Ignaz Goldziher, PH.D., D.LITT., LL.D. <i>Budapest, Hungary.</i>
1904 Mar. 2.	Sir Charles Lyall, M.A., K.C.S.I., C.I.E., LL.D. <i>82, Cornwall Gardens, London, S.W.</i>
1904 Mar. 2.	Sir William Ramsay, PH.D. (Tüb.), LL.D., SC.D. (Dubl.), F.C.S., F.I.C. <i>University College, Gower Street, London, W.C.</i>
1904 July 2.	Dr. George Abraham Grierson, PH.D., D.LITT., C.I.E., I.C.S. (retired). <i>Rothfarnham, Camberley, Surrey, England.</i>
1906 Mar. 7.	The Right Hon'ble Baron Curzon of Kedleston, M.A., D.C.L., F.R.S. <i>1, Carlton House Terrace, London, S.W.</i>

ASSOCIATE MEMBERS.

Date of Election.	
1874 April 1.	Revd. E. Lafont, C.I.E., S.J. <i>Archbishop's House, 12, Park Street, Calcutta.</i>
1875 Dec. 1.	Revd. J. D. Bate. <i>15, St. John's Church Road, Folkstone, Kent, England.</i>
1882 June 7.	Herbert Giles, Esq. <i>Europe.</i>
1884 Aug. 6.	F. Moore, Esq., F.L.S. <i>Claremont House, Avenue Road, Penze, Surrey, England.</i>
1885 Dec. 2.	Dr. A. Führer. <i>Europe.</i>
1886 Dec. 1.	Sri Sarat Chandra Das, Rai Bahadur, C.I.E. <i>32, Creek Row, Calcutta.</i>
1892 April 6.	Acharyya Satyavrata Samasrami. <i>16-1, Ghose's Lane, Calcutta.</i>
1892 Dec. 7.	Professor Paul Johannes Brühl. <i>Civil Engineering College, Sibpur, Howrah.</i>
1899 April 5.	Rai Bahadur Ram Brahma Sanyal, Superintendent Zoological Gardens. <i>Alipur, Calcutta.</i>

Date of Election.	
1899 April 5.	Pandit Visnu Prasad Raj Bhandari. Chief Librarian, Bir Library. <i>Katmandu, Nepal.</i>
1899 Nov. 1.	Revd. E. Francotte, s.J. 10, <i>Park Street, Calcutta.</i>
1902 June 4.	Revd. A. H. Francke, Moravian Missionary. <i>Kyelang, Kangra District.</i>

LIST OF MEMBERS WHO HAVE BEEN ABSENT FROM
INDIA THREE YEARS AND UPWARDS.*

* *Rule 40.*—After the lapse of three years from the date of a member leaving India, if no intimation of his wishes shall in the interval have been received by the Society, his name shall be removed from the List of Members.

The following members will be removed from the next Member List of the Society under the operation of the above Rule:—

J. C. Fergusson, Esq.
Dr. William Roy Macdonald.
Babu Panna Lal.
Babu Parmeshwar Lall.
Montague Churchill Shaun, Esq.

LOSS OF MEMBERS DURING 1907.

BY RETIREMENT.

The Hon. Mr. Charles George Hillersden Allen, I.C.S.
Charles Walter Bolton, Esq., C.S.I., I.C.S. (retired).
Sir James Austin Bourdillon, K.C.S.I., C.S.I.
Rev. Walter Kelly Firminger, M.A., B.D., F.R.C.S.
Rev. Henry Barry Hyde, M.A.
H. E. Kempthorne, Esq.
The Hon. Mr. Krishna Govinda Gupta, I.C.S.
Capt. John Cyril Holdich Leicester, M.D., B.S., B.Sc., F.R.C.S.,
M.B.C.P., I.M.S.
Norman McLeod, Esq.
F. J. P. Minchin, Esq.
W. Parsons, Esq.
Lieut.-Col. David Prain, M.A., M.B., LL.D., I.M.S. (retired).
Pandit Pramatha Nath Tarkabhusana.
Pandit Rajendra Nath Vidyabhusana.
Kaviraja Upendra Nath Sen.
Lieut.-Col. John. Henry Tull Walsh, I.M.S. (retired).

BY DEATH.

Ordinary Members.

Syed Abdul Alim.
 Patrick Doyle, Esq., C.E., F.R.A.S., F.G.S.
 Lieut.-Col. Herbert Jekyl Dyson, F.R.C.S., I.M.S.
 Babu Girindra Nath Dutt, B.A., M.R.A.S., M.S.A.
 Major David Macbeth Moir, M.A., M.D., I.M.S.
 Maharaja Pratab Narain Singh.

Life Members.

Lieut.-Genl. Sir Henry Edward Landor Thuillier, KT.,
 C.S.I., F.R.S., R.A.

Honorary Members.

Sir Michael Foster, K.C.B., M.A., M.D., D.C.L., LL.D., D.S.C.,
 F.L.S., F.R.S.
 Lord Kelvin, G.C.V.O., D.C.L., LL.D., F.R.S.E., F.

UNDER RULE 9.

Captain William Wesley Clemesha, M.D., I.M.S.
 Pandit Gauri Dutta Misra Vidyabhusana, M.R.A.S.
 Captain D. Harvey, R.A.M.C.
 Sri Kripamaya Ananga Bhimkishore Gajapati Maharaj
 Dev.
 M. Krishnamachariar, Esq.
 Dr. A. M. Leake.
 Captain G. B. Riddock, R.A.M.C.

UNDER RULE 38.

Babu Bhupendra Sri Ghosha, B.A., B.L.
 Babu Purmeshwar Narain Mahatha.
 Raja Satindra Dev, Rai Mahasaya.

UNDER RULE 40.

Miss Margaret Adams.
 Ameer Ali, Esq., B.A., C.I.E.
 Rev. Thomas Grahame Bailey, M.A., B.D.
 Duncan Campbell, Esq.
 H. C. Fanshawe, Esq., C.S.I., I.C.S.
 F. R. Leistikow, Esq.
 P. H. O'Brien, Esq., I.C.S.
 R. D. Oldham, Esq., A.R.S.M., F.G.S.
 Sir George Watt, KT., C.I.E.

The names of the following absent members have been removed from the List of Ordinary Members as they are Honorary Members:—

- Dr. Augustus Frederick Rudolf Hoernle, PH.D., C.I.E.
 Sir George King, M.B., K.C.I.E., LL.D., F.L.S., F.R.S., I.M.S.
 (retired).
 Sir Charles Lyall, M.A., K.C.S.I., C.I.E., LL.D.
 Dr. George Abraham Grierson. PH.D., D.LITT., C.I.E., I.C.S.
 (retired).
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ELLIOTT GOLD MEDAL.

RECIPIENTS.

- 1893 Chandra Kanta Basu.
 1895 Yati Bhusana Bhaduri, M.A.
 1896 Jnan Saran Chakravarti, M.A.
 1897 Sarasi Lal Sarkar, M.A.
 1901 Sarasi Lal Sarkar, M.A.
 1904 { Sarasi Lal Sarkar, M.A.
 { Surendra Nath Maitra, M.A.
-

BARCLAY MEMORIAL MEDAL.

RECIPIENTS.

- 1901 E. Ernest Green.
 1903 Major Ronald Ross, F.R.C.S., C.B., C.I.E., F.R.S., I.M.S.
 (retired).
 1905 Lieut.-Colonel D. D. Cunningham, F.R.S., C.I.E.,
 I.M.S. (retired).
 1907 Lieut.-Colonel Alfred William Alcock, M.B., LL.D.,
 C.I.E., F.R.S.
-

[APPENDIX.]

ABSTRACT STATEMENTS
OF
RECEIPTS AND DISBURSEMENTS
OF THE
ASIATIC SOCIETY OF BENGAL
FOR
THE YEAR 1907.

STATEMENT

Asiatic Society

1907.

Dr.

TO ESTABLISHMENT.				Rs.	As.	P.	Rs.	As.	P.
Salaries ... ..	...	...	...	5,053	12	1			
Commission ... ..	...	...	...	496	2	8			
Pension ... ..	...	...	...	240	0	0			
Grain Compensation Allowance ... ..	...	...	...	172	14	3			
							5,962	13	0
TO CONTINGENCIES.									
Stationery ... ..	...	...	...	114	1	6			
Taxes ... ..	...	...	...	1,465	0	0			
Postage ... ..	...	...	...	559	4	3			
Freight ... ..	...	...	...	390	8	5			
Auditing ... ..	...	...	...	100	0	0			
Electric Fans and Lights ... ..	...	...	...	334	9	0			
Insurance fee ... ..	...	...	...	187	8	0			
Petty repairs ... ..	...	...	...	31	12	9			
Miscellaneous ... ..	...	...	...	420	15	3			
							3,603	11	2
TO LIBRARY AND COLLECTIONS.									
Books ... ..	...	...	...	2,045	0	0			
Binding ... ..	...	...	...	1,294	10	3			
							3,339	10	3
TO PUBLICATIONS.									
"Journal and Proceedings," and "Memoirs,"	...	...	...	7,875	7	5			
To printing charges of Circulars, Receipt	...	...	...			
Forms, &c. ... ..	...	...	...	594	4	0			
							8,469	11	5
TO BUILDING.									
Servants' Latrine ... ..	...	...	...	318	15	6			
Unfiltered water-supply ... ..	...	...	...	107	13	6			
Iron pipes, bends, etc. ... ..	...	...	...	665	12	0			
Boundary Wall ... ..	...	...	...	70	8	0			
Arches (repairs) ... ..	...	...	...	453	9	3			
							1,616	10	3
Donation to the fund in honour of Prof. De	...	...	...			
Goeje ... ..	...	...	...				157	8	0
Furniture ... ..	...	...	...				28	14	0
Magic Lantern Installation ... ..	...	...	...				235	0	0
Interest on Government Paper purchased ... ..	...	...	...				38	1	1
Paging Manuscripts ... ..	...	...	...				297	0	0
To Personal Account (written off and miscella-	...	...	...			
neous) ... ..	...	...	...				185	1	0
TO EXTRAORDINARY EXPENDITURE.									
Royal Society's Scientific Catalogue ... ..	...	...	...				9,628	1	9
Balance ... ..	...	...	...				1,81,836	15	6
TOTAL Rs.							2,15,399	1	5

No. 1.
of Bengal.

1907.

Cr.

	Rs.	As.	P.	Rs.	As.	P.
By Balance from last report	1,79,519	3	3

BY CASH RECEIPTS.

Publications sold for cash	...	...	1,571	0	5
Interest on Investments	...	...	6,520	8	0
Rent of room in the Society's premises	...	...	600	0	0
Allowance from Government of Bengal for the publication of papers on anthropological and cognate subjects	...	...	2,000	0	0
Allowance from Government of Eastern Bengal and Assam	...	...	1,000	0	0
Miscellaneous	...	...	94	8	0
Sale of Books rejected from Library	...	...	45	14	0
				11,831	14 5

BY EXTRAORDINARY RECEIPTS.

Sale of old beams and joists	...	...	1,200	0	0
Subscriptions to Royal Society's Scientific Catalogue	...	...	8,781	9	0
				9,981	9 0

BY PERSONAL ACCOUNT.

Admission fees	...	...	2,096	0	0
Subscriptions	...	...	10,754	0	0
Compound subscription	...	...	300	0	0
Sales on credit	...	...	880	14	0
Miscellaneous	...	...	35	8	9
				14,066	6 9

TOTAL Rs. 2,15,399 1 5

J. A. CHAPMAN,

Honorary Treasurer,
Asiatic Society of Bengal

STATEMENT
1907. Oriental Publication Fund, No. 1, in

Dr.

TO CASH EXPENDITURE.				Rs.	As.	P.	Rs.	As.	P.
Salaries	...	...	...	1,560	11	5			
Commission on collection	...	...	...	26	3	8			
Editing charges	...	...	...	2,340	15	5			
Postage	...	...	...	176	6	6			
Freight	...	...	...	124	1	0			
Printing charges	...	...	...	6,885	9	3			
Stationery	...	...	...	13	1	3			
Contingencies	...	...	...	81	9	0			
Binding	...	...	...	0	10	0			
Grain Compensation Allowance	...	...	...	54	13	3			
							11,264	0	9
To Personal Account (written off and miscellaneous)	...	...	...				8	14	0
		Balance	...				5,109	4	3
TOTAL Rs.							16,382	3	0

STATEMENT
1907. Oriental Publication Fund, No. 2, in

Dr.

				Rs.	As.	P.	Rs.	As.	P.
To Balance				2,000	0	0
TOTAL Rs.							2,000	0	0

No. 2.

Acct. with the Asiatic Soc. of Bengal. 1907.

Cr.

	Rs.	As.	P.	Rs.	As.	P.
By Balance from last Report				1,335	14	0

BY CASH RECEIPTS.

Government Allowance	9,000	0	0			
Do. do. special	3,000	0	0			
Publications sold for cash	1,496	0	6			
Advances recovered	64	10	6			
				13,560	11	0

BY PERSONAL ACCOUNT.

Sales on credit				1,485	9	3
------------------------	--	--	--	-------	---	---

TOTAL Rs.				16,382	3	0
------------------	--	--	--	--------	---	---

J. A. CHAPMAN,
*Honorary Treasurer,
 Asiatic Society of Bengal.*

No. 3.

Acct. with the Asiatic Soc. of Bengal. 1907.

Cr.

BY CASH RECEIPTS.

	Rs.	As.	P.	Rs.	As.	P.
Government Allowance				2,000	0	0
TOTAL Rs.				2,000	0	0

J. A. CHAPMAN,
*Honorary Treasurer,
 Asiatic Society of Bengal.*

STATEMENT

1907. Sanskrit Manuscript Fund in Acct.

Dr.

To CASH EXPENDITURE.

	Rs.	As.	P.		Rs.	As.	P.
Salaries	1,316	11	9				
Travelling charges	1,438	8	0				
Printing	482	14	3				
Postage	14	14	0				
Stationery	18	1	3				
Contingencies	25	4	9				
Purchase of Manuscripts	50	0	0				
Insurance fee	125	0	0				
Grain Compensation Allowance	96	6	9				
Freight	15	5	0				
					3,578	1	9
Balance					3,271	9	2
TOTAL Rs.					6,849 10 11		

STATEMENT

1907. Arabic and Persian MSS. Fund in

Dr.

To CASH EXPENDITURE.

	Rs.	As.	P.		Rs.	As.	P.
Salaries	2,473	1	3				
Grain Compensation Allowance	27	5	6				
Purchase of Manuscripts	3,043	3	0				
Stationery	7	12	0				
Contingencies	248	13	6				
Postage	29	9	9				
Travelling charges	1,963	2	6				
Printing	7	12	6				
Insurance fee	31	4	0				
					7,832	0	0
Balance					1,153	8	9
TOTAL Rs.					8,985 8 9		

No. 4.

with the Asiatic Society of Bengal. 1907.

Cr.

	Rs.	As.	P.	Rs.	As.	P.
By Balance from last Report	3,643	8	11
BY CASH RECEIPTS.						
Government Allowance	3,200	0	0	
Advances recovered	0	2	0	
			3,200	2	0	
BY PERSONAL ACCOUNT.						
Sales on credit	6	0	0
TOTAL Rs.				6,849	10	11

J. A. CHAPMAN,
Honorary Treasurer,
Asiatic Society of Bengal

No. 5.

Acct. with the Asiatic Soc. of Bengal. 1907.

Cr.

	Rs.	As.	P.	Rs.	As.	P.
By Balance from last Report	1,985	8	9
BY CASH RECEIPTS.						
Government Allowance	7,000	0	0
TOTAL Rs.				8,985	8	9

J. A. CHAPMAN,
Honorary Treasurer,
Asiatic Society of Bengal.

STATEMENT
1907. Bardic Chronicles MSS. Fund in

Dr.		Rs. As. P.	Rs. As. P.
To Balance	2,400 0 0
TOTAL Rs.		...	2,400 0 0

STATEMENT
1907. Personal

Dr.		Rs. As. P.	Rs. As. P.
To Balance from last Report	...	...	2,703 13 3
TO CASH EXPENDITURE.			
Advances for purchase of Manuscripts, &c.	...	...	3,033 11 6
To Asiatic Society	...	14,066 6 9	
„ Oriental Publication Fund, No. 1	...	1,485 9 3	
„ Sanskrit Manuscript Fund	...	6 0 0	
			15,558 0 0
TOTAL Rs.		..	21,295 8 9

No. 6.

Acct. with the Asiatic Soc. of Bengal. 1907.

Cr.

	Rs.	As.	P.	Rs.	A.	P.
By Balance from last Report ...				2,400	0	0
TOTAL Rs.				2,400	0	0

J. A. CHAPMAN,

*Honorary Treasurer,**Asiatic Society of Bengal.*

No. 7.

Account.

1907.

Cr.

	Rs.	As.	P.	Rs.	As.	P.
By Cash Receipts ...				17,011	4	6
„ Asiatic Society ...	185	1	0			
„ Oriental Publication Fund, No. 1 ...	8	14	0			
				193	15	0

By Balance.	Due to the Society.			Due by the Society.		
	Rs.	As.	P.	Rs.	As.	P.
Members ...	2,677	13	0	211	1	6
Employés ...	30	0	0	100	0	0
Arabic and Persian Manuscripts Fund	675	0	0	...	...	...
Sanskrit Manuscripts Fund	1,000	0	0	...	...	...
Miscellaneous	142	2	3	123	8	6
	4,524	15	3	434	10	0

... 4,090 5 3

TOTAL Rs.

21,295 8 9

J. A. CHAPMAN,

*Honorary Treasurer,**Asiatic Society of Bengal.*

STATEMENT

1907.

Invest-

Dr.

	Value.			Cost.		
	Rs.	As.	P.	Rs.	As.	P.
To Balance from last Report ...	1,84,700	0	0	1,84,326	7	0
„ Purchase ...	6,000	0	0	5,857	3	2
TOTAL Rs. ...	1,90,700	0	0	1,90,183	10	2

FUNDS.	PERMANENT.				TEMPORARY				Total Cost.						
	Value.		Cost.		Value.		Cost.		Rs.	A. P.					
	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.							
Asiatic Society ...	1,53,950	0	0	1,53,436	4	9	35,350	0	0	35,407	15	5	1,88,844	4	2
Trust Fund ...	1,400	0	0	1,339	6	0	...	...	...	...	...	...	1,339	6	0
	1,55,350	0	0	1,54,775	10	9	35,350	0	0	35,407	15	5	1,90,183	10	2

STATEMENT

1907.

Trust

Dr.

					Rs.	As.	P.
To Pension ...	...	...	...	...	48	0	0
	Balance	...	...	...	1,462	11	10
TOTAL Rs. ...					1,510	11	10

No. 8
ment.

1907.

Cr.

	Value.			Cost.					
	Rs.	As.	P.	Rs.	As.	P.			
By Balance	1,90,700	0	0	1,90,183	10	2
TOTAL Rs.	<u>1,90,700</u>	<u>0</u>	<u>0</u>	<u>1,90,183</u>	<u>10</u>	<u>2</u>

J. A. CHAPMAN,
Honorary Treasurer,
Asiatic Society of Bengal.

No. 9.
Fund.

1907.

Cr.

	Rs.	As.	P.			
By Balance from last Report	1,461	11	10
„ Interest on Investment	49	0	0
TOTAL Rs.	<u>1,510</u>	<u>11</u>	<u>10</u>

J. A. CHAPMAN,
Honorary Treasurer,
Asiatic Society of Bengal.

STATEMENT

1907.

Cash

Dr.

				Rs.	As.	P.
To Balance from last Report	...	...	...	3,315	11	3

RECEIPTS.

			Rs.	As.	P.		
To Asiatic Society	...	...	21,813	7	5		
.. Oriental Publication Fund, No. 1	...	...	13,560	11	0		
.. Do. do No. 2	...	...	2,000	0	0		
.. Sanskrit Manuscript Fund	...	...	3,200	2	0		
.. Arabic and Persian Manuscript Fund	...	...	7,000	0	0		
.. Personal Account	...	...	17,011	4	6		
.. Trust Fund	...	...	49	0	0		
						64,634	8 11
TOTAL Rs.	...	...				67,950	4 2

STATEMENT

1907.

Balance

LIABILITIES.

			Rs.	As.	P.	Rs.	As.	P.
Asiatic Society	...	...	1,81,836	15	6			
Oriental Publication Fund, No. 1	...	...	5,109	4	3			
.. Do. do. No. 2...	...	...	2,000	0	0			
Sanskrit Manuscript Fund	...	...	3,271	9	2			
Arabic and Persian Manuscript Fund	...	...	1,153	8	9			
Bardic Chronicles Manuscript Fund	...	...	2,400	0	0			
Trust Fund	...	...	1,462	11	10			
						1,97,234	1 6	
TOTAL Rs.	...	...				1,97,234	1 6	

We have examined the above Balance Sheet, and the appended detailed Accounts with the books and vouchers presented to us, and certify that it is in accordance therewith, correctly setting forth the position of the Society as at the 31st December, 1907.

CALCUTTA,

29th January, 1908.

MEUGENS, KING & SIMSON.

Chartered Accountants.

Auditors.

No. 10.

Account.

1907.

Cr.

		EXPENDITURE.			
		Rs.	As. P.	Rs.	As. P.
By Asiatic Society	...	33,377	0 11		
.. Oriental Publication Fund, No. 1	...	11,264	0 9		
.. Sanskrit Manuscript Fund	...	3,578	1 9		
.. Arabic and Persian Manuscript Fund	...	7,832	0 0		
.. Personal Account	...	3,033	11 6		
.. Investment	...	5,857	3 2		
.. Trust Fund	...	48	0 0		
				64,990	2 1
Balance	...			2,960	2 1
				<hr/>	
TOTAL Rs.	...			67,950	4 2

J. A. CHAPMAN,

*Honorary Treasurer,
Asiatic Society of Bengal.*

No. 11.

Sheet.

1907.

		ASSETS.			
		Rs.	As. P.	Rs.	As. P.
Personal Account	...	4,090	5 3		
Investment	...	1,90,183	10 2		
Cash Account	...	2,960	2 1		
				1,97,234	1 6
Government Pro. Note at Bank of Bengal's					
Safe Custody Account	Cashier's Security				
Deposit Rs 500	...				
				<hr/>	
TOTAL Rs.	...			1,97,234	1 6

J. A. CHAPMAN,

*Honorary Treasurer,
Asiatic Society of Bengal.*



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

- Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [N. S.], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained by application to the Honorary Secretary, 57, Park Street, Calcutta.

PRIVILEGES OF ORDINARY MEMBERS.

- (a) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.
- (b) To propose and second candidates for Ordinary Membership.
- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
- (e) To take out books, plates and manuscripts from the Library.
- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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JOURNAL & PROCEEDINGS
OF THE
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Vol. IV, No. 3.

MARCH, 1908.



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1908.

Issued May 26th, 1908.

List of Officers and Members of Council

OF THE

ASIATIC SOCIETY OF BENGAL

For the year 1908.

President :

The Hon'ble Mr. Justice Asutosh Mukhopadhyaya, M.A., D.L.,
D.Sc., F.R.S.E.

Vice-Presidents :

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G. Thibaut, Esq., C.I.E., Ph.D., D.Sc.

Mahamahopadhyaya Haraprasad Shastri, M.A.

Lieut. Colonel G. F. A. Harris, M.D., F.R.C.P., I.M.S.

Secretary and Treasurer :

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Treasurer :—J. A. Chapman, Esq.

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Harinath De, Esq., M.A.

J. A. Cunningham, Esq., B.A.

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H. G. Graves, Esq.

Babu Monmohan Chakravarti, M.A., B.L.

Abdulla al-Mamun Suhrawardy, Esq., M.A., LL.D.

13. Notes on Indo-Scythian Coinage (with two plates).

By RAKHAL DAS BANERJI.

The following notes were drawn up while arranging the Joint Cabinet of the Asiatic Society of Bengal and the Indian Museum, according to the new catalogue by Mr. V. A. Smith.

EARLY GREAT KUSHĀN.

Kadphises I.

Mr. Smith remarks that on the reverse of coin No. 3 of this prince "he can read only *ga*; the other characters seem to be peculiar."¹ I find that all letters except *ga* has been reversed in the legend. Apparently this is a mistake of the die-sinker. I read the legend from a cast and with the help of a mirror as follows:—

" Yavugasa la kuju dhrama

The complete legend on the coins of Kadphises I is:—

"Kujula Kasasa Kuṣana Yavugasa Dhramaḥidasa."

The absence of the second part of the name, *viz.*, Kasasa or any of its variants, such as Kadphisasa, Kaṣsa, etc., is a peculiarity. For this reason I am inclined to call it an ancient forgery, (Pl. IV. 1.)

LATER GREAT KUSHĀN.

Up to the present day nothing particular is known about the successors of Vāsudeva or ΒΑΖΟΔΗΘ with the exception of the fact that the majority of their coins bear the name of Vāsudeva and that irregular Brāhmī syllables occur on them. The late Sir Alexander Cunningham was a pioneer in this field, and his introductory Essays on the later Indo-Scythian and White Hun Coinage are not of much help to the students of History. The scholarly chronological arrangement of the later Kushān coins in the catalogue of the Indian Museum and Bengal Asiatic Society's Joint Cabinet will, I think, be of great help towards the elucidation of the chronology of the great Kushāns and their immediate successors. It appears that three successors of Vāsudeva assumed imperial title (ΒΑΟΝΑΝΟΡΑΟ or Śāhānuṣāhi for Persian شاهنشاه). Their names are Kaniṣka Vāsudeva, and Vāsu (ΚΑΝΗΡΚΟ, ΒΑΖΟΔΗΘ and वासु). I think there will

¹ V. A. Smith, Catalogue of the Coins in the Indian Museum, Vol. I, p. 66.

be no objection against naming these princes, respectively, Kaniṣka II, Vāsudeva II and Vāsu (deva) III. Kaniṣka II seems to have been the direct successor of Vāsudeva I. In my paper on the "Scythian Period of Indian History" (Indian Antiquary, 1908, p. 25) I have tried to show that the 26th year of the reign of Gondopernes or *Guduphara* falls on the 103rd year of the Saka era and that the North-Western Provinces of the Kūshān empire must have been acquired by Gondopernes in the earlier part of the reign of Vāsudeva I. The reigns of the Parthian conqueror and his successors must have been very short because in the Panjtār inscription, the date of which must be reckoned according to the Saka era, we find a Kūshān king still ruling over the provinces to the west of the Indus. The reigns of Abdagases and Orthagnes must have been completed before the Saka year 122, *i.e.*, 200 A.D., the date of the Panjtār inscription.¹

Judging from the execution of the coins Mr. V. A. Smith has placed Kaniṣka II and Vāsudeva II in the third century² A.D., while he places Vāsu or Vāsudeva about 200 A.D.³ According to his Laukika era theory Vāsu becomes to some extent a contemporary of Vāsudeva I. But I find that Cunningham has described some coins of Vāsu which bear on their obverse the full Greek legend of the coins of Kaniṣka II⁴ (ΠΑΟΝΑΝΟ ΠΑΟΚΑΝΗΠΚΟ ΚΟΡΑΝΟ).

The probability is then in favour of the fact that Vāsu for some time acknowledged the suzerainty of Kaniṣka II. Consequently it becomes impossible to place Vāsu in 200 A.D. before Kaniṣka II. Kaniṣka II must have succeeded Vāsudeva I. The coins of Kaniṣka II are fairly numerous, and an average reign of 30 years may with safety be assigned to him. The latest known date of Vāsudeva I is the year 99, *i.e.*, 177 A.D. Assuming that Vāsudeva I lived a year longer, we find that the date of the accession of his successor Kaniṣka II falls in the year 178 A.D. At this time serious disturbances must have been going on in the Kūshān kingdom, because three years later we find the Parthian king in complete possession of the fair province of Gāndhāra. It is quite certain that Gāndhāra was included in the Kūshān empire during the earlier years of the reign of Vāsudeva I, because some of his coins were found in the square stūpas at Ali Masjid. Vāsu-

1 The Panjtār inscription has been partially edited by Cunningham with a drawing in the Reports of the Archæological Survey, Vol. V, p. 14.

2 Catalogue of the Coins in the Indian Museum, Vol. I, p. 87.

3 *Ibid.*

4 Numismatic Chronicle 1893, p. 118-19, pl. VIII, Nos. 5-8. I have been obliged to accept Cunningham's readings of the Greek legends on the obverse of these coins, because there are no coins of Kaniṣka II issued by Vāsu in the Joint Cabinet. The coins of Vāsu in the Joint Cabinet seem to be later than those described by Cunningham. The reproductions of Cunningham coins are not very bad, but I have not been able to make out the complete legend. I have relied on Cunningham, because I find that he has already made the distinction between Kaniṣka II and Vāsudeva II among the later great Kūshāns. The validity of the assertion that Vāsu was a subordinate prince under Kaniṣka II depends entirely upon the correctness of Cunningham's readings.

[N.S.]

deva I must have been losing his ancestral possessions one after another, and, three years after his death, we find his adversary in the Punjab. During the later years of the reign of Vāsu-deva I, the western frontier of the empire must have been the Indus. The grand empire of Kadphises II, and Kaniska I, has fallen, and the Śāhānuṣāhi was ruling over the Punjab, Central India and the United Provinces. Assuming the duration of the reign of Gondophernes to have been 30 years, we find that the accession of Abdagases or Avadagasa falls in the year 185 A.D. The reigns of Orthagnes and Abdagases must have been very short as their coins are very few in number. An average reign of ten years may be assigned to each of these princes. I think Gāndhāra was reconquered from the Parthians immediately after the accession of Pakores, the successor of Orthagnes. There is a good deal of probability that this conqueror must have been Vāsu himself. In the first place we find that he was a subordinate chieftain under Kaniska II. Secondly, some of his coins bear his own name in Brāhmi on the obverse, but the marginal Greek legend consists merely of two or more groups of letters. The majority of these coins come from Seistan. Last of all we find a gold currency in Seistan immediately following the coins of Vāsu, but bearing the name of a Kushāna King Bazdeo. These facts make it apparent that a relative named Vāsudeva was appointed by Kaniska II against Orthagnes or Pakores during a border war or to punish a raid. The general accomplished much more than this; he reconquered the whole of Gāndhāra for his suzerain. The Governorship of the restored province was bestowed as a reward on the successful general. The coins of Kaniska II issued by Vāsu from the province of Gāndhāra naturally bear the name of the Emperor in Greek and the initial letters of the name of the issuing chieftain in Brāhmi. Vāsu pushed the border towards the south-west till he completed the conquest of Seistan. This, I think, is the only probable reason of the fact that the majority of the coins bearing the name of Vāsu come from Seistan. The successor of Gondophernes continued to rule over modern Afghanistan and their capital was most probably *Balkh*. They were known to occidental nations as the Bactrian Arsacidae.¹

The recovery of Gāndhāra was made probably during the later years of Kaniska II, about 200 A.D. There are several other varieties of the coins of Kaniska II, issued by his subordinate chieftains or governors of provinces. They bear three different syllables or groups of syllables on their obverse. One syllable below the right hand of the king,² another between his feet, and the third below his left hand. From the analogy of the coins of Kaniska II, struck by Vāsu, we can deduce that the syllable or syllables below the right arm of the king are the

¹ Rawlinson, the 7th Great Oriental Monarchy, p. 37.

² The standing figures on the obverse of later Kushān coinage has generally been taken by Numismatists to be the figure of the reigning sovereign. Cf. Smith, I.M. Cat., Vol. I, p. 89.

initial letter or letters of the name of the chief by whom the coin has been issued. This deduction is supported by other names such as Mahi-(dhara), Viru-(dhaka), etc., which are also found below the right arm of the king on the coins of Kaniska II. The other two syllables are probably initial letters of the names of mint towns and provinces: thus *Ga* probably stands for Gāndhāra (the province), *Khu* for Khudraka (Sans. Kṣaudraka) the country of the Oxydrakae (?). Names of mint towns probably are mentioned by their first syllables which occur below the left arm-pit of the king, such as *Pu* for Puṣkalāvati and *Ga* for Gāndhāra (the city), *Na* for Nagarahāra, etc. In exceptional cases where only one syllable is found, whether below the left arm or under the feet, I think it is to be taken as the initial letter or letters of the name of the mint town.

Four coins of Kaniska II, issued by Vāsu, have been described by Cunningham:—

Province.	Mint.	Name of issuing chief.	REMARKS.
1. Sa	Cu	Vāsu	I am inclined to identify the <i>Cu</i> as the initial letter of the name Cutsa, which has been found on the Taxila copper-plate of Patika. ¹
2. Na	...	..	In this coin Cunningham reads the letter below the left arm of the king as <i>Sa</i> , and says there is a <i>Ga</i> between the feet, but his plate (N.C. 1893, pl. VIII, No. 6, p. 119) shows that the letter to the left is <i>Na</i> , and the space between the feet is blank.
3. Khu	Cu	..	...
4. Na	...	..	In this coin also Cunningham finds a <i>Bha</i> to the left and a <i>Ga</i> between the feet, but his plate shows a blank space between the feet and a <i>Na</i> with a curved base line (Bühler, Indische Palæographie, pl. III, Col. V, No. 25) to the left (N.C. 1893, pl. XIII, No. 8).

Cunningham has also described several other varieties of the coinage of Kaniska II:—

5. Pu	...	Viru	Cunningham read the letter below the left arm of the king as <i>Nya</i> , but I cannot imagine how it can be taken to be <i>Nya</i> , either Brāhmī or Kharoṣṭhi. His plate shows that it is the Kharoṣṭhi syllable <i>pu</i> standing probably for Puṣkalāvati. The use of Kharoṣṭhi on Kushān coins ends with Kadphises II, but this seems to be
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¹ J.R.A.S. 1894, p. 557, and Epigraphia Indica, Vol. IV, p. 56.

Province.	Mint.	Name of issuing chief.	REMARKS.
			a revival. The latest dated Kharoṣṭhi inscription is the Dewai inscription of the year 200. (Journal Asiatique, 9 Serie, Tome IV, p. 510) i.e., 278 A.D. If I am correct then the revival of Kharoṣṭhi legends on later Kushān coins won't go much against Bühler's theory of the limit of Kharoṣṭhi. On the reverse of this coin the Brāhmi syllable <i>ru</i> appears to the right of the head of the seated goddess.
6. Ha	...	Vi(ru)	This coin also seems to have been issued by Viru or Virudhaka.
7. Pu	Sa (or Sra)	„	Cunningham read the mint name as <i>tha</i> and the name of the province as <i>Nya</i> , but his plate shows that they are <i>Br. Sa</i> or <i>Sra</i> and <i>Kh. Pu</i> respectively.
8. Vau	Thā	Kṣa	Cunningham reads the mint names of this and the following coins as <i>thā</i> . His plate shows that on this coin (No. 9) it is certainly <i>thā</i> , but on No. 10 and I.M. Kaniska II. No. 6 (I.M. No. 7694), I find that the mint name is <i>Dhā</i> . ¹ Cunningham read the initial letter of the name of the province as <i>Vai</i> , but it is most certainly <i>Vau</i> (cf. Bühler Indische Palæographie, Tafel IV, Col. IV, No. 7 and Col. VII, No. 27). The name of the chief begins with <i>Kṣa</i> and not <i>Chu</i> (see pl. IV. 4).
9. Vau	Dhā	Si	Cunningham's No. 10. <i>Si</i> or <i>Sie</i> was the name of the viceroy who crossed the Tagh-Dumbash Pāmīr to fight the Chinese General Panchao in 90 A.D.
10. ...	Pu	Mahi (dhara)	On the coins issued by Virudhaka we find the letter <i>Pu</i> , evidently standing for Puṣkalāvati. On this coin of Mahidhara we also find <i>Pu</i> but this time in <i>Brāhmi</i> . Mahidhara thus seems to have succeeded Virudhaka in the government of Puṣkalāvati.
11. ...	...	Bhr(gn)	.....
12. ...	...	Pa	.....
13. Ga	Gho	Hu	In the Joint Cabinet two coins of Kaniska II are duplicates of this coin. ²
14. Ga	Gho	Phri	There is a duplicate of this coin in the Joint Cabinet (No. 4).

¹ Smith, I.M. Cat., Vol. I, p. 88.

² Smith, I.M. Cat., p. 87, Nos. 2 and 3.

Pro- vince.	Mint.	Name of issuing chief.	REMARKS.
15. Ga	Dhā	Ā	Cunningham read the initial letter of the name of the province as <i>Ha</i> , but his plate shows that it is most certainly <i>ga</i> . He also read the first letter of the name of the issuing chief as <i>Anm</i> , but his plate shows it is simply <i>Ā</i> (for <i>An</i> , see Bühler's <i>Indische Palæographie Tafel IV, Col. XX, No. 6</i>). Coin No. 1 of the Joint Cabinet is a duplicate of this coin. Pl. IV. 3.

After the decease of Kanishka II, Vāsudeva II seems to have succeeded him (C. 207 A.D.) The seven coins of Vāsu in the Joint Cabinet possess a peculiarity. The marginal Greek legends on them are fragmentary and very corrupt. On one of them (No. 1) ΑΡΔΟΧΡΟ is written ΟΔΟΔ. The majority of these coins come from Seistan. But we should not lose sight of the fact that the Kushāno-Sassanian coinage of Seistan bears legends in intelligible though corrupt Greek, while the Greek legends on the coins of Vāsu are altogether unintelligible. The Kushāno-Sassanian coinage decidedly belongs to a later period, and so we come to the conclusion that Vāsu intentionally corrupted the Greek legends on the coins issued by him during the earlier portion of the time of his occupation of Seistan. The cause of this unusual conduct probably was that the governor intended to assume independence in the principality under his control gradually without giving a shock to the people. While the Śāhānuṣāhi was occupied with troubles nearer home, the disaffected viceroy was gradually seceding from his allegiance. Most probably Vāsu remained in a state of semi-independence during the reign of Vāsudeva II. The fact that no coins of Vāsudeva II issued by Vāsu have been discovered up to date supports this assertion.

1.	Bha	Vi	Vāsu	Mr. Smith has omitted the initial letter of the mint name in his description of this coin. ¹
2.	Bha	"	"	.....
3.	"	"	"	Corrupt Greek legend on both faces. One of the coins of Kanishka II issued by Vāsu (No. 1) has <i>Sa</i> as the initial letter of the name of the Province whence it was issued.
4.	Bha	"	"	.....
5.	Vi	"	"	.....
6.	Bha	"	"	.....
7.	Bha	Vi	"	.....

Coins of Vāsudeva II are very rare and consequently his reign must have been very short. A reign of ten years would be quite sufficient for him. Vāsudeva II seems to have been the

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last of the Imperial Kushāns. The presence of the epithet *Śāhā-nu-Śāhi* on the Allahabad plate of Samudra Gupta makes it extremely probable that the title lingered up to the fourth century. Possibly it was assumed by a collateral or subordinate Scythian dynasty after the extinction of the Imperial Kushāns. With the data at present within our reach this conclusion seems to be reasonable. No trace either epigraphic or numismatic has been found of the successors of Vāsudeva II. The great Kushān empire seems to have followed the precedent of all other oriental monarchies. The coins described by Mr. V. A. Smith as "the coins of sundry chiefs ruling in the Punjab and the neighbouring countries during the third and the fourth century A.D." are coarse copies of later Great Kushān coinage. They prove that the late Great Kushān coinage was succeeded by a coinage issued simultaneously by various local dynasties. The coins of Vāsudeva II are ruder than those of Kanīṣka II. Cunningham, during his life-long search for coins, was able to procure only three coins of this prince:—

Province.	Mint.	Name of issuing chief.	Reverse.	REMARKS.
1. ...	...	Ha	Ha	.....
2. Raju	Gho	Rada		.....
3. ..	..	Phri		Cunningham read the initial letter of the name of the issuing chief as <i>Pri</i> , but his plate shows it is <i>Phri</i> . The prince who issued this coin was also a subordinate of Kanīṣka II. (See Kanīṣka II, No. 14.)

The Joint Cabinet contains a new specimen:—

4. Ga	Thā	Ā	...	The initial letters of the names of the province, mint and the issuing chief are identical with those of the coin of Kanīṣka II, No. 15. (See pl. IV. 5.)
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That Vāsudeva II is a distinct personage from Vāsu or Vāsudeva III is proved by the difference between their respective coinages:—

1. *Seistan Coins of Vāsu*:—

- (a) Intentionally corrupted Greek legends on the margin of the obverse.
- (b) Initial syllables of mint-names only given in most cases.

(c) The name of the issuing chief is expressed intelligibly in Brāhmī.

2. *Coins of Vāsudeva II*:—

- (a) Greek legend, though corrupt, is fairly intelligible.
 (b) Initial letters of the names of mints, provinces, and issuing chiefs given. The difference to be noticed here is that on the majority of the coins of Vāsu initial letters of the names of provinces are omitted, and on the coins of this prince, only one syllable of the name of the issuing chief is given, while on the coin of Vāsu it is almost fully expressed.

It may be said quite reasonably that Vāsu succeeded Kanīṣka II in Northern India, and issued this type of coinage. But it is to be noticed that coins of Vāsudeva II are found over a limited area, *viz.*, Western Panjab and the Kabul Valley, while all coins of Vāsu in the Joint Cabinet come from Seistan. At the same time it should be noted that in Seistan a Kushān coinage,¹ resembling the coins of Vāsu, became current immediately after this period. The legitimate conclusion from these facts should be that one Vāsudeva, *i.e.*, Vāsudeva II, ruled for a very short period over a very small area in Northern India, while another chief named Vāsu, who at first was only a feudatory prince, gradually asserted his independence. In Northern India the remnant of the Kushān empire was divided between two rival Scythian dynasties, the *Sākas* and the *Śiladas* (neither *Pakaldhi* nor *Śalada*. See *infra*). Before we come to notice the coinage of these princes, we should take note of what became of the Kushāns in Seistan and the Eastern Arsacidæ. When Vāsu conquered Seistan from the successors of Gondophores, the mountainous territory around Balkh seems to have sheltered the last of the Arsacid kings of the East. This is proved by the sayings of the occidental historians. When Artaxerxes established the Sassanide empire in 226 A.D., there were two minor branches of the Arsacidæ, one in Armenia and the other in Bactria.² When Khusrū of Armenia determined to help the Parthian Arsacids, "he had some hopes that the Bactrian Arsacids would join him."³ Thus it becomes quite sure that the successors of Gondophores were not quite extinguished by the conquest of Vāsu. The Arsacidæ of Bactria were probably overpowered by one of the successors of Vāsu after the close of the first Roman War of Shahpur I (244 A.D.). It is said that Bactria which, during the later Parthian period, had enjoyed a sort of semi-independence, now succeeded in detaching herself altogether from her southern neighbour and becoming a distinct and separate power.⁴ It is not possible that the eastern

¹ This coinage cannot be assigned to the 5th century A.D. It is certainly not later than the Hormuzd I and Ardāmītra coinage. (See Pl. V. 11.)

² See the authorities quoted by Rawlinson, *Seventh Great Oriental Monarchy*, p. 39, footnote 4.

³ Mozes of Chorene *History of Armenia II*, 69.

⁴ Rawlinson, *Seventh Oriental Monarchy*, p. 79.

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Arsacid monarchs recovered so far as to separate themselves completely from Sassanian domination and to form alliances with Rome. A new power must have risen in Bactria and it is possible that the Kushāns of Gāndhāra and Seistan gradually recovered the lost provinces on the Western border-land. Nothing particular is known about the successor of Vāsu. From the history of Persia we learn that their kingdom was wrested from them by Varahran II of Persia in or about the year 283 A.D. In India proper various local chiefs seemed to have assumed independence. We have to rely on palæography only for this assertion, but in some cases these assertions are found to be borne out by epigraphical records. The several varieties of local coinage described in the second part of Mr. V. A. Smith's catalogue, such as the coins of Taxila and those of the Kuṇindas and the Yaudheyas, show that these, for the most part, occupied the place of the currency formally supplied by Kushān coins. Kuṇinda, Yaudheya, Mālava and Taxila coins show a large number of varieties. Palæographical details, too numerous to mention, show that certain of these varieties are contemporaneous with Gupta coins. Particular mention should be made of Acyuta, the king Ahichatra, to whom Mr. Smith assigns the date of 330 A.D., who was defeated by Samudra Gupta.¹ It should be noticed in this connection that, even after six or seven centuries of foreign domination, native Indian coinage still had enough vitality left to stifle out even for a short period coins of foreign types and standards. It is only when the Gupta emperors began to imitate Kushān coinage that local coinages of ancient Indian types began gradually to die away.

MINOR SCYTHIAN DYNASTIES.

The coins of the minor Scythian dynasties, which succeeded the Great Kushāns in Northern or more properly North-Western India, are not very numerous. They fall into two great classes according to the tribal names mentioned on them:—

- (1) The *Śakas* and
- (2) The *Śiladas*.

No record has been kept of the findspots of these coins, but the recent discovery of a hoard of *Śaka* coins near Peshawar prove that that dynasty ruled the country around modern Peshawar. Nothing is known about the *Śiladas*. But it is certain that if the *Śakas* are to be placed in Gāndhāra, to the *Śiladas* must be assigned a territory to the east of the Indus, because in the first quarter of the third century we find that the Parthians and the Kushāns occupy the whole tract from the Oxus to the Arabian Sea, and later on we find the Sassanians and the Kushāns filling up the same region (up to 283 A.D.). The name *Śilada* was read by E. Thomas as *Sanḍi*.² General Cunningham

¹ Fleet Corpus Inscriptionum Indicarum, Vol. III, p. Pl. I. I.

² Indian Antiquary, Vol. XII, p. 8.

corrected it as Pakandhi or Pakaldhi.¹ In the catalogue of the Joint Cabinet Mr. Smith reads the name as Salada,² thus approximating to the correct reading. The plates will show that the *i* mark is quite distinct over the *sa* (see plate IV, Nos. 5 and 10).

I have excluded Gadahara (or Gādakhara) coins from this class where they were put by Cunningham and Mr. V. A. Smith, and have classed them with Kidāra Kuṣana coins for reasons which will be stated when I come to describe Kidāra Kuṣana coins.

The Joint Cabinet possesses all described varieties of the coinage of the Śiladas and shows a new variety. The coins of two Śilada princes have been described by Cunningham:—

- (1) Bhadra.
- (2) Pāsana.³

The name of the new prince is:—

- (3) Bacarna.⁴

The coins of the *Śākas* show larger numbers of varieties than those of the *Śiladas* and probably indicate the longer duration of their rule than that of the *Śiladas*. The Joint Cabinet possesses all varieties of *Śāka* coinage described by Cunningham with the exception of two varieties.⁵

(1) *Sayatha* (Cunningham's No. 5).—Cunningham read the legend as *Saya* or *Salya*, but it is *Sayatha* as read by Mr. Smith on I.M. Sundry Chiefs, No. 3, which is a duplicate coin. The mint name is *Bha*.

(2) *Sya* (Cunningham's No. 6).—Cunningham read the legend on this coin also as *Saya* or *Salya*, and Mr. Smith reads the legend of the two duplicates of this coin in the Joint Cabinet as *Sayatha*, but Cunningham's plate⁶ and the coins⁷ in the Cabinet show that it cannot be anything but *Sya*. The mint name on these coins is *Vi*. Cunningham's No. 7 seems to be a unique specimen of the coinage of this prince, as the name reads *Sasya* or *Syasya*. This may be the full name of the prince or simply a mistake of the die-sinker as in I.M. specimen of *Kaṇiṣka*, II, No. 7, where the name of the province looks like *gaga* or *gga* (*for ga* or *Gāndhāra*).

(3) *Sita* (Cunningham's No. 2).—The Joint Cabinet possesses three specimens of the coinage of this prince (Sundry Chiefs, Nos. 6, 7 and 8). Mr. Smith enumerates five specimens in his catalogue, but on examination I find Nos. 9 and 10 to be coins of another prince. Recently a hoard of coins was discovered near

¹ Numismatic Chronicle 1893, p. 123.

² Smith, I.M. Cat. Vol. I, p. 83-89.

³ The Joint Cabinet specimen of this prince's coin shows the name distinctly to be Pāsana and not Bāsana (Cunningham) or Pāsaka (Smith). See Pl. I, No 10.

⁴ Smith, I. M. Cat. Vol. I, p. 89.

⁵ Nos. 1 and 4 of the list on p. 124, Numismatic Chronicle 1893.

⁶ Numismatic Chronicle 1893, Pl. IX, No. 6. ⁷ See Pl. I, No. 7.

Peshawar which consists mainly of the coins of this prince. Seven coins out of this hoard were presented to the Indian Museum, out of which two coins belong to Sita (see Pl. V. 2). The Asiatic Society of Bengal received two specimens, both of which are coins of this prince. The initial letter of the name of the mint town on all coins of Sita is *Bha*.

(4) *Sena or Sena*.—As I have already noticed, Nos. 9 and 10 of the Coins of Sundry Chiefs described in Mr. Smith's catalogue, p. 89, do not belong to Sita, but are coins of *Sena*,¹ Mr. Smith's No. IV., but the name is *Sena* and not *Sana*. (See Pl. II, No. 1). The initial letter of the name of the mint town on all catalogued specimens of the coins of *Sena* is *Vi*. Five out of the seven coins received by the Indian Museum from the Peshawar Treasure Trove belong to *Sena*. These coins show a variant form of the name. On some coins the name is spelt with the lingual *na* (Pl. IV. 12), on other with the dental *na*.² The initial letter of the name of the mint town on these coins also is *Vi*.

KIDĀRA KUṢANAS.

No arrangement is possible of these coins which may be called chronological. I have set down my own readings of the legends in the order adopted by Mr. V. A. Smith:—

(1) *Krtavirya*.—The Joint Cabinet possesses three specimens of these coins. Under the right arm of the standing figure occurs the syllable *Sanagī* or *Sanadhī* (see Pl. V. No. 3. Mr. Smith passes this over as illegible). The *ī* strangely enough resembles the long *ī* of the Eastern variety of the Gupta alphabet³ (see Pl. V, No. 3).

(2) *Sarvayaśa*, the *śa* on the only I.M. specimen is defective. —Under the right arm of the standing figure is the word *Baśa* (not *Baga* as Mr. Smith says). Below the left arm is the word *Kirada*, the four-headed *mātrā* being simply the Eastern Gupta form of the long *ī*.

(3) *Bhāsvan*.—Both Cunningham⁴ and V. A. Smith⁵ reads the name on the reverse of these coins as *Viśva*. But Cunningham's plate shows that it is *Bhāsu*. The better state of the preservation of the specimen in the Joint Cabinet makes it possible to hold *Bhāsvan* as the correct form. Below the right arm of the standing figure is the letter *śa*, and below the left *ki* (Pl. V. 4). (These facts have been omitted from the catalogue).

(4) *Silāditya*.—Neither the specimen published by Cunningham nor the three duplicates of it in the Joint Cabinet possess the complete legend. The name begins with a dental instead

¹ See Pl. I, Nos. 8 and 9.

² See Pl. I, No. 11.

³ Bühler Indischen Palæography. Table IV, Col. I, Nos. 24 and 43.

⁴ Numismatic Chronicle 1893, p. 201, Pl. XV, No. 10.

I.M. Cat. Vol. I, p. 90, No. 4.

of the usual palatal *śa* (Pl. V. 5). The three specimens in the Joint Cabinet are respectively :—

Coins of the chiefs of the Little Yue-chi, No. (6).—Below the left arm, *Kida* and portions of *Kaśa* for *Kidara-Kuśana* and below the right *Kṣuṇa*. Both Cunningham and Smith read this as *Kapan*. The right vertical line of *Pa* is absent and the letter cannot be anything but *Kṣa*. The greater length of the vertical line of *Ka* shows that the extra length denotes “u.” Then the *ṇa* is lingual and neither the lingual nor the dental *na* can ever be written as “n” in transliteration. The word is simply *Kṣuṇa* and cannot be anything else. It is reproduced here at least three times and a glance at the plates will convince the reader of the accuracy of my reading. (See Pl. V, Nos. 5, 7 and 10.) The reverse shows *Sala* on the margin with a *la* of the Eastern Gupta variety.

(8) On this coin there is *Kirada* and *Kṣuṇa* on the obverse and *Sala* on the reverse.

(10) *Kida (ra)*, *K(u) śa (na)* and *Kṣuṇa* on the obverse and *Sala* on the reverse (see Pl. V. 7).

These three coins are exact duplicates of the coin published by Cunningham.¹ Coins of two other *Kidara Kuśana* princes have been published by Cunningham² but the Joint Cabinet does not contain specimens of these :—

IV. *Prakāśa*.

V. *Kuśala*.

Coin No. 13 of the Joint Cabinet is an unique specimen. The name of the prince on the margin of the reverse looks like *Dadara* (see Pl. II, No. 6). The marginal legend below the right arm of the standing figure on the obverse of coin No. 15 of the Joint Cabinet is *Srī śāhi* as Cunningham read it and not *Srī vāhi* as Mr. Smith says (Pl. V. 9). The form of the *śa* is like that of the Eastern Gupta variety. The *ā* cannot be indicated in these coins by a long vertical stroke which is only a tenth-century-Nāgarī form. Meaningless Brāhmi characters of the Maurya variety occur both on the obverse and reverse of coin No. 15a, and the coin looks like a modern forgery (Pl. V. 8). Coin No. 16 possesses *Kirada* (not *Kidara* as Mr. Smith says. See Pl. V, No. 10). *K(u) śa (na)* and *Kṣuṇa* on the obverse.

Coins of the chiefs of the *Gaḍahara* or *Gaḍakhara* tribe must be classed with those of the Little Yue-chi chiefs. There are two reasons for this :—

(1) The *Ga* in *Gaḍahara* or *Gaḍakhara* resembles the *Ga* of the 5th century A.D. (cf. Bühler Indischen Palæographie Tafel IV, Col. VIII, No. 9.)

(2) The syllable *Kṣuṇa* so common on Little Yue-chi coins occurs on all but one of these coins.

¹ Numismatic Chronicle 1893, p. 202, Pl. XV, No. 12.

² Numismatic Chronicle 1893, p. 202, Pl. XV, Nos. 13 and 15.

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Cunningham has enumerated three types of *Gaduhara* coinage :—

(1) *Peraya*.—There is a duplicate of this coin in the Joint Cabinet.¹ The complete name is neither *Peraya* nor *Peyasa*, but *Perayasa* with *sa* as a possessive-case-ending.

(2) *Kirada*.

(3) *Samudra*.—The resemblance between this coin and the coin of *Samudra Gupta* No. 10 (*Spearman* type variety *a*, *Cat. I*, p. 102) is so great that it is possible to say that the *Gaduhara* tribe at last acknowledged the suzerainty of the great conqueror and placed his name on their coins.

¹ *Smith, I.M. Cat. Vol. I, p. 127.*



14. The Seven Sahajātā of the Buddha.

By H. C. NORMAN.

IN Fausböll's edition of the Jātaka, Volume I, page 54, occurs the following passage: "Yasmiṃ pana samaye amhākaṃ Bodhisatto Lumbinivane jāto, tasmim̄ yeva samaye Rāhulamātā devī, Channo amacco, Kāludāyī amacco, Kanthako assarājā, Mahābodhirukkho, cattāro nidhikumbhiyo ca jātā." "Now at the very time that our Bodhisattva was born in the Lumbini grove, there also came into existence the queen, the mother of Rāhula; Channa, the courtier, Kāludāyī, the courtier; Kanthaka, the king of horses; the great Bodhi-tree; and the four vases full of treasure." After giving a short account of the treasure-urns, the text adds: ime satta sahajātā nāma, "these seven are called the Connatal Ones."

Rhys Davids in his translation, p. 68, was the first to call attention to a discrepancy between the summary account and the details. In his note he says: "There is some mistake here, as the list contains nine—or if the four treasures count as one, only six—Connatal Ones. I think before Kāludāyī we should insert Ānanda, the loving disciple. So Alabaster and Hardy (Wheel of the Law, p. 106; Manual of Buddhism, p. 146). Bigandet also adds Ānanda." Warren in his note (Buddhism in Translations, p. 48) writes: "In making up this number the future Buddha is to be counted as number 1, and the four urns of treasure together as number 7."

But in a Sinhalese edition of the Jātakatthakathā by Silānanda Thera, published in Sinhalese characters in 1892, we find after Kāludāyī (*sic*) amacco, and before Kanthako assarājā the addition Ājāniyyo hatthirājā. This would solve the difficulty raised above by the two translators of the Jātaka. Presumably Silānanda had good MSS. before him when constituting his text, for another numerical puzzle in the Nidānakathā (Fausböll, Jātaka, I, 3) is solved by his reading. The passage in Fausböll is the commentary on dasahi saddehi avivittam, which runs thus: hatthisaddena, rathasaddena, bherisaddena, mutiṅgasaddena, viṅāsaddena, gītasaddena, sammasaddena, saṃkhasaddena, tālasaddena, "asanātha (*lege asnātha*) pivatha khādathā" ti dasamena saddenā "ti imehi dasahi saddehi avivittam ahoṣi. This list gives a 'saddo' too much, as noted by Rhys Davids in his 'Buddhist Suttas,' p. 249, note: "this enumeration is found also at Jātaka, p. 3, only that the *chank* is added there—wrongly, for that makes the number of cries eleven." In Silānanda's text 'saṃkhasaddena' is omitted, and this agrees with the enumeration as given in other texts (see Dīgha II, 170 P.T.S.)

To return to the Satta Sahajātā, the addition of the elephant seems very suitable, not only because it makes up the required

number, but also because the elephant is one of the seven jewels of the Cakkavattirājā. The second ratana mentioned in the Mahāsudassanasutta (Dīgha II, 174) is the “sabbaseto sattappatitṭho iddhimā vehāsaṃgamo Uposatho nāma nāgarājā.” The two lists closely correspond, with the exception that in the case of the Buddha we have the bo-tree, and in the case of Mahāsudassana the wheel, the former appropriate for a Buddha as the latter for a universal monarch. The *devī* corresponds to the *itthiratanam*, *Channa* and *Kāludāyī* to the *gahapatiratanam* and *parināyakaratanam*, *Kanthaka* to the *assaratanam* and the *nidhikumbhīyo* to the *maniratanam*. This correspondence seems to show that the reading of Śīlānanda has much to recommend it to the consideration of Pāli scholars.

15. Quotations in the Bhāṣāpariccheda.

By VANAMĀLI VEDĀNTATĪRTHA.

The *Bhāṣāpariccheda* is the "First Book" or ABC of *Navyanyāya* Philosophy. It is the most popular of all *Naiyāyika* works, being read and learnt by heart by almost all the *paṇḍitas* in Bengal, as well as by the majority of them in other parts of India. It has been commented upon by the author *Viṣvanātha Nyāyapañcānana* himself. The commentary is called the *Siddhāntamuktāvalī*. The popularity of the *Siddhāntamuktāvalī* is immense, as will be evident from the fact that its commentary, the *Dinakarī*, has been made the subject of another commentary called the *Bāmarudrī*. This series of commentaries has been printed and published.

The author of the *Bhāṣāpariccheda* flourished during the first part of the 17th century A.D. There is evidence that his father *Vidyānivāsa* was living in 1588 A.D. (*vide* M. M. Haraprasāda Chāstrin's Nepal Catalogue, Preface, p. xvi, and also Eggeling's India Office Catalogue, Vol. III, p. 409B.) The verses of the *Bhāṣāpariccheda* are generally supposed to have been, all them, composed by *Viṣvanātha*. But the truth seems to be that he often quoted from previous works, now completely forgotten. In fact, *Viṣvanātha* seems to state this rather clearly in the introduction to his *Siddhāntamuktāvalī*. Cf.

निजनिर्मितकारिकावलीमतिसंक्षिप्तचिरन्तनोक्तिभिः ।

विश्वदौकरवाणि कौतुकात् ननु राजीवदयावशंवदः ॥

The usual way of construing this passage is as follows:— I now propose to explain, by means of the very brief sentences of the ancients, the memorial verses composed by myself, etc., अनिसंक्षिप्तचिरन्तनोक्तिभिः विश्वदौकरवाणि. Thus the sentences of the ancients are to be found in the explanation, *i.e.*, in the *Siddhāntamuktāvalī*. But it seems it would be better to take अनिसंक्षिप्तचिरन्तनोक्तिभिः both with the word that precedes it and with the word that follows, by what is called the काकाचिगीलकन्याय. Every one will see that अनिसंक्षिप्तचिरन्तनोक्तिभिः निजनिर्मितकारिकावली विश्वदौकरवाणि gives a better sense. For it clearly states the reason why the author himself should think it necessary to annotate his book. The book contains *extremely short sentences long current among men*. The sentences are extremely short, and hence the author must himself explain them. But why did he write such short sentences. Because, he did not really compose them; he only put them together from works that were then current among

the *paṇḍitas*. If he composed them he might have made them longer and hence easier to understand. This interpretation will be substantiated by adducing a positive proof that there are some lines in the *Bhāṣāpariccheda* which actually occur in earlier books, e.g. the *Dakṣiṇāmūrtistotra-vārtika*.

The *Dakṣiṇāmūrtistotra* is a poem summarizing the teachings of the Monistic Vedānta Philosophy in ten stanzas. It was composed by Ṣaṅkara. It is a *stava*, a prayer, a hymn addressed to the Supreme Being, in the form of our *guru* (teacher). Such prayers or praise-hymns written with a philosophical intent are very common in India. The celebrated *Mahimnaḥstava* and the *Vitarāgastuti* are other examples to the point. This *Dakṣiṇāmūrtistotra* has been commented upon by the great *Sureṣvara*, the contemporary and pupil of Ṣaṅkara. This commentary, as might be expected, is in verse and is called the *mānasollāsa* or the *Dakṣiṇāmūrtistotra-vārtika*. Thus the age of this *mānasollāsa* cannot be later than the 8th century A.D., though I would place it much earlier, viz., the end of the 6th century A.D. (*vide* Bhandarkar's Report, 1882-83, p. 15).

Now in this *Dakṣiṇāmūrtistotra-vārtika*, otherwise called the *Mānasollāsa*, there are eleven slokas containing a short summary of the *Vaiṣeṣika* Philosophy (II. 20-30). The first *ṣloka* runs as follows :—

द्रव्यं गुणस्तथाकर्म सामान्यं सविशेषकम् ।

समवायं च काणादाः पदार्थान् षट् प्रचक्षते ॥

The first line of this *ṣloka* is identical with the corresponding *ṣloka* in the *Bhāṣāpariccheda*. This is not due to mere chance, for the construction in *सविशेषकम्* is so peculiar that it completely precludes such a supposition, though it may be urged, on the other side, that given the six or seven categories as also the order in which they are to be arranged [for the order is the order of the *sūtras* and *Praçastapāda Bhāṣya*], the number of ways in which they may be put into verse (*anuṣṭup*) is limited, and hence the identity of the *ṣlokas* may after all be due to mere chance. But the line "सामान्यं द्विविधं श्रोत्रं परब्रह्मपरमेष्ठ च" occurs in both the *Bhāṣāpariccheda* and the *Mānasollāsa*, and is this also due to mere chance ?

The *Mānasollāsa* is a Vedantic work, and the account of the other systems is given only for subsequent refutation. It is not likely that *Viçvanātha* would borrow from such a work. Thus we are led to suppose that *Sureṣvara* also is quoting these verses from some work, of which no trace is to be found now. It must have been a work in verse upon the *Vaiṣeṣika* system. Would anyone undertake to find it out? If a versified *Vaiṣeṣika* work of Ṣaṅkara's date could be discovered, it would throw much new light on Indian Thought.

The custom of quoting from previous authors without acknowledgment was very common in those days. In fact, it is not

uncommon even now. Those passages of literature, which have got a universal currency, may perhaps be regarded as common property, and, as long as there is no decline of letters, these passages may surely be quoted without acknowledgment, without any violation of literary ethics. Everybody knows whose words they are, it becomes mere waste of paper and breath to quote the names of their authors. Thus Shakespeare's more famous lines are quoted without acknowledgment.

In the light of these remarks, *Sureçvara* and *Viçvanātha* must have quoted from a very famous work. What was it?

16. Pāla Inscriptions in the Indian Museum.

By NILMANI CHAKRAVARTTI, M.A.

*Communicated by N. ANNANDALE, D.Sc., Officiating Superintendent,
Indian Museum.*

The following inscriptions have been found on the pedestals of images from Bihar deposited in the Archæological gallery of the Indian Museum.

All the inscriptions are votive records and, with one exception, are dated in regnal years of the Pāla sovereigns of Magadha, who were Buddhists and great promoters of Buddhism in the eastern parts of India. One of these records—No. 1—is, strictly speaking, non-Buddhistic, though found in a great centre of Buddhism; the remaining ones are purely Buddhistic.

No. 1.—Bodh-Gaya Inscription of the 26th year of Dharmapāla:—

The inscription was found by Sir Alexander Cunningham about 1879, to the south of the great temple at Mahābodhi, and he made it over to Dr. Rājendralāla Mitra, who published a transcript and a translation of it in the Proceedings of the Asiatic Society of Bengal, 1880, page 80. But the transcript of Dr. Rājendralāla had many mistakes, and, consequently, the translation was not correct. Cunningham published only a facsimile of it in his *Mahābodhi*, pl. xxviii, 3. I re-edit the inscription from the original, which is now in the Indian Museum.

The inscription is on the left portion of a slab measuring 20·5" × 7·35" inches,—the other portion containing three figures in three recesses—and consists of nine lines, written in the 9th century, eastern Nāgarī. The language is Sanskrit, and the whole of it is in verse. The number of verses are four. At the end of every line of verse there is a stop, except at the end of the second line of the second verse and at the end of the first line of the fourth. The verses are irregularly written. With the exception of a letter in the end of the third line, and another at the beginning of the fourth line, the whole of the inscription is distinctly legible.

Dr. John Anderson in his Catalogue of the Archæological Collections in the Indian Museum, Vol. ii, p. 48, has described the slab, on which the inscription is incised, in the following way: "A slab with three Bodhisattvas, each in a recess, the right side of this rudely carved stone being occupied with the inscription beginning *ye dhammā*, etc., in nine lines." But his description is entirely wrong; the inscription is neither *ye dhammā*, etc., nor the three figures are those of Bodhisattvas. The figure to the extreme right is that of Sūrya, recognisable by his hands in the posture of granting protection (*Abhaya-mudrā*), holding two lotuses, and his legs

wearing boots. The figure to the extreme left is that of Viṣṇu, recognisable by his four hands holding Śaṅkha, Cakra, Gaḍā and Padma. The figure in the middle is probably that of Bhairava.

The object of the inscription is to record the consecration of a four-faced Mahādeva and the excavation of a tank at Mahābodhi at the expense of three thousand *drammas*, by one Keśava, the son of a sculptor named Ujjvala. The inscription further states that the image of the four-faced Mahādeva was consecrated for the spiritual benefit of the Mallas of Mahābodhi.

The inscription is dated in the 26th year of the reign of Dharmapāla, the second king of the Pāla dynasty and the son of Gopāla, the founder of the dynasty. The following particulars of the date are given in the inscription: Saturday, the 5th day of the waning moon of Bhādra.

Transcript.

1. ॐ चम्पशायतने रम्ये उज्ज्वलस्य शिलाभिदः । के
2. शवाख्येन पुत्रेण महादेवस्तुर्मुखः ॥ अस्थाना
3. मेव मल्लानां महाबोधिनिवासिनां ॥ स्नातक +
4. मज्जयास्तु अयेसे प्रतिष्ठापितः (॥) पुष्करि
5. ख्यद्यगाधा च पूता विष्णुपदीसमा ॥ त्रितये
6. न सहस्रेण द्रम्याणां खानिता सतां ॥
7. षड्विंशतितमे वर्षे धर्मपाले महौमुजि
8. भाद्रवज्जलपक्ष्म्यां सूनोर्भास्व
9. रस्याहनि ।

Translation.

In the pleasant Campaśāyatana, (Campaśa temple ?) a four-faced Mahādeva was consecrated by the son of the sculptor Ujjvala, Keśava by name, for the (spiritual) benefit of the chief Mallas dwelling at Mahābodhi.

A very deep tank, sacred as the Ganges (born of the feet of Viṣṇu) was also excavated by him at a cost of three thousand *drammas*. In the 26th year of the reign of Dharmapāla, the day of the son of the creator of light (Saturday), the 5th day of the waning moon of Bhādra.

No. II.—*Bodh-Gaya pedestal inscription of the reign of Gopāla-deva :—*

The inscription No. II was exhumed by Sir A. Cunningham in the year 1879, and a facsimile only was published by him in his Mahābodhi pl. xxviii, 2. Of this inscription Cunningham says in page 63 of the same work: "The inscription which was exhumed at Mahābodhi, simply records the dedication of a statue in the reign of Śri Gopāla-deva." I edit the inscription from the

original in the Museum gallery for the importance which it has in the records of the Pāla kings.

The inscription is on the base of a statue measuring 3'5 × 8" 50". The front of the pedestal is not one plane, but is divided into five surfaces. On the middle one is inscribed *Yedharmā*, etc.; the inscription proper is on the four other surfaces. It is written in three long lines, extending from one end of the pedestal to the other. The name of the reigning king is written in a fourth line below the inscription. The language is Sanskrit verse, with high sounding metaphors, and is written in the 10th century Nāgari character. The letters are clearly and boldly written.

The inscription is not dated, but it simply states that it was incised in the reign of Gopāladeva. Now, there were at least three kings of this name in the Pāla dynasty (see *Ep. Ind.*, Vol. viii, App. i, pp. 17-18). It is very difficult to determine to which of the three Gopāladevas the inscription belongs. This and the inscription No. III, the Nālandā image inscription, have been attributed to Gopāladeva I, the founder of the Pāla dynasty, both by Cunningham and Prof. Kielhorn (see *A.S.R.* Vol. i, p. 36; Vol. iii, p. 120; *Mahābodhi*, p. 63, and pl. xxviii, 2. *Ep. Ind.*, Vol. v, App. i, p. 85; and Vol. viii, App. i, p. 17). But from the following comparison of the palæography of these two inscriptions attributed to Gopāladeva I, with that of the inscription No. I belonging to the 26th year of the reign of Dharmapāla, the son and successor of Gopāla I, we are led to believe that the Gopāladeva of these two inscriptions must be later than Dharmapāla and not his predecessor:—

(1) Palatal *Ṣa* occurs six times in the same form in the Bodh Gaya pedestal inscription. The same letter occurs seven times in the Nālandā image inscription and is identical with *Ṣa* in the Bodh Gaya inscription. In the inscription of Dharmapāla the letter occurs seven times, five times in the Gupta form and twice only in the later form, resembling the form in the inscriptions of Gopāla. Here then there is the probability of five to two in favour of Gopāla being later than Dharmapāla.

(2) The letter *Ja* occurs ten times in the Bodh-Gaya inscription and thrice in the Nālandā inscription, the only difference between the two types being that the lower-most horizontal line turns into a short curve in the Bodh Gaya inscription; while in Nālandā inscription the curvature exists, but it is not so sharp; it is rather wavy. The letter occurs thrice in the inscription of Dharmapāla, year 26, of which the first in the first line is typical. The second in the fourth line is decidedly of a later type. The third *Ja* in the seventh line is exactly like the first one. *But the abrasions in the stone make the end of the second and third horizontal line look like curved hooks.* The differentia between the two forms are:—(1) the first horizontal line of the Gupta *Ja* which gradually becomes the serif (*mātrā*) of the *Ja* of the nailheaded type is parallel, both in the Gupta and early nailheaded type to the other two horizontal lines. The *Ja* in the inscription of Dharmapāla, year 26,

is exactly like that of the early nailheaded type. Further progress shows the gradual curvature of the other two horizontal lines, which gradually assume the Bengali form to be found in the inscriptions of the 10th and 11th centuries as well as in those of Gopāladeva.

(3) The peculiarity of the Ja of the inscription of Dharmapāla, year 26, seems to be that the second horizontal line is strictly parallel to the *mātrā*, thus differing from the Ja in the Lakkhamaṇḍal Prasasti in which the line shows a marked inclination downwards.¹ Bühler, Ep. Ind., I, 10.

This Pāla Ja throws a shred of doubt on Bühler's remark in his Indian Palæography, page 54. 12, where he says:—"The central bar of Ja is first made to slant downwards (plate iv, 14, xxi-xxiii, etc.), and then changed into a vertical (v, 17, xiii, etc.; vi, 22, xii, etc.). At the same time, the upper bar becomes the top-stroke of the letter, and the lowest is gradually converted into a double curve."

The examination of these test letters shows that the difference in time between Bodh Gaya and Nālandā inscriptions of Gopāla and the inscription of the 26th year of Dharmapāla is considerable.

At the same time the affinity of the characters of Bodh Gaya and Nālandā inscriptions of Gopāla with those of the Bādal pillar inscription of Nārāyaṇapāla (Ep. Ind. ii, p. 160) is remarkable. If we take the test letters Ja and Śa into consideration, we find that the inscriptions of Gopāla must be referred very close to the reign of Nārāyaṇapāla. The palatal Śa appears in the Bādal pillar inscription in two distinct forms. One of them is the form which occurs universally in the Bodh Gaya and Nālandā inscriptions of Gopāla, viz., Śa in Śāṇḍilya. The other form is peculiar and resembles to some extent Bühler, Indian Palæography, plate v, 39, ii. This form of Śa is only explicable as a provincial peculiarity. The other test letter Ja is throughout identical in form and with that in the inscriptions of Gopāla. Now we know from other Pāla inscriptions that the second Gopāla was the grandson of Nārāyaṇapāla, and probability is very strong in favour of the identification of Gopāla of Bodh Gayā and Nālanda inscriptions with Gopāla II.

The object of the inscription is to record the consecration of an image of Buddha by one Śakrasena, who was known as Dhārmabhīma and who calls himself Sindhūdbhava. M. M. Haraprasād Shāstri has shown me a passage in the Rāmapāla-carita, where the Pāla kings are described as the descendants of Samudra, and he is of opinion that Śakrasena, who calls himself Sindhūdbhava, might have been related to the Pālas. Sindhūdbhava may be taken in its ordinary sense to mean a person born in Sindhu-deśa. Cf. the expression Sindhūdeśa vinirgata which is evidently a mistake for Sindhu-deśavinirgata in the inscriptions Nos. v and vi.

¹ Bühler assigns an earlier date to the Lakkhamaṇḍal Prasasti than that done by Kielhorn to this inscription of the 26th year of Dharmapāla.

Transcript.

1. ॐ कृत्वा मैत्रीं तनुत्रं स्फुरदुत्करणा खड्गमालम्बयन् यः । स्फूर्ज
त्कन्दर्पसेना प्रलयजलनिधेर्द्धानभीमप्रमोषी । कल्पान्तादीप्त-वङ्गि-ज्वलित-
तर-वपुः क्रोधजिह्वाीकृ—

2. तभुं । जिग्येनिर्व्वान्तहेमद्युतिः ललितवपुः सोस्तु भूयै जिनोव ॥ यः
शारदेन्दु-किरणोज्वल-कीर्त्तिपुञ्जः । सम्बुद (ङ)-पाद-शत-पत्र-मनः-
षडङ्घ्रिः । श्रीधार्म्मभी

3. म इति च प्रथितः पृथिव्यां । सिन्धुद्वोभावदनस्यकृपाईचितः
(त्तः) ॥ तेनेयं शक्रसेनेन कारिता प्रतिमामुनेः काङ्क (ख) ता
ऽनुत्तराम्बोधिं-जगतोदुःख-शान्तये ॥

4. श्री गोपाल-देव-राज्ये

Translation.

May the Jina be for your welfare; who making friendliness his armour and wielding the bright sword of mercy put down the heavy uproar of the army of Kāndarpa, which was like that of the ocean at the end of a kalpa, whose body was more radiant than the fire at the end of a kalpa, and whose brows were frowning with anger. Who was like unto the autumnal moon on account of the mass of his fame, whose mind was a bee to the lotus feet of the fully awakened one, who was known in the world as Dhārmabhīma, and whose mind was not a little moistened with kindness, by that Sakrasena this image of the saint was dedicated in hopes of the unsurpassed knowledge for the mitigation of the suffering of the world. In the reign of the illustrious Gopāladeva.

No. III.—Nālandā inscription of the first year of Gopāladeva :—

The inscription was found by Sir A. Cunningham in 1862 at Nālanda (present Barāgaon), and a drawing of it was published by him in his Survey Report, Vol. i, pl. xiii, 1. It was afterwards transcribed and translated by him in his report, Vol. iii, page 120. I give a transcript and facsimile of it for the convenience of comparing the palæography with the two preceding ones. The last three words were not read by Cunningham. The last word which was read by M. M. Haraprasād Shāstri as Suvarṇa Vrihi Saktā refers probably to the custom of covering images with gold leaves. Babu Rakhāl Das Banerjee says that even up to this time pilgrims from the far east cover images at Bodh Gayā with gold leaves.

Transcript.

१ । सम्बत् १ अश्विन शुदि ८ परमभट्टारक महाराजाधिराज परमेश्वर
श्रीगोपाल राजनि श्रीनालन्दायां

२ । श्री वागीश्वरी भट्टारिका सुवर्णश्रीहिसक्ता

Translation.

In the year 1, the eighth day of the bright fortnight of Āśvina, while the paramount sovereign, the king of kings, the great lord Gopāla was king, at Nālandā the Goddess Vāgiśvari was tinged with gold streaks.

No. IV.—Nālandā inscription of the 11th year of the reign of Mahipāladeva :—

“The inscription was discovered by Captain Marshall early in 1864, when excavating the great temple of Bālāditya, at Nālanda, at the foot of one of the jambs of the inner gateway. It was afterwards rediscovered by Mr. Broadley. Sir A. Cunningham has given the following description of the inscription in his report, Vol. iii, page 123 consists of 10 short lines beginning with

- 1—Sri Man Mahipāla De
- 2—Va rājye samvat. 11.”

I edit the inscription from the original which is now in the Museum gallery.

The inscription is on a portion of the door-jamb 27"·5 × 5", of which the inscription proper occupies only a space 9" × 5". The character is the 11th century Nāgari, and the language is Sanskrit. There are altogether 12 short lines and not 10 as Sir A. Cunningham has described. The letters are large and clearly written. The maximum number of letters in a line is 11.

The object of the inscription is to record the placing of the door-jamb on which it has been incised, when the restoration of the place after a conflagration was completed. Bālāditya, the donor, calls himself a lay-disciple and a follower of the Mahāyāna or great vehicle. He was originally an inhabitant of Kosambī, and afterwards settled at Tailāḍhaka or Telāḍhā (for which see A.S.R. Vol. xi, page 164, and Vol. viii, 34). The word Jyāviṣa in this inscription is a peculiar one. M. M. Haraprasād Shāstri says the word Jyāviṣa is probably equiva en to the modern Nepalese word Jaiṣi which means a mixed cast formed by the union of Brahman and Kṣatriya.

The inscription is dated in the 11th year of the reign of Mahipāla-deva, and there is no other particular. There were at least two kings of the Pāla dynasty who bore this name, of the first of whom there is the date 1026 A.D. (see Ep. Ind. Vol. viii, App. i, p. 18), and palæographical evidence is in favour of assign- ing this inscription to his reign.

Transcript.

1. श्रीमन्महीपाल दे
2. व राज्य समत् ११
3. समिदाहोद्वारे

4. गते देयधर्मोयं प्रवर
5. मा(म)हाथान याविमः पर
6. मोपासक श्रीमत्तैलाङ्
7. कौथ ज्याविष कौशाम्बी
8. विनिर्गतस्य हरदत्तनप्त
9. : गुंरदत्त सुत श्रीवाला
10. दिव्यस्य । यदत्र पुण्यं त
11. इ भवतु सर्व्व सत्त्व राशेर
12. नुत्तर ज्ञानावाप्तय ति ॥

Translation.

The 11th year of the reign of the fortunate King Mahipāla-deva. This is the pious gift of Bālāditya, the son of Gurudatta and grandson of Haradatta, a follower of the greater vehicle, the best of the lay-disciples, an inhabitant of Telāḍhaka, and an emigrant from Kośambi, when the place was restored after a conflagration. Whatever merit

Nos. V and VI.—Inscription of the second year of Sūrapāla-deva :—

These two inscriptions which are identical, were discovered by me while preparing a catalogue of additions in the Archæological gallery of the Indian Museum, in May last, on the pedestals of two sculptures, numbered 3763 and 3764, representing two different scenes in the life of Buddha. No. 3763 represents Buddha attended by Indra and Brahmā, and 3764 Buddha meeting the elephant. No history can be had of these two pieces of sculpture, except that they are from Behar and have been lying in the Museum gallery since September 1891.

Each of the pedestals on which the inscriptions are written measure 18" x 4". Though the inscriptions are the same, yet they are differently written on account of the ornaments on the pedestal. The language is incorrect Sanskrit prose, and is written in the eastern variety of Nāgarī character of the 12th century.

The object of the inscriptions is to record the consecration of these images of Buddha by one Uddanḍa Cūḍa, who was originally an inhabitant of Sindhudeśa, in a caitya which he himself caused to be constructed. The ceremony of consecration was conducted by the elder Puṇḍāśa, who was the oldest man in the Paḍikramaṇa Vihāra.

The inscription is dated in the second year of the reign of Sūrapāladeva, the eleventh day of the dark fortnight of Āṣāḍha. According to Professor Kielhorn, Sūrapāla was the brother of Mahipāla II. and Rāmapāla, and was the successor of the former and predecessor of the latter.

Professor Kielhorn in his list of the inscriptions of Northern India does not mention any inscription of this king. Sir A. Cunningham in his Survey report, Vol. xi, page 178, writes of this king "that he was not only different from Vīgrahapāla, but also reigned not less than 13 years." But he does not mention any inscription of this king.

Transcript.

1. ॐ महार(र)जाधिराजा(ज) श्रीशुरपालतेवराज्य सम्बत् २
2. द्विराशा(षा)ठ वदि ११ अस्मिन् सम्बत्सर मास दिव
3. सानुकमे श्रीमदुद्वन्द्वचूरो(डो) इह विहाय नैवा
4. सिक सिन्दुहे ष(देश) विनिर्गतपाडिक्रमण विहार वृद्ध
5. परिषद्य(शुद्ध)प्रदर्शिन(र) स्यविर पूर्वदासेन स्वकारित चैत्रे भट्टार
कस्य शिला प्रतिमा देवद्व(यध) म्नाय प्रतिस्थ(र)पित यत्पु
शय () मातापितर(रौ) उपाध्यायं पूर्वकृतं कृत्वा अनुत्तर ()
सकल सत्पराशे(ः) इति:

Translation.

In the second year of the reign of Mahārājādhirāja Śūrapāla, the 11th day of the dark fortnight of Āṣāḍha. In this year, month and day fortunate Uddanḍa Cūḍa had the stone image of the Lord placed in a caitya which he himself caused to be made, by the elder Pūrṇadāsa who was in the Vihāra there, who was the oldest person in the Pāḍīkramaṇa Vihāra, and who was possessed of a pure sight. Whatever merit

No. VII.—Bihar inscription of the reign of the second year of Rāmāpāla-deva :—

This inscription, like the preceding two, was discovered in the Museum gallery on the pedestal of an erect figure of Tārā. No history of this inscription can be had, except that it came from Behar in October, 1891. Sir A. Cunningham in his report, Vol. iii, published a note on this inscription from Mr. Broadely, in which the date only was given.

The pedestal on which the inscription is incised measures 24" × 2". It is in two lines with a break in the middle, the surface of the stone being peeled off. The language is incorrect Sanskrit written in an eastern variety of Nāgarī character.

The object of the inscription is to record the dedication of the statue, on whose pedestal it is incised, by one Bhaṭṭa Icchara, probably incorrectly for Īśvara, the son of Bhaṭṭa Nābha. Its importance lies in its date, which is given as the second year of the reign of Rāmāpāladeva, the 28th of Vaiśākha. No inscription of this king occurs in Kielhorn's list of Northern inscriptions.

Transcript.

1. देवधर्मोयं परवरमहाज.ासक ॥ भट्टनाभोसुतभट्ट ईश्वरस
यदत्र पुन तद्भवतु माता

2. पितु पुर्व्वङ्गं सकलसत्वानरासे अतु — — — — राज
श्रीरामपालदेव सम्बत् २ वैशाख दिने २८ सेतासुत महावित गठितं चि ।

Translation.

The pious gift of the best of lay-disciple Bhaṭṭa Īśvara, son of Bhaṭṭa Nābha, who was a follower of the greater vehicle. Whatever merit In the second year of the reign of Rāmapāla, 23th of Vaiśākha. Carved by Mahābita, the son of Setā.

P.S.—In Cunningham's Report of the Archæological Survey, Vol. i, pl. xiii, No. 1, the following letters appear to be quite different from their originals :—

1. 1. ā in āśvina.
na in „
Ja in Mahārājādhirāja.
1. 2. ṭṭa in Bhaṭṭārikā.
va in Suvarṇa.
ktā in Saktā.

In Cunningham's Mahābodhi, pl. xxvii, No. 2, the fourth word looks like *Sphuradukukukana*, while in reality it is *Sphuradurukaruna*. This difference is remarkable as the reproduction seems to have been mechanical.—N. M. C.

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17. Notes on Indian Mathematics. No. 2.—Āryabhaṭa.

By G. R. KAYE, *Bureau of Education, Simla.*

I.

In works on Indian astronomy references to the famous Āryabhaṭa abound, and, from the time of Varāha Mihira to the present day, we find numerous quotations from him. Unfortunately, a great many of these quotations are second hand ; for it appears that the original works were practically lost for centuries. At the beginning of the eleventh century Albiruni wrote (*India* I., 370) : "I have not been able to find anything of the books of Āryabhaṭa. All I know of him I know through the quotations from him given by Brahmagupta" ; and, at the beginning of the nineteenth century, we are told by Colebrooke (*Algebra, etc.*, p. v) that "a long and diligent research in various parts of India failed of recovering the Algebraic and other works of Āryabhaṭa." Also that the original works of Āryabhaṭa were either not available, or existed only in a much mutilated condition in the fourteenth century, is indicated in the following passage from the *Maha Āryasiddhānta* : "That (knowledge) from the Siddhānta, propounded by Āryabhaṭa, which was destroyed, in recensions, by long time, I have in my own language thus specified." (Bhāu Dāji, *Journ. Roy. Asiatic Soc.*, 1864, 392.)

Albiruni (I., 386), quoting Brahmagupta, tells us that Āryabhaṭa was the author of two books, one of which is called *Dāsagitikā*, the other *Āryāstasāta*. The former title means a work of ten Āryās or strophes ; about the latter there has been some dispute. Lassen and Colebrooke interpreted it as meaning 'eight hundred couplets,' but Dr. Bhāu Dāji pointed out that the correct meaning is 'a treatise of 108 couplets.' In the time of Colebrooke and Lassen the *Āryāstasāta* had not been rediscovered. Bhāu Dāji was able to procure three copies of the *Dāsagitikā* and of the *Āryāstasāta*, and in each case the former consisted of thirteen and the latter of 108 couplets. Kern's edition is of precisely the same length, while my copy contains 15 plus 108 couplets.

Āryabhaṭa's works consist of four parts : (i) The *Gitika*, which properly consists of ten couplets and contains astronomical tables ; (ii) the *Ganitu* consisting of 33 couplets. This is the mathematical section proper, a translation of which is given below ; (iii) The *Kālakriyā*, which deals with the measure of time ; and (iv) the *Gola*, or Sphere. The last three sections make up the *Āryāstasāta*, or work of 108 couplets, while the first part is known as the *Dāsagitikā*.

Other works have been attributed to Āryabhaṭa, but the above mentioned are probably all now known that can be justly called his. From Albiruni (I., 156) we learn that the contents of the book *Karaṇa-khaṇḍa-khāḍyaka* represent the doctrines of Āryabhaṭa, and that Brahmagupta wrote a commentary thereon.

In 1874 Kern published the *Aryabhaṭīya* consisting of the *Daśāṅgītikā* and the *Āryāśtaśata*, together with a long comment by Parāmdīçvara. Rodet (*Journal Asiatique*, 1879) gave a translation of the mathematical section of Āryabhaṭa's work with very interesting and valuable notes, and Thibaut (*Indo-urische Philologie*, III, 9) in 1899 summed up all that there was then known on the subject. Other valuable information will be found in Kern's introduction to the *Bṛhat Sañhitā* (p. 54f.), in Thibaut's edition of the *Pāñchasiddhāntikā*, and in Bhāu Dāji's notes. We need hardly mention Colebrooke and others who knew of Āryabhaṭa only from quotations in other works, and whose statements have all to be reviewed in the light of later research.¹

Rodet's contribution is particularly valuable, although he was occasionally misled by the commentators and so came to erroneous conclusions. He was inclined to exaggerate the mathematical powers of the Hindus of that age, and to credit them with discoveries that cannot justly be attributed to them. For example, he supposed that the modern (place-value) system of arithmetical notation was their invention. He appears to have believed that Āryabhaṭa owed at least some of his mathematics to a Greek source, although he explicitly defers the consideration of this troublesome question.

Dr. Thibaut, the highest authority on Indian astronomy, has recently restated his views on Āryabhaṭa as follows: "About twenty or thirty years ago Āryabhaṭa was generally spoken of, by modern writers on Indian astronomy, as the earliest 'scientific' Indian astronomer. . . . But since that time our ideas as to the history of Indian astronomy have been considerably expanded and cleared, mainly by the publication of that work—a work indeed of fundamental importance in this department of enquiry—in which Varāha Mihira, writing in the sixth century, gives a summary account of the five most important astronomical Siddhāntas, the doctrines of which were in his time current in India. . . . Āryabhaṭa may have been the first, or one of the first, to expound the principles of that system in a highly condensed and technical form, and he may have improved the general theory in details; but the main body of doctrine existed before him:—he did not create it, but merely recast it in a different form. It is with regard to this indubitable fact that the editors of the *Pāñchasiddhāntikā* remarked that originality of doctrine cannot, on the whole, be claimed for Āryabhaṭa. That he was original, at least as far as India is concerned, in maintaining the daily rotation of the earth on its axis, nobody of course has ever denied. The same view had, indeed, been previously held by certain Greek

¹ A fuller list of authorities is given in the bibliography annexed.

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astronomers; but there is no evidence¹ for Āryabhaṭa having been acquainted with those views; nor, indeed, is this generally likely. And even if the idea had first been suggested to Āryabhaṭa by those Greek speculations, we should have to give him credit for 'originality,' in the sense that he had the insight and courage to maintain a view, which appears utterly paradoxical to the vulgar and had been rejected by the best known, and on the whole most competent, astronomers of the west. That the view of the earth's rotation did not fare better in India also is well known: the most famous astronomers subsequent to Āryabhaṭa refer to it only to reject it; and Āryabhaṭa's originality in this one point hence stands out all the brighter." (*Indian Thought*, 1907, 215.)

Bhāu Dāji reproduces nearly all the passages in the Āryabhaṭa Sūtra that have been controverted by Brahmagupta. These are all astronomical as are, strangely enough, all those quoted by Albiruni. The first purely mathematical quotation we find is by Chaturvēda-Prithūdaṣa Śwāmi who, in his comment on Brahmagupta, says: "What is termed by us 'diameter less arrow,' is by Āryabhaṭa denominated the greater arrow." He then quotes direct from the *Ganita* (see below § 17), and this is possibly the earliest direct reference to it known. According to Colebrooke Chaturvēda was anterior to Bhāskara, being more than once quoted by him. Albiruni (I., 158) also mentions a Prithūdaka-svāmin as an astrologer whom Sachau (II., 308n) identifies with the commentator of the *Brahma Siddhānta*. Sūryadāsa (1541 A.D.), a commentator of Bhāskara, also speaks of Āryabhaṭa, together with "the son of Jishnu" (*i.e.* Brahmagupta) and Chaturvēda as "ancient mathematicians" (*Vij. Gan.*, 128). Brahmagupta nowhere in his mathematical sections mentions Āryabhaṭa, although his subject-matter is, in many cases, identical with that of the *Ganita*. Neither does Bhāskara refer to Āryabhaṭa anywhere in his mathematical works, although Colebrooke says (p. iv): "He repeatedly adverts to preceding writers and refers to them in general terms, where his commentators understand him to allude to Āryabhata, to Brahmagupta, etc."

II.

That the Āryabhaṭa we are dealing with was born about 476 A.D. is now generally accepted as a fact (*Journ. Roy. Asiatic Soc.*, 1864, 392; Kern, *Bṛhat Saṅhitā*, 57; *Journ. Asiatique*, 1878): but still there is an element of doubt about it, and the whole subject is complicated by the question of identification. There were at least two² astronomers of the name of Āryabhaṭa, prior to Albiruni, who clearly distinguishes between them. The younger of these he always designates as Āryabhaṭa of Kusumapura (*India*, I., 176;

¹ Plenty of evidence, indirect though it may be, is given below.

² The author of the *Maha Āryasiddhānta* also calls himself Āryabhaṭa, but according to Kern (*Bṛhat Saṅhitā*, p. 60) this was only a *nomme de guerre*.

246; 316; 330; 335; 370). "This author," he says, "is not identical with the elder Āryabhāṭa, but he belongs to his followers, for he quotes him and follows his example" (i., 246). We infer from Albiruni's remarks that the elder Āryabhāṭa was not of Kusumapura; but Weber, Kern and Bhāu Dāji say distinctly that he was, and the opening verse of the *Ganita* indicates its author as belonging to Kusumapura.

Āryabhāṭa was an innovator. He attempted to free at least one department of knowledge from corrupt beliefs, and, as an almost natural consequence, the orthodox Hindu teachers opposed him. We read (*India*, I., 376) that Brahmagupta was so intolerant that he was blind to the truth "from sheer hatred of Āryabhāṭa, whom he abuses excessively . . . He is rude enough to compare Āryabhāṭa to a worm, which, eating the wood, by chance describes certain characters in it, without understanding them and without intending to draw them. 'He, however, who knows these things thoroughly stands opposed to Āryabhāṭa like the lion against gazelles. They are not capable of letting him see their faces.' In such offensive terms he attacks Āryabhāṭa and abuses him."

The cause of this vilification is Āryabhāṭa's unorthodoxy as is indicated in other passages. For example, Brahmagupta states that Āryabhāṭa's teaching regarding eclipses was not in accordance with the *Veda* and "the book *Smṛiti* composed by Manu and the *Samhita* composed by Garga, the son of Brahma," and that Āryabhāṭa "stands outside of the generally acknowledged dogma and that is not allowed" (*India*, II., 111). "Further," Albiruni writes (I., 373), "Brahmagupta says that Āryabhāṭa considers the four *yugas* as the four equal parts of *caturyuga*. Thus he differs from the doctrine of the book *smṛiti* . . . and he who differs from us is an opponent."

Later Hindu opinion was more favourable, at least in intention. In the sixteenth century Sūryadeva ascribed the acquirement of the elements of astronomy by Āryabhāṭa to supernatural agencies (*Kern*, p. xi), and an article in the *Indian Review* (1905) also suggests divine inspiration: "Divine favour dawned upon him; he was inspired: he gave utterance to a spontaneous outburst of astronomical knowledge, clothed in poetical language. . . . These facts lead the learned to believe that the ten verses were inspired and could not be attributed to human authorship." (*Āryabhāṭa or the Newton of Indian Astronomy*).

Attributions to divine sources were common enough in earlier days. We are told that the Surya Siddhānta was revealed from heaven and communicated to Meva about four million years ago, and that our modern system of arithmetical notation was communicated to the Hindus by the Creator; but to meet with such interpretations in the twentieth century is rather disconcerting.

III.

The most interesting personage connected with Āryabhāṭa is a certain Pulisa. Albiruni couples their names together on many

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occasions; so often, indeed, that had we only Albiruni to rely upon we should hardly be able to distinguish between the two with regard to their work and teaching. They always appear to be in agreement, and are both abused by Brahmagupta. "Āryabhaṭa, Pulisa, Vasishṭha, and Lāṭa agree in this, that when it is noon in Yamakoṭi, it is midnight in Rūm, beginning of the day in Laṅkā, and the beginning of the night in Siddhapura, which is not possible, if the world is not round" (i., 370). "Āryabhaṭa, the elder, and Pulisa compose the *manvantara* from 72 *caturyugas*, etc.," and, "according to Āryabhaṭa and Pulisa, the *kalpa* and *caturyuga* begin with midnight, etc." (i., 370). Regarding Brahmagupta's hatred—"In this respect Āryabhaṭa and Pulisa are the same to him," writes Albiruni (i., 376).

Āryabhaṭa, the younger, speaks highly of the intelligence of Pulisa (*India*, i., 316), and Albiruni was engaged in translating his works. Unfortunately this translation is not available, but, in the *India*, Albiruni gives several direct quotations from the *Pulisa-Siddhānta*. For example (i., 266):—"Pulisa says in his *Siddhānta*: 'Paulisa, the Greek, says somewhere that the earth has a globular shape. Besides, all scholars agree on this head, as Varāhamihira, Āryabhaṭa, etc.'" He quotes a list of the orders of numbers which is almost identical with that given in the *Ganita*, and particulars of a table of sines which are the same as those given by Āryabhaṭa. In his list of Hindu works on astronomy, Albiruni states that the *Pulisa-Siddhānta*, composed by Pulisa, was so called from Paulisa, the Greek, from the city of Saintra, which he supposes to be Alexandria. It has been suggested that this Paulisa is the Paulus of Alexandria who, in A.D. 378, wrote an *Introduction to Astrology*, which has come down to us. One is justified from the circumstances in making the supposition, but the identity is by no means established.

According to Weber, Pulisa was a contemporary of Āryabhaṭa and the two were rivals, while Kern places Pulisa a century before Āryabhaṭa. It is generally supposed that they were both prior to Varāhamihira, but it appears that Pulisa quotes both Āryabhaṭa and Varāhamihira on one occasion and, if this quotation is to be relied upon, we must conclude that Āryabhaṭa was not posterior to Pulisa and that Varāhamihira and Pulisa were contemporaries. But it is very probable that the latter part of the quotation attributed by Albiruni to Pulisa should have more probably been put into the mouth of Albiruni himself. If so, the traditional order—Pulisa, Āryabhaṭa, Varāhamihira—may be accepted as correct.

IV.

The section of Āryabhaṭa's work that deals with mathematics is entitled the *Ganita*. It consists of thirty-three couplets, into which is condensed a great deal of matter. At first sight it seems to be devoid of order and to be a mere jumble of rules; but this apparent confusion disappears, to a certain extent, on closer examination. Starting with the orders of numerals, our author

proceeds at once to involution, evolution (3-5), areas and volumes (6-9). Next comes an astronomical-mathematical section in which he deals with the circle (10-12), shadow problems (13-16), eclipse problems (17-18). Then comes a set of propositions dealing with progressions (19-22), which are followed by some algebraic identities (23-24). The remaining rules (25-23) may be classed as practical applications.

I am inclined to think that Āryabhata intended his mathematical work to be supplementary to what was ordinarily known to Hindu scholars. This hypothesis eliminates many difficulties and, in particular, it explains why Āryabhata made the rather incongruous selection of mathematical rules given in the *Ganita*. Few of these rules deal with the elements of the subject. He evidently takes for granted that his readers are acquainted with the easier problems of mathematics and only gives certain more difficult problems which were, probably, not found in other Hindu works in his time.

Āryabhata's selection must have been determined by the works that were available. What those works were it is now difficult to say, but it is pretty certain that their original source was the later Alexandrian school. The content and form of the *Ganita* remind one of the works of Heron and of Sextus Julius Africanus. Parts of it can be traced indirectly to Ptolemy, to Diophantus, to Theon and others, and no portion of it deals with matter that had not been pretty fully dealt with by the Alexandrians. While there is no evidence which contradicts an ultimate Egyptian¹ origin, there are many points in detail which support this hypothesis.

Āryabhata's work is of interest, principally because it appears to form a connecting link with Alexandria. As a mathematical treatise it ranks neither with the works of the Greeks nor with those of the Muhammadans of the middle ages. In India itself Āryabhata became renowned as an astronomer rather than as a mathematician, and the *Ganita* is seldom directly referred to by Hindu writers. Brahmagupta's work contains very nearly all the matter given in the *Ganita*, but, as it is much fuller, we must conclude that it was not a mere copy. The evidence all points to a common origin of the two works, and the identification of this common origin would not be difficult if we had it before us. As the case at present stands, we cannot come to any very definite conclusion. Possibly Pulisa was the connecting link.

A translation of the *Ganita* together with a commentary is given below.

THE GANITA.

1. *Āryabhata having rendered homage to Brahma, the Earth, the Moon, Mercury, the Sun, Mars, Jupiter, Saturn and the constellations sets forth his knowledge which was well appreciated in the city of Kusumapura.*²

¹ Damascius (circ A D. 500) tells us how "There came Brahmins down to Alexandria to Severus." (Quoted by T. Kennedy, *Journ. Roy. Asiatic Soc.*, 1907, p. 956)

² The translation of the text is printed in italics.

[N.S.]

Āryabhata here uses क्रोण (Greek κρόνος) for Saturn, while elsewhere he uses मनि (i.e., slow moving). Kusumapura is identified with Patnā. Albiruni calls Āryabhata the younger "that one from Kusumapura"; hence an element of doubt as to the authorship of the *Ganita* is introduced. See note above.

2. *Units, tens, hundreds, thousands, tens of thousands, hundreds of thousands, millions, tens of millions, hundreds of millions, thousands of millions.* In these each succeeding place is ten times the preceding.

Albiruni devoted much attention to the subject of *orders* of numbers and wrote a book on it (*India*, i., 174). He quotes the Indian names for eighteen orders (i., 175) and notices the considerable differences between those in vogue and those given by Āryabhata of Kusumapura, and in the *Pulisa-siddhānta*. The important differences, which occur after the fifth order, are exhibited in table below:—

Orders.	A. <i>Ganita</i>	B. <i>Ar. of Ku.</i>	C. <i>Pul. Siddh.</i>	D. <i>Albiruni.</i>	E. <i>Bhāskara.</i>
10 ⁰	Eka	...	...	Ekam	Eka
10 ¹	Dasau	...	...	Dasam	Dasā
10 ²	Sata	...	...	Satam	Sata
10 ³	Sahasra	...	Sahasram	Sahasram	Sahasra
10 ⁴	Ayuta	Ayutam	Ayutam	Ayuta	Ayuta
10 ⁵	Niyuta	Niyutam	Niyutam	Laksha	Laksha
10 ⁶	Prayuta	Prayutam	Prayutam	Prayutam	Prayuta
10 ⁷	Koti	Koti padma	Koti	Koti	Koti
10 ⁸	Arbuda	Parapadma	Arbudam	Nyarbuda	Arbuda
10 ⁹	Vrinda ?	...	Kharva	Padma	Padma
10 ¹⁰	...	...	...	Kharva, &c., to 10 ¹⁷	Kharva, &c., to 10 ¹⁷

The term *vrinda* was probably not the name of a definite order, but simply meant a great number. If this is true, the *Ganita* list is identical with that of the *Pulisa-siddhānta*. In the older lists with the fifth order, a new nomenclature commences, and, according to Rodet, "Les Grecs seuls au monde ont fait de la myriade l'unité numérique de second ordre."

In the *Gitikā* a peculiar notation is used, which does not occur in the *Ganita*. This notation is best exemplified by quoting

the tenth couplet of the *Gītikā* in which a table of differences of sines is given:—

मखि भखि फखि धखि णखि जखि डखि हखि स्वकि क्रिया प्रथकि क्रिध्व
 छलकि क्रिय हका घाहा स स्या श्म ड् ल्क प्र फ क् कलार्थच्याः ॥

225, 224, 222, 219, 215, 210, 205, 199, 191, 183, 174, 164, 154, 143, 131, 119, 106, 93, 79, 65, 51, 37, 22, 7, are the half-chords in minutes.

Other examples given in the *Gītikā* are as follows:—

खुघु = 4,320,000. चयगियिडुशुक्लु = 57,753,336.

डिशिषुणरुष्ट = 1,582,237,500; etc.

These examples give us the key to the notation which may be exhibited thus:—

क ख ग घ ङ च छ ज झ ञ ट ठ ड ढ ण त
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

य द ध न प फ ब भ म य र
 17 18 19 20 21 22 23 24 25 30 40

ल व श ष स ह
 50 60 70 80 90 100

कि कु कृ खि गि घि
 100 10,000 1,000,000, etc., 200 300 400, etc.

Usually the texts give a verse explaining this notation, but this explanatory verse is not Āryabhata's.

In the *Ganītā* there is no kind of notation used strictly speaking. The only place where it could possibly occur is in the formula that gives the value for π (§ 10).

No measures of any kind are referred to in the *Ganita*, but in the *Gītikā* it is stated that 1 *yōjana* = 8,000 *nri* (*puruṣa*), and that 1 *nri* = 4 *hasta* = 96 *āṅgula*. This table exhibits a remarkable similarity with the change ratios used by the Greeks, and if the length of the *yōjana* is as given by Fleet (*Journ. Roy Asiatic Soc.*, 1907, p. 656), 9'09" miles, there is a still more remarkable similarity between the actual lengths used by Āryabhata and the Greeks. These close relationships are shown in the following tables:—

	Āṅgula.	Hasta.	Puruṣa.	Yōjana.	Approximate length in English measures.
Āṅgula	1	...	...	...	75 inches.
Hasta	24	1	...	...	18'00 "
Puruṣa	96	4	1	...	72'00 "
Yōjana	3,072,000	32,000	8,000	1	9'09 miles.

	Daktulos.	Pexus.	Orguia.	Approximate length in English measures.
Daktulos ...	1	...	...	75 inches.
Pexus ...	24	1	...	18'00 "
Orguia ...	96	4	1	72'00 "

The approximate lengths in the first table are calculated from the length of the *yōjana* given by Dr. Fleet, and in the second are taken from Dr. Smith's Classical Dictionary. Other Hindu tables do not agree so closely with Aryabhata.

3. *A square is a figure having all the four sides equal and its area is the product of two equal numbers.*

The product of three equal numbers is a cube and it also has twelve edges.

Euclid, in his seventh book, gives the following definitions:—

"Two numbers multiplied together produce another which is called a plain number, while the numbers which were multiplied together are called sides."

"Three numbers multiplied together produce another which is called a solid number, while the numbers which were multiplied together are called sides." (11., 187 Heiberg et Menge.)

4. *Square having been subtracted from square always the non-square must be divided by double the square root. The quotient in a place set apart is the root.*

To this and the following rule, Rodet attached undue importance. He was led to think that the rule implies a knowledge of our modern system of arithmetical notation; but he was led to this conclusion by the commentators of the *Lilāvati*, and by the practice followed by Hindu mathematicians in the fifteenth century.¹ The rule, as it stands, is perfectly general and applies to all notations. Theon, of Alexandria, gave a similar rule admirably expressed, which applied to the sexagesimal notation; but the Greeks used sexagesimal fractions generally in astronomical problems only and were able to obtain in ordinary fractional notation very accurate results in the extraction of square roots.

Brahmagupta does not give this rule at all, although he gives the next one, relating to cube-roots, word for word. It may be noticed also that Bhāskara does not usually employ the general rule. His examples are as follows: First "Square 9; 14; 297; 10005. Answers—81; 196; 88209; 100100035." Then, "Find the square roots of 4; 9; 81; 196; 88209; 100100025. Answers: The roots are 2; 3; 9; 14; 297; 10005." (*Lilāvati*, ii., 20-21.)

To the present day those Hindus, who are taught on purely indigenous lines, learn tables of squares to a prodigious extent. These enormous tables are a relic of the times when the modern 'place-value' notation was unknown. (See *Journ. Asiatic Soc. Bengal*, 1907, p. 495.)

¹ Rodet appeared to modify his views afterwards. He asks (*Journ. Asia tique*, 1880): "Aryabhata effectuait-il encore ses calculs sur l'abaque The answer is 'No.' The Hindus did not generally use the abacus which was and is almost unknown to them except as a recent foreign introduction.

5. *Multiply the square of the root of the cubic quantity by three, and divide the second non-cubic part by the product. Multiply the square of this by three times the preceding and subtract the product from the first non-cubic. Then the cube is to be subtracted from the cube.*

Like the preceding rule this is perfectly general (*i.e.*, algebraical) and applies to all arithmetical notations. Brahmagupta gives the rule as follows:—"The divisor for the second non-cubic is thrice the square of the cube root. The square of the quotient, multiplied by three and the preceding, must be subtracted from the next; and the cube from cubic; the root." (*Colebrooke*, p. 280.)

Neither Āryabhaṭa nor Brahmagupta gives examples; while those given by Bhāskara are similar to those he gives for square roots.

6. *The area produced by a trilateral is the product of the perpendicular that bisects the base and half the base.*

The half of the product of this by the height is the solid with six edges.

The first part gives the area of an isosceles triangle, not as Rodet states, of the general triangle. The second part gives inaccurate rule for finding the volume of a triangular pyramid. Rodet says; "J'ai longtemps hésité à admettre la bonne conservation du texte en cet endroit; mais le vers est parfaitement régulier, et on ne saurait, sans le rendre boiteux, substituer le tiers à la moitié du produit. . . Il faut donc accepter comme authentique l'énoncé de notre auteur, et y voir une preuve, conservée fidèlement à travers les âges, de son ignorance en géométrie de l'espace, ignorance dont nous aurons une preuve nouvelle dans un instant, à propos du volume de la sphère. Et alors, le maintien de ces fautes grossières, qui eussent pu être corrigées, ou tout au moins relevées, par les commentateurs disciples de Bhāskara, nous est un garant très précieux de la servilité avec laquelle les copistes nous ont transmis intact le texte primitif d'Āryabhaṭa." (p. 20.)

Brahmagupta does not give a rule for the volume of a pyramid, and Bhāskara gives it only as a sort of rider (*Lil.*, 221).

Āryabhaṭa again gives a wrong formula in the case of the volume of a sphere, while Brahmagupta and Bhāskara both give the same inaccurate formula for the volume of a cone. (*Br. VII.*, 50; *Lil.* 223.)

It is hardly necessary to state that the correct rules for these cases were known to the Greeks, although it may be pointed out that Heron falls into error in finding the volume of a truncated pyramid.

M. bin Musa gives the correct formula for the volume of a pyramid. He could not very well have copied it from the Hindus.

7. (a) *Half the circumference multiplied by the radius gives the surface of the circle.*

(b) *This last multiplied by its own root is the exact volume of the sphere.*

[N.S.]

(a) The first rule was, of course, well known to the Greeks: Heron gives it in this form. An attempt to find, by practical means, a circle equal in area in a given square is exhibited in the *Sulvasutras* (Thibaut in *Journ. Asiatic Soc. Bengal*, 1875, 253).

Brahmagupta's rule is: "The square of the diameter multiplied by three is the practical area; the square root extracted from ten times the same is the real value." (XII., 40.)

M. ibn Musa says: "The area of any circle will be found by multiplying the circumference by half the diameter; since in every polygon of equal sides and angles, such as triangles, quadrangles, pentagons and so on, the area is found by multiplying half the circumference by half the diameter of the middle circle that can be drawn through it." (*Rosen*, 72.)

(b) The formula for the volume of a sphere is not even approximately correct. It may be expressed thus:—Volume = $\pi r^3 \sqrt{\pi r^2}$. This would give $\pi = 16/9$. Strangely enough Ahmes gave the value $\pi = (16/9)^2$. Suppose Ahmes' value to be correct, then the area of a circle would be $(16/9)^2 r^2$ which, multiplied by $(4/3)r$ would give the volume of the sphere. It looks as though $\frac{4}{3}r$ had, by mistake, been taken as the root of $(\frac{16}{9})^2 r^2$.

Rodet writes: "La formule qu'il donne pour le volume de la sphere $R^3 \sqrt{\pi^3}$ n'est même pas une approximation numérique . . . Mais elle a, pour l'histoire des mathématiques, d'autant plus de valeur, parce qu'elle nous démontre que si Āryabhata avait reçu quelque enseignement des Grecs, il ignorait au moins les travaux d'Archimède." I do not for a moment think that Āryabhata had direct access to the works of Archimedes, but it is quite possible that Āryabhata's incorrect rule was indirectly derived from the great mathematician's formula.

It is doubtful whether Archimedes was known in Āryabhata's time even to the ordinary Alexandrian mathematicians. He was out of fashion amongst the degenerates of that age.

8. *Each of the two sides multiplied by their distance apart and divided by their sum gives the lines from the point of intersection.*

By multiplying half the sum of the sides by their distance apart the area of the figure is found.

Let $ABCD$ be any trapezium, having the sides AB and CD parallel, then the triangles AEB and CEB (E being the point of intersection of the diagonals) will be similar and

$$AE : EC :: AB : DC$$

from which we get

$$AE = AC \cdot AB / (AB + DC)$$

and similarly

$$A'E' = A'C' \cdot AB / (AB + DC)$$

where $A'C'$ is the perpendicular to the parallel sides through the point of intersection

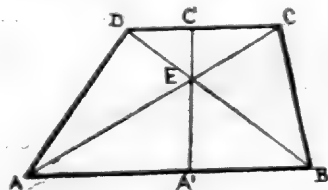


Fig. 1.

of the diagonals. It appears that the latter case only is here intended; but Brahmagupta gives the more general case also. Here is Colebrooke's translation of Brahmagupta's rule: "At the intersection of the diagonals, or the junction of a diagonal and a perpendicular, the upper and lower portions of the diagonal, or of the perpendicular and diagonal, are the quotients of those lines taken into the corresponding segment of the base and divided by the complement of the segments." (XII., iv., 25.) Chrishna's example is an isosceles trapezium, and it may be remarked that the isosceles trapezium was a favourite figure with Ahmes and that Heron devoted nine chapters of his geometry to it: in the *S'ulvasūtras* also we find that the traditional shape for the Vedi at the Soma sacrifice is also a trapezium with equal flanks.

9. (a) *Universally the area of a figure is obtained by multiplying the sides.*

(b) *The chord of the sixth part of the circumference is equal to the semi-diameter.*

(a) Rodet suggests that this means that the area of a rectilinear figure may be obtained by decomposing it into a succession of trapeziums.

(b) Euclid IV., 15. Heron gives a rule that the sides of a polygon inscribed in a circle is equal to three diameters divided by the number of sides. This is, of course, true only in the case of the regular hexagon.

10. *Add four to one hundred, multiply by eight and add again sixty-two thousand: the result is the approximate value of the circumference when the diameter is twenty thousand.*

This gives $\pi = 62832/20000 = 3927/1250 = 3\frac{177}{1250} = 3.1416$.

A great deal has been made of this statement on account of its extreme accuracy, and it has often been said that this accurate result was the discovery of the Hindus, if not of Āryabhata himself. But this cannot be true. According to Albiruni (Ī., 168) Pulisa employed the ratio of 1: $3\frac{177}{1250}$. Archimedes proved that the ratio is less than $3\frac{1}{7}$ and greater than $3\frac{0}{71}$; Ptolemy used the value $377/120 (=3.141\bar{6})$. Brahmagupta gives the values 3 and $\sqrt{10}$; M. ibn Musa not only gives the value 62832/20000, but also gives a summary of Archimedes' proof, and it is absolutely certain that M. ibn Musa did not copy this from the Hindus. According to Albiruni (I., 169) Ya'kub ibn Tarik used $3\frac{177}{1250}$. Bhāskara gives 3927/1250. (See *Journ. Asiatic Soc. Bengal*, 1907, p. 500).

Brahmagupta finds fault with Āryabhata the elder for using in one place the value $3393/1080 (=3.141\bar{6})$, i.e., Ptolemy's value, and in another $3393/1050 (=3.23\dots)$. No early Hindu mathematician quotes Āryabhata as using the value given in the text. In practical applications¹ where the value of π is required, the Hindu

¹ Calculated from these practical applications the value of the ratio would be: Āryabhata $\pi=1.7$; Brahmagupta $\pi=3$; Bhāskara $\pi=3$. See also the *Surya Siddhānta* (Ed. Burgess, E. J., Am. Or. Soc. i., 58) and the *Pañcha Siddhāntikā* (Ed. Thibaut, iv., 1), and Warren's *Kala Sankalita* (p. 92).

mathematicians generally fall into error (see § 7 above). Albiruni writes (I, 167): "The elements of the calculations of the Hindus on the circumference of the circle rests on the assumption that it is *thrice the diameter.*"

11. *If the fourth part of a circle be cut by a triangle and quadrilateral, the semi-diameter is divided into as many half chords of arcs as we choose.*

12. (a) *If the first and second be bisected in succession the sine of the half chord is obtained.*

(b) *The differences are diminished by successive quotients by the first sine.*

These rules are obscurely expressed and difficult to translate. Rodet confessed he did not understand the former, and left the first part of the latter untranslated. They may be simply a rough attempt at the enunciation or application of Ptolemy's theorem: but possibly something like the following is meant: Let OP (Fig. 2) be a square, then P bisects the arc BA . Let OQB be an equilateral triangle, then Q trisects the arc AB ; and the angle $OPQ = 15^\circ$. Now if the angles OPB and OQB are bisected in V and U , then the angle OVU is $7\frac{1}{2}^\circ$. This bisected is $3\frac{3}{4}^\circ$, which is the required angle.

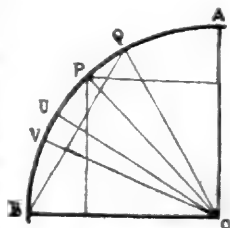


Fig. 2.

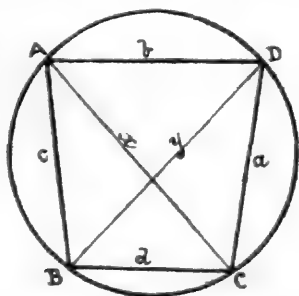


Fig. 3.

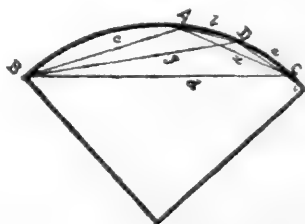


Fig. 4.

The theorem of Ptolemy referred to is: In a quadrilatera inscribed in a circle, the rectangle contained by the diagonals is equal to the sum of the two rectangles contained by its opposite sides. Thus (Fig. 3) $ac + bd = xy$, and in the particular case when y bisects B we have $c + d = xy/a$, and it was this particular case (which was known to Euclid) that provides the rule (12b) of the text.

If (Fig. 4) $\text{arc } AD = \text{arc } DC = \gamma$ and $\text{arc } BA = (n-1)\gamma$ then $\text{arc } BD = n\gamma$ and $\text{arc } BC = (n+1)\gamma$, and we have

$$chd (n+1)\gamma + chd (n-1)\gamma = (chd n\gamma \cdot chd 2\gamma) / chd \gamma$$

and $\sin (n+1)\gamma + \sin (n-1)\gamma = (\sin n\gamma \cdot \sin 2\gamma) / \sin \gamma$

from which we get

$$\sin (n+1)\gamma - \sin n\gamma = \sin n\gamma - \sin (n-1)\gamma - \sin n\gamma / \sin \gamma$$

by substituting the values of $\sin 2\gamma$ and $\sin \gamma$, when $\gamma = 3\frac{1}{2}^\circ$, given in the table.

The last formula may be expressed—

$$D_{n+1} = D_n - \sin \gamma / \sin \gamma,$$

which is the rule given in the text (12b).

Āryabhata gives the corresponding table of differences of sines in the *Gitikā* (§ 10). In the *Sūrya Siddhānta* the matter is expressed thus (II, 15): “The eighth part of the minutes of a sine is called the first sine; that, increased by the remainder left after subtracting from it the quotient arising from dividing it by itself, is the second sine. Thus, dividing the tabular sines in succession by the first and adding to them, in each case, what is left after subtracting the quotients from the first, the result is twenty-four tabular sines in order as follows”: then follows the table of sines which corresponds exactly with Āryabhata’s table of differences.

In the *Pañchasiddhāntikā* (iv., 3) the following methods are given: “In order to find the remaining desired (sines) take the double of the arc, deduct it from the quarter, diminish the radius by the sine of the remainder, and add to the square of half of that the square of half the sine of double the arc. The square root of that sum is the desired sine Another method is also taught here. Lessen the radius by the sine of three signs from which double the required arc has been previously deducted and multiply the remainder by sixty; the result is the square.”

These rules may be expressed thus:—

$$4 \sin^2 \gamma = \sin^2 2\gamma + (1 - \sin (90 - 2\gamma))$$

and

$$r^2 \sin^2 \gamma = r(r - \gamma \sin (90 - 2\gamma)).$$

As Dr. Thibaut has shown, these methods are not essentially different. Ptolemy proved that

$$(\text{chord } \gamma)^2 = 120 (60 - \frac{1}{2} \sqrt{120^2 - (\text{chord } 2\gamma)^2})^2$$

from which the second formula given in the *Pañchasiddhāntikā* is obviously derived.

Using the formula given by Āryabhata and in the *Sūrya Siddhānta*, we find that only five of the sines¹ following the first can

¹ The term *sine* is here not used quite in the modern sense. The term used by the Hindus was $\sqrt{r^2 - a^2}$ or *half-chord*, and like Ptolemy’s *chord* it is not a ratio but a length. Strictly $r \sin A = \text{chord } 2A/2$, but the relation used by

be obtained by its means, and that with the seventh sine begins a discordance between the table and the result of calculation by the rule which finally amounts to as much as 70 minutes. It follows, therefore, that either the rule was used, but corrections were made by the aid of other tables, or the table was copied wholesale.

In the *Pañchasiddhāntikā* is given a table that was obviously deduced from Ptolemy's table of chords (J. Burgess in *Ind. Ant.* 1891, 228). Ptolemy's table increased by half degrees and he divided the radius into sixty equal parts and subdivided it sexagesimally. The *Pañchasiddhāntikā* table is obtained by simply dividing Ptolemy's chords by two, and hence the term *half-chord*. This table is only for twenty-four angles at intervals of $3\frac{3}{4}$ degrees. Āryabhaṭa and the compilers of the *Sūrya Siddhānta* express their results in a sort of circular measure, and to obtain them from Ptolemy's chords it is simply necessary to multiply by $3/2\pi$; for whereas Ptolemy made the radius equal to 60° , the Hindus made it equal to $90^\circ \times 2\pi$. In Ptolemy's measure $J90^\circ = \text{chord } 180^\circ/2 = 120^\circ/2$, while in Āryabhaṭa's measure $J90^\circ = 90^\circ \times 2\pi$; therefore to change chord 180° to $J90^\circ$ we have $120^\circ \times C = 90^\circ \times 2/\pi$ or the change ratio $C = 3/2\pi$.

Āryabhaṭa has $J90^\circ = 3438'$, therefore $10800'/\pi = 3438'$ which gives $\pi = 3.141361 \dots$ Rodet puts the matter thus: $10800/3.1416 = 3437.7 = 3438$ nearly and concludes that the ratio 3.1416 was used; but this is not quite ingenuous. We might replace this value by Ptolemy's value and then we should have $10800 \times 120/377 = 3437.66 = 3438$ nearly and just as forcibly conclude that Ptolemy's value was used. Indeed, Ptolemy's value was most probably used in the reducing factor, but when the reduction took place is not easy to determine. There were two stages in the process: first, as in the *Pañchasiddhāntikā*¹ the chords of Ptolemy were simply halved, and the old measure for the radius ($=60^\circ$) retained; secondly, the new measure for the radius ($=3438'$) was introduced. This new measure first occurs in the *Paulīsa-siddhānta*, for Albiruni writes (i., 275): "Our calculation is based on this, that the *sinus totus* is 3438' The source of this calculation is the *Paulīsa Siddhānta*, which divides the arc of the quarter of a circle into 24 *kardajāt*. He says: 'If anybody asks for the

Āryabhaṭa may be put as 'sin A' = chord $2A/2$. The Hindu 'sine' is a projection of the chord. Putting J for the so-called Hindu sine a correct relation is $J A = \frac{\text{chd } 2A}{2}$.

¹ This portion (Ch. iv) of the *Pañchasiddhāntikā* is generally allotted to the *Paulīsa Siddhānta*, but there is an element of doubt about it. Dr. Thibant says (p. x.): "I am more doubtful about the position of chapter IV, which, in the colophon, is merely counted as such, without any special designation It is not improbable that here also Varāha Mihira sums up, in his own fashion, whatever he found of value in the corresponding chapter of the Romaka, Paulīsa and Sūrya Siddhāntas. On the other hand, as the fourth chapter follows and precedes chapters devoted to the Paulīsa Siddhānta, it is not impossible that its contents are meant to sum up the teaching of that Siddhānta only."

reason of this, he must know that each of these *kardajāt* is $\frac{1}{96}$ of the circle and equals 225 minutes.'” Albiruni, in explaining another quotation from Pulisa, again refers to this matter (ii., 74): “The last-mentioned two numbers are products of the multiplication of the *yōjanas* of the sun and moon by 3438, which is the number of minutes in the *sinus totus*.”

The historical order of the development of these tables is Hipparchus, Ptolemy, Paulisa, Pulisa; and very probably Āryabhata obtained his results from Pulisa.

The part of the following extract that I have put in italics is quite untrue, otherwise the passage is pertinent to the matter in hand:—

“The earliest institution of the sines in calculations for the chords, which were employed by the Greeks, is generally attributed to the Arab astronomer Albatgenius (al-Battāni), who flourished in the latter part of the ninth century of our era. It can hardly admit of question, however, that the sines had already at that time been long employed by the Hindus. And considering the derivation of the Arabs from India of their system of notation, and of so many of the elements of their mathematical science, it would seem not unlikely that the first hint of this so convenient and practical improvement of the method of calculation may also have come from that country. This cannot be asserted, however, with much confidence, because the substitution of the sines for the chords seems so natural and easy, that it may well have been hit upon independently by the Arabs: it is a matter of astonishment, as remarked by Delambre, that Ptolemy himself, who came so near it, should have failed of it. If Albatgenius got the suggestion from India he, at any rate, got no more than that. His table of sines, much more complete than that of the Hindus, was made from Ptolemy’s table of chords by simply halving them. The method, too, which in India remained comparatively barren, led to valuable developments in the hands of the Arab mathematicians.” (*Sūrya Siddhānta*, E. Burgess, p. 200.)

The accompanying table shows the close connection between the chords of Ptolemy, the *Pañcasiddhāntikā* sines, and the table of differences given by Āryabhata.

13. *The circle is produced by a rotation; the triangle and rectangle are each determined by their hypotenuse, the horizontal by water and the vertical by the plumb-line.*

This serves as an introduction to a section which deals with shadow problems. It is doubtful whether the Hindus used sundials for telling the time, and it appears that they probably had only a theoretical acquaintance with them. Brahmagupta gives a crude method for calculating the time of the day from the length of shadows, but for any advance in this direction we must look to the Muhammadans. In India a simple form of clepsydra has generally been preferred. (See *Pañcasiddhāntikā* xiv., 31f; *Sūrya Siddhānta* xii., 23; *Indica* i., 337, 339; *Ethnographic Notes in S. India*, Thurston, 562 f.)

ARCS.	A. Aryabhata and Sur. Sidd.	B. Chds. of Ptolemy re- duced to '	C. Paul. Sidd. sines in '	D. Correct sines in '
a	3° 45'	225	225	225 a
b	7° 30'	449	449	449 b
c	11° 15'	671	671	671 c
d	15°	890	890	890 d
e	18° 45'	1105	1105	1105 e
f	22° 30'	1315	1316	1316 f
g	26° 15'	1520	1520	1520 g
h	30°	1719	1719	1719 h
i	33° 45'	1910	1910	1910 i
j	37° 30'	2093	2093	2093 j
k	41° 15'	2267	2267	2267 k
l	45°	2431	2431	2431 l
m	48° 45'	2585	2585	2585 m
n	52° 30'	2728	2727	2727 n
o	56° 15'	2859	2858	2858 o
p	60°	2978	2977	2977 p
q	63° 45'	3084	3083	3083 q
r	67° 30'	3177	3176	3176 r
s	71° 15'	3256	3255	3255 s
t	75°	3321	3321	3321 t
u	78° 45'	3372	3372	3372 u
v	82° 30'	3409	3409	3408 v
w	86° 15'	3431	3430	3430 w
x	90°	3438	3438	3438 x

Column A is taken from the table of differences given in the *Gītika* quoted above, and is identical with the table given in the *Sūrya Siddhāntā*. Column B is obtained from Ptolemy's table of chords by multiplying by 47745 $\left(= \frac{3}{2} \cdot \frac{120}{377} \right)$. Column C is obtained from the *Pañchasiddhāntikā* by multiplying by 4775 $\left(= \frac{3}{2 \times 3 \cdot 1416} \right)$ i.e., using the value of π attributed to Aryabhata. If Ptolemy's value had been used in this case also, the agreement with column B would have been closer.

The following extracts will serve as a comment on this rule, which is connected with the construction of some form of dial:—

“Having, by means of water, levelled a raised surface, on which the directions are marked, and having placed on its southern side a gnomon of the same measure as the surface, etc.” (*Pañch. Siddh.* xii., 30.) “On a stony surface, made water-level, or upon hard plaster made level, there draw an even circle of a radius equal to any required number of the digits of the gnomon Draw a circumscribing square, by means of lines going out from the centre The square-root of the sum of the squares of the gnomon and shadow is the hypotenuse” (*Sur. Siddh.* iii., 1f.)

“The fundamental arrangements of all instruments depend upon strings, water, and bits of earth. By means of them one may make, on a level surface, instruments shaped like a tortoise, a man and so on.” (*Pañch. Siddh.* xiv., 27. See also *Sur. Siddh.* xii., 19-23 and Warren’s *Kala Sankalita*, p. 92.)

14. *The square-root of the sum of the squares of the length of the style and shadow is the radius of its circle.*

This rule occurs, in some form or other, in all the early Hindu mathematical works in connection with shadow problems. In other works than this the reference to the circle is omitted, but the rule cannot be a mere statement of the Pythagorean theorem, and I am inclined to believe that it has a definite connection with the subject in hand. All the shadow problems given by Āryabhata and Brahmagupta relate to vertical gnomons, but the following passage in the *Pañchasiddhāntikā* shows that the Hindus were at least acquainted with the inclined gnomon: “The observer, placing his eye at the base of the straight gnomon, is to incline it in such a way that the top of the gnomon is in a straight line joining the eye and the pole star.” (xii., 31.)

Now the equinoctial shadow of a vertical gnomon gives the latitude of a place, *i.e.*, the tangent of the latitude is equal to the shadow divided by the gnomon; and to mark out the hour angles on an ordinary sun-dial, it is necessary to describe two circles, one of which has its radius equal to the vertical gnomon and the other with radius equal to the hypotenuse of the triangle formed by the equinoctial shadow and the gnomon. It is this circle whose radius is the “the square-root of the sum of the squares of the length of the style and shadow” that is referred to in our text.

15. *Multiply by the style the distance between the style and the height and divide by the difference between the style and the height; the quotient obtained will give the shadow reckoned from the origin of the style.*

Brahmagupta gives the same rule thus: “The distance between the foot of the light and the bottom of the gnomon, multiplied by the gnomon of given length, and divided by the difference between the height of the light and the gnomon is the shadow.” (XII., ix., 53.)

16. *Multiply by the shadow the distance between the ends of the shadows and divide by the difference: this will give the side. This height multiplied by the style and divided by the shadow gives the other side.*

17(a). *And so the square of the height with the square of the base gives the square of the hypotenuse.*

Here the style ST (Fig. 5) is supposed to be moved to $S'T'$. Now $OL : ST :: OH : SH$ and $OL : S'T' :: OH' : S'H'$ but $ST = S'T'$ therefore $OH : SH :: OH' : S'H'$, whence $OH = SH$. $HH' / (S'H' - SH)$ as expressed by the rule.

“According to Pliny and Diogenes Laertius, Thales ascertained the height of pyramids and similar edifices by measuring their shadows at that hour of the day when a man's shadow is of the same length as himself. Plutarch, however, puts into the mouth of Niloxenus a different account of the process. ‘Placing your staff at the extremity of the shadow of the pyramid,’ says he to Thales, ‘you made, by impact of the sun's rays, two triangles, and so showed that the pyramid was to the staff as the shadow to the staff's shadow.’ This is obviously only another calculation of the *segt*” (Gow, 142) and is identical with the rules 15 and 17a given by Āryabhata.

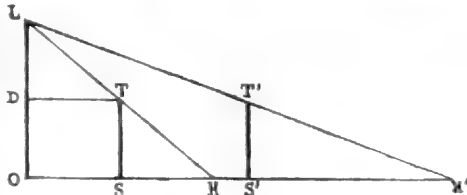


Fig. 5.

17(b). *In the circle the product of the arrows is the square of the semi-chord of the arc.*

18. *Two circles diminished by the ‘bite’ multiplied separately by this ‘bite’ and divided by the sum of the circles less the ‘bite’ give respectively the arrows starting from the intersection.*

The ‘arrows’ are the segments of the diameter bisecting the arc. Thus in the circle FAB the arrows are FE and ED . The word ‘bite’ is here applied to CD , and is suggested by the legend of Rahu, who is supposed to cause eclipses by devouring the sun or moon. The former rule is a particular case of Euclid iii., 35. The latter (18) is easily deduced therefrom and means:—

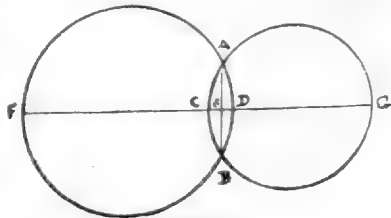


Fig. 6.

$$OE = CD (FD - CD) / (FD - CD + CG - CD)$$

and that

$$ED = CD (CG - CD) / (FD - CD + CG - CD)$$

or

$$CE = CD.FC / (FC + GD) \text{ and } ED = CD.GD / (FC + GD).$$

For from 17(b) we get

$$FE.ED = GE.EC \text{ or } ED/CE = (CD + ED) / (FC + CE),$$

whence

$$ED/CE = GD/FC \text{ and } ED/CD = GD / (FC + GD).$$

Brahmagupta, M. ibn Musa and Bhāskara use terminology similar to that of Āryabhata. Brahmagupta gives the same matter as Āryabhata slightly amplified (XII., iv., 41-43). M. ibn Musa says: "If you want to ascertain the circle to which it belongs, multiply the moiety of the chord by itself, divide it by the arrow and add the quotient to the arrow, the sum is the diameter of the circle to which this bow belongs. If you want to compute the area of the bow,¹ multiply, etc." (*Rosen*, p. 75).

Obviously the source of information is the same in all three cases, and obviously M. ibn Musa did not get his rules through the Hindus, who nowhere, before his time, dealt with the area of segments of circles.

19. (a) *That sought diminished by one and halved added to the foregoing and multiplied by the common difference added to the first term gives the mean: this result multiplied by that sought is the answer.* (b) *Or you multiply the first and last by half the number of terms.*

We are here introduced to a set of propositions on progressions, etc., which, in some respects, correspond pretty closely to those given by Hypsicles and Diophantus. Brahmagupta (XII., iii., 17-20) gives practically the same rules as Āryabhata, with the exception of that expressed above (19a), which occurs neither in Brahmagupta nor Bhāskara. This rule may be stated as follows: Let S be the sum of the terms of an arithmetical progression starting from the $(p+1)$ th term and ending with the $(p+n)$ th, then

$$\begin{aligned} S &= (p+n)\{a + (a+n-1)d/2\} - p\{a + (p-1)d/2\} \\ &= n \left\{ a + \left(\frac{n-1}{2} + p \right) d \right\} \end{aligned}$$

If we put $p=n$, we get $S-S_n = n^2d$, which was given by Hypsicles in the second century B.C.

¹ After Theon of Alexandria.

[N.S.]

The second rule (19b) appears to be out of place, and can hardly have been intended to apply only to the particular case of 19a when $p=0$ as, of course, it does.

20. *The number of terms: Multiply (the sum) by eight times the common difference, add the square of the difference between twice the first term and the common difference: the square-root diminished by twice the first term and divided by the common difference with one added take one half.*

The rule means

$$n = \frac{1}{2} \left\{ \sqrt{\frac{8dS + (2a-d)^2 - 2a}{d}} + 1 \right\}$$

which may be obtained directly from

$$S = n \left(a + \frac{n-1}{2} d \right).$$

Diophantus in his *Polygonal Numbers* gives this rule in the form $8dS + (d-2)^2 = \{d(2n-1) + 2\}^2$ which is identical with Āryabhaṭa's formula except that the first term is unity. Alkarkhi, whose work is based on that of Diophantus, gives a good number of solutions of which the following are particular examples: (i) $3 + 5 + 7 + \dots$ (n terms) = 255, $n = 15$; (ii) $10 + 15 + 20 + \dots$ (n terms) = 325, $n = 10$. Brahmagupta (XII., iii., 18) and Bhāskara (*Lil.* v., 125) give the same rule, but give no examples.

21. (a) *The common difference and the first term being unity, take the number of terms for the first factor and one for the increase and multiply together thrice and divide by six: it is the volume of the pile.* (b) *Or the cube of the number of terms plus one minus its root.*

These are rules for finding the contents of a pile with a triangular base, which may be expressed thus:

$$(a) P = n(n+1)(n+2)/6. \quad (b) P = \frac{(n+1)^3 - (n+1)}{6}.$$

As Rodet remarks, it appears strange that Āryabhaṭa should give the correct formula here, while he gives an incorrect rule for finding the volume of a pyramid (§ 6). The only conclusion is that Āryabhaṭa did not recognise the connection between the two rules.

These and similar problems were favourites with the Greeks (cf. Nicomachus, p. 89f, ed. Hoche; Boetius, p. 107, ed. Friedlein; Archimedes *On Spirals*, prop. x.; Alkarkhi, p. 60, etc.). Alkarkhi points out the identity between the formula (a) in (b). Brahmagupta (XII., iii., 19) gives the rule for a pile with a square base and connects this with the sum of the squares of the natural numbers. He also gives the rule for the sum of the cubes. Alkarkhi gives elegant demonstrations of these rules.

22. Take the sixth part of the product of the three factors made up of the last term, the last term plus one, and of this plus the number of terms: the result is the volume of the pile of squares. The square of the pile is the volume of the pile of cubes.

The first part means $P = n(n+1)(2n+1)/6$ and the second $(1+2+3+4+\dots+n)^2 = 1^2+2^2+3^2+4^2+\dots+n^2$.

See Alkarkhi (p. 61); Brahmāgupta (XII., iii., 20); etc., etc.

23. If from the square of a sum is taken the sum of the squares the half of the result is the product of the factors.

24. From a product multiplied by the square of two and increased by the square of the difference extract the root: add and subtract the difference. The two factors are obtained by dividing by two.

The former of these in our notation is $(a+b)^2 - (a^2+b^2) = 2ab$, the latter

$$\sqrt{4ab + (a-b)^2} + (a-b) = 2a \text{ or } \sqrt{4ab + (b-a)^2} + (b-a) = 2b.$$

This appears to be a fragmentary section on identities. It corresponds somewhat to a fuller section of Alkarkhi's entitled "Theorems that help to solve difficulties," which contains a number of identities corresponding pretty closely to the second book of Euclid. The chief use of these identities was to help to solve indeterminate equations of the second degree.

The first of the above formulae (23) is an expression of Euclid II., 4. The second $(a-b)^2 + 4ab = (a+b)^2$ (Euclid II., 8) is used by Diophantus, in his section on Polygonal Numbers.

25. The interest on the original sum plus the interest on that is multiplied by the time (and the original sum) and increased by the square of half the original sum: take the square root, deduct half the original sum and divide by the time. The result is the interest on the amount.

We have the relation *Discount + Interest on discount = Interest on amount* or $Prt + Prt. rt = M$ where P is what is termed the present worth, r the rate of interest, t the time, and M the interest on the amount. The problem here solved is: Given P , M and t find r or rather Pr . Solving $Prt + Prt. rt = M$ for r we get

$$r = \sqrt{M/Pt^2 + (1/2t)^2} - 1/2t$$

and

$$Pr = \frac{\sqrt{MP + P^2/4} - P/2}{t} =$$

$$\frac{\sqrt{Pt(Pr + Pr. rt) + P^2/4} - P/2}{t}$$

which is the rule given by Āryabhaṭa.

Brahmagupta has (XII, ii, 15) the following rule: "The product of the time and principal divided by the further time is twice set down. From the product of the one by the mixt amount, added to the square of half the other, extract the square root; that root less half the second, is the interest of the principal." In symbols

$\sqrt{M'Pt'/t + (Pt'/2t)^2} - Pt'/2t = Prt'$. This can be obtained direct from Āryabhata's equation by multiplying both sides by t and putting M' for Mt'/t . It would, however, appear more natural to derive Āryabhata's rule from that of Brahmagupta by putting $t'=t$.

Brahmagupta's commentator, Chaturvēda, gives the following example: "Five hundred *drammas* were a loan at rate of interest not known. The interest of that money for four months was lent to another person at the same rate; and it accumulated in ten months to seventy-eight. Tell the rate of interest on the principal. Answer 60."

Chaturvēda's working may be set down as follows: Let y be the interest on 500 *drammas* for 4 months; then $y^2/200$ is the interest on y for the 10 months, and $y^2/200 + y = 78$, whence $y = 60$. The actual rate, 3% per mensem, is not mentioned.

Considerable acquaintance with the rules that govern interest problems must have obtained in these times and at least the rudiments of compound interest were understood.

26. In the rule of three the 'fruit' multiplied by the 'demand' and divided by the 'measure' gives the 'fruit of the demand.'

The first term is the 'measure'; the second is the 'fruit'; and the third is the 'demand' or question. Thus in $a : b :: c : x$, the 'measure' is a ; the 'fruit' is b ; the demand' is c and the 'fruit of the demand' is $bc/a = x$.

Brahmagupta (XII, i, 10) and Bhāskara (*Lil.* 70f.) use the same nomenclature and deal with "Three or more uneven terms, up to eleven."

27. (a) The denominators are multiplied by one another in multiplication and in division. (b) Multiply separately by the opposite denominator to get the same kind.

Cf. Brahmagupta (XII, i, 2f).

28. Multiplication becomes division and division multiplication; profit becomes loss and loss profit in the inverse.

Cf. Bhāskara (*Lil.* 47-48).

29. If the sum of several numbers joined together be diminished by each in turn and divided by the number of terms less one such it is exactly.

If there be three terms the rule means that

$$(m+n+p)/2 = a+b+c$$

where

$$a + b + c - a = m.$$

$$a + b + c - b = n.$$

$$a + b + c - c = p.$$

Cantor maintains that this is a Greek theorem, disguised in form by Āryabhata, in order to conceal his plagiarism. The rule is given by Jamblichus as follows: "When any defined or undefined quantities amount to a given sum, and the sum of one of them plus every other (in pairs) is given, the sum of these pairs minus the first-given sum is (if there be 3 quantities) equal to the quantity which was added to all the rest (in the pairs); or (if there be 4 quantities) to $\frac{1}{2}$ of it: (if 5) to $\frac{1}{3}$; (if 6) to $\frac{1}{4}$; etc. That is, if $x_1 + x_2 + x_3 = S$ be given, and $x_1 + x_2 = S_1$, and $x_1 + x_3 = S_2$, then $x_1 = S_1 + S_2 - S$. And, generally, if $x_1 + x_2 + x_3 + \dots + x_n = S$ and $x_1 + x_2 = S_1$, $x_1 + x_3 = S_2$, \dots , $x_1 + x_{n-1} = S_{n-1}$, then $x_1 = (S_1 + S_2 + \dots + S_{n-1} - S)/(n-2)$. The proposition is known as the *epanthem* or 'after blossom' (Gou, 97).

Rodet maintains that this resemblance between the Greek and Indian rules is not very close; but the following two examples given by Diophantus (i., 16 and 17), apparently noticed neither by Rodet nor Cantor in this connection, dispel all doubt as to the origin of Āryabhata's rule. In ordinary notation the examples given by Diophantus are

$$(i) \quad x_1 + x_2 + x_3 = \phi, \quad x_1 + x_2 = 20, \quad x_2 + x_3 = 30, \quad x_3 + x_1 = 40$$

whence

$$\phi = (20 + 30 + 40)/2 = 45.$$

$$(ii) \quad x_1 + x_2 + x_3 + x_4 = \phi, \quad x_1 + x_2 + x_3 = 20, \quad x_2 + x_3 + x_4 = 22, \\ x_3 + x_4 + x_1 = 24, \quad x_4 + x_1 + x_2 = 27 \text{ whence } \phi = 31.$$

30. *The difference between the objects divides the difference between the money possessed by two persons. The quotient is the original value of an object the wealth being equal.*

The rule states that $x = (b - a)/(m - p)$ when $mx + a = px + b$.

Ahmes designated the unknown quantity by *hau* or 'heap,' and, according to Rodet, the word गुलिका here used is a direct translation of *hau*. See *Diophantus*, i., 4f.

31. *Division of the space when going in opposite directions by the sum of their speeds; when going in the same direction by the difference of their speeds. The two quotients are the times of meeting as they pass by sought for.*

$$T = S/(v + v')$$

$$T' = S/(V - V').$$

32-33. *The greater original divisor is divided by the lesser original divisor and the rest divide one another. An assumed number together with the original difference is thrown in. The lower is multiplied by the upper and the last added. Divide by the smaller first divisor and multiply the remainder by the larger first divisor and add the original larger remainder for the final result.*

[N.S.]

This rule is not expressed at all clearly and is difficult to translate into unambiguous mathematical language; nevertheless its general aim is obvious. It is a rule for the solution of indeterminate equations of some such form as $(Ax + C) / B = y$.

It is not our business here to give an exposition of the general theory of indeterminate equations, but rather to attempt to trace their history up to the time of Āryabhata. Even a cursory examination of the mathematics of our author will convince any one familiar with the subject that Āryabhata was not the inventor of the method under consideration; and a closer investigation establishes this conclusion beyond all doubt. At one time, indeed, it was thought that this special treatment of indeterminate equations was of Indian origin. Colebrooke, Woepecke, Chasles and Rodet seemed to think so; and the conclusions of such eminent scholars cannot be altogether ignored. But Colebrooke, Woepecke and Chasles attributed the discovery to Brahmagupta and in this were obviously wrong: they had only very vague ideas about Āryabhata whose works were not available in their time; while Rodet was misled by the later commentators. Now we are in a position to give at least a more correct version of this portion of the history of mathematics. Still there are difficulties in the way, and it must not be expected that the conclusions here set forth are quite final.

A diligent search through Hindu works has failed to bring to light any of those orderly processes by which such a complicated theorem as this is bound to be preceded; but we do find the necessary preliminary notions abundantly set forth by Greek writers.

The fundamental process involved in the method given by Āryabhata is contained in the first and second propositions of the seventh book, and the second and third of the tenth book of Euclid. The results of these propositions translated into Algebraic notation¹ give us the following indeterminate equations: $AL - BM = 1$ and $AL' - BM' = g$. The process by which the former of these is arrived at may be exhibited thus:—

$$\begin{array}{l}
 B) A (a_1 \\
 \frac{a_1 B}{r_1}) B (a_2 \\
 \frac{a_2 r_1}{r_2}) r_1 (a_3 \\
 \frac{a_3 r_2}{r_3}) r_2 (a_4 \\
 \dots \\
 \dots (a_{n+1} \\
 r_n
 \end{array}
 \quad \text{or} \quad
 \frac{A}{B} = \frac{1}{a_1 +} \frac{1}{a_2 +} \frac{1}{a_3 +} \frac{1}{a_4 +} \dots$$

¹ The question has often been asked, had Euclid any substitute for Algebra? If not, his skill, as shown particularly in the tenth book, was

represents the process of finding the greatest common measure of the two numbers A and B . If the last remainder is unity, Euclid states that the two numbers A and B are prime *inter se*. His proof may be set down as follows :—

$$\begin{aligned}
 r_1 &= A - a_1B \\
 r_2 &= A(-a_2) + B(1 - a_1a_2) \\
 r_3 &= A(1 + a_2a_3) + B(-a_1 - a_3 - a_1a_2a_3) \\
 r_4 &= A(-a_2 - a_4 - a_2a_3a_4) + B(1 + a_1a_2 + a_1a_4 + a_3a_4 + a_1a_2a_3a_4) \\
 &\dots\dots\dots \\
 r_n &= (-1)^{n+1}(AL - BM).
 \end{aligned}$$

If $r_n = 1$ then A and B are prime to each other : for if not, let their common factor be f such that $A = af$ and $B = bf$ and $afL - bfM = 1$, which, as all the terms are integral, is impossible. Therefore, etc.

If $Ax - By = C$ and $AL - BM = 1$, we get $ALC - BOM = C$ and $A(x - LO) - B(y - MC) = C$ or $(x - LO)/(y - MC) = B/A$; and further, as A and B are prime to each other, we have $x - LO = Bt$ and $y - MC = At$ (Euclid VII., 33), where t is any integer.

In solving

$$Ax - By = C \text{ when } r_3 = 1$$

we have

$$A = a_2 + a_4 + a_2a_3a_4,$$

$$B = 1 + a_1a_2 + a_4 + a_3a_4 + a_1a_2a_3a_4$$

$$x = Bt + LC = t(1 + a_1a_2 + a_1a_4 + a_3a_4 + a_1a_2a_3a_4) - C(a_1 + a_3 + a_1a_2a_3)$$

$$y = At + Mc = t(a_2 + a_4 + a_2a_3a_4) + C(1 + a_2a_3).$$

Now, following Āryabhata's instructions, set down

$$\begin{array}{r}
 a_1 \\
 a_2 \\
 a_3 \\
 ta_4 - C.
 \end{array}$$

Add the lowest term to the product of the two preceding $t + a_3(ta_4 - C)$; multiply this result by the next highest term (a_2) and add to the product the penultimate term ($ta_4 - C$) and so on. The final result in this case is—

$$t(1 + a_1a_2 + a_1a_4 + a_3a_4 + a_1a_2a_3a_4) - C(a_1 + a_3 + a_1a_2a_3)$$

which equals $LC + Bt = x$ as above.

marvellous. Whether or not Euclid employed some sort of algebraic symbolism, we know that the later Alexandrian scholars did, and we also know that they translated Euclid's proposition into their new symbolism. (See Gow, 83 and 104.)

[N.S.]

As t is any integer we may substitute any other integer for it. Set $t' = ta_r - C$ then $t = (t' + C)/a_r$, and we have the series $a_1, a_2, a_3, \dots, a_{r-1}, t', (t' + C)/a_r$, which may be treated as before.

If in $Ax - By = C$ we have $x > B$ set $x = B + x'$. We then have $A + (Ax' - C)/B = y$. Therefore if $(Ax - C)/B$ is integral so is $(Ax' - C)/B$ integral, and x' is a solution of $Ax - By = C$. These results, which are vaguely embodied in Āryabhaṭa's rule, may, of course, be put in a perfectly general form.

Although there is ample evidence in Greek mathematics as to the existence of the preliminary notions necessary for the evolution of the particular rule under consideration, yet we nowhere find in extant Greek works the rule itself applied in just this manner. On the other hand we do find that the Greeks carried the treatment of indeterminate equations much further than did Āryabhaṭa, and there is no doubt that they were able to manipulate indeterminates of the first degree in the manner indicated in the rule of Āryabhaṭa.

It is interesting to note that discord in the early Christian church possibly had a significant connection with the development of Hindu mathematics. The Alexandrian Christians appear to have been much given to wrangling, and one of the points they chose to quarrel about was the ecclesiastical calendar. As early as the second century of our era great disputes had arisen about the proper time of celebrating Easter. At the Council of Nice (A.D. 325) a decision on this point was arrived at, but it was left to the scholars of Alexandria to find the exact date each year. Diophantus lived about A.D. 300-350, and Hypatia, who wrote a commentary on the works of Diophantus, was murdered by these quarrelsome Alexandrian Christians in A.D. 415. Āryabhaṭa was born in A.D. 476.

It is in connection with questions on the calendar that the most useful applications of indeterminate equations of the first degree arise. The following example in a very marked manner illustrates many points of Āryabhaṭa's rule that at first seemed inexplicable:—

“The year 1 of the Christian era was in the Solar cycle the year 10 and in the Metonic cycle it was 2. What was it in the Dionysian cycle?”

The Solar cycle consists of 28 years, the Metonic cycle of 19 years, and the Dionysian cycle of 28×19 years. Let n be the date in years in the Dionysian cycle, then $n/28$ and $n/19$ must give respectively 10 and 2 as remainders, or $n/28 = x + 10/28$ and $n/19 = y + 2/19$, whence $28x - 19y = -8$.

In accordance with Āryabhaṭa's rule we go through the process of finding the G.C.M. of 19 and 28, and obtain the series 1, 2, $t, (t - 8)/9$. Adding the last of the series to the product of the two preceding we get, when $t = 17, 1 + 17 \times 2 = 35$. Multiplying this result by the preceding term and adding to the product the penultimate term, we get $35 \times 1 + 17 = 52$. These results, 35 and 52, are values for x and y which satisfy the equation; but they are not the simplest results, so we divide the 35 by the smaller

original divisor ($35/19 = 1 + 16/19$) and the remainder 16 is a value sought.

Multiplying this remainder by the larger first denominator and adding the larger first remainder we obtain $16 \times 28 + 10 = 458$ as a value for n .

Although Āryabhata's rule is by no means unambiguous in parts, yet the working of the above problem agrees so closely with it that there is no doubt that the rule is intended for similar examples.

Brahmagupta gives numerous examples of indeterminate equations of the first degree. At one time it was even thought that he was the inventor of the method he employs in solving them, but that is now known to have been impossible. Like Āryabhata he does not establish the rules he uses, but unlike his predecessor he gives numerous examples and exhibits the working of them. After having gone through all his examples and checked all the workings, the impression gained is that he was not quite master of this part of his subject. On one occasion he gives a correct rule (XVII, iv., 61), but immediately discards it saying, "What occasion is there for it? . . . with exception of one unknown put arbitrary values for the rest," and the commentator remarks: "The author here delivers his own (incorrect) method with a censure on the other (correct method)." He makes no pretence of being the original discoverer of the rules he gives. He calls his work an 'interpretation' and uses such expressions as "the text expresses" (§74) and "the meaning of the rest will be shown further on" (§70—72). Finally, it may be remarked that the first claim on behalf of the Hindus as the inventors of this indeterminate analysis appears in the nineteenth century of our era, and that claim was based on a very inadequate knowledge of the true state of affairs.

APPENDIX I.

CHRONOLOGY.

				Circ.
Thales	...	...	...	B.C. 600
Eudoxus	...	...	...	360
Euclid	...	...	...	290
Archimedes	...	...	...	287
Hypsicles	...	...	...	180
Heron	...	...	...	120
Nichomachus	...	...	...	A.D. 100
Theon, Smyrn.	...	...	...	100
Hipparchus	...	...	...	130
Ptolemy	...	...	...	150
Sextus J. Africanus	...	...	...	200
Jamblichus	...	...	...	340
Diophantus	...	...	...	360
Paulus, Alex.	...	...	...	378
Theon, Alex.	...	...	...	380
Pulisa	...	...	...	400 ?
Hypatia	...	...	...	415 <i>d.</i>
Proclus	...	...	...	450
Boethius	...	...	...	470 <i>b.</i>
Āryabhata	...	...	...	476 <i>b.</i>
Eutocius	...	...	...	560
J. Philoponous	...	...	...	650
Varāha Mihira	...	...	...	587 <i>d.</i>
Brahmagupta	...	...	...	628
Ya'kub Ibn Tarik	...	...	...	770
M. Ibn Ibrahim Alfazāri	...	...	...	750 ?
M. Ibn Musa	...	...	...	820
Albatgenius (M. Ibn Jabir Ibn Senan Abu Abdillah)	...	...	...	877
Albumaser	...	...	...	885 <i>d.</i>
Ahmad Ibn M. al-Farqani	...	...	...	861
Thabit Ibn Qurra	...	...	...	901 <i>d.</i>
Abu Bakr Ibn al-Hasan al-Karkhi	...	...	...	950 ?
Albiruni (Abu Raihan M. al-Biruni)	...	...	...	973 <i>b.</i>
Avicennā (Abu' al-Husain Ibn Sina)	...	...	...	980 <i>b.</i>
Utpala	...	...	...	1068
Chaturvéda	...	...	...	?
Ibn al-Haitam	...	...	...	1038
'Umar Khayyām	...	...	...	1123 <i>d.</i>
Bhāskara	...	...	...	1114 <i>b.</i>
Averroes (Abu' l-Walid Ibn Rushd)	...	...	...	1120 <i>b.</i>

APPENDIX II.

BIBLIOGRAPHY.

(Only works actually consulted by the writer are given in this list.
A complete bibliography of Indian Mathematics would be valuable).

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18. Translation of a Letter by Abū 'l-Faẓl.

By LIEUT.-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*

The letters¹ of Abū 'l-Faẓl '*Allāmī*, the famous minister and secretary of Akbar, which were once considered the acme of style, are turgid, bombastic, prolix, and frequently puerile. His *inshā-pardāzi* exhibits examples of almost every vice enumerated in English text-books on Rhetoric. Everywhere sense is sacrificed to sound; improprieties, solecisms, and barbarities abound; the thought and the metaphors are confused or strained; while the meaning of the intricate complex sentences is obscure. One letter begins:—

“The inhalation of the fragrance of the spring-tide posy of heart-to-heart union and oneness, a posy arranged by the gardeners of the summer-house of friendship, and the perusal of the series of life-pictures from the gallery of foresight and wisdom, a gallery coloured by the painters of the studio of that art which brightens and expands the soul * * * [and so on for ten lines more] became to Us an ornament of gladsome delight and a source of heart-expanding joy”: anglicé. “Your letter reached me.”

Each letter must be regarded as a riddle; for not only is it couched in veiled language, in which the meaning depends on allusions known only to the correspondents, but the sentences themselves are often so involved that the writer has entangled himself in the meshes of his own verbosity. The reader has frequently to grope his way laboriously from the subject, for a distance of nearly a page, through an intricate maze of subordinate and sub-subordinate clauses, before he can draw breath at the finite verb that closes the period. The clauses have then to be bracketed off like fractions in Algebra, before the meaning can be disentangled. Not infrequently the reader fails to reach his goal, for the writer, losing himself in the labyrinths of his multiloquence, has never arrived at the finite verb at all.

A Persian gentleman, manager and editor of a well-known Persian newspaper, once declared to me his inability to fathom the meaning of even two consecutive lines.

An Indian Muslim, complaining of modern degeneracy, said to me that the path of learning had been unduly smoothed, for no stumbling-blocks were now-a-days cast in the way of students. Perhaps it is to impede the haste of these modern scholars

¹ His letters were collected by his nephew 'Abdu 's-Ṣamad in A.H. 1015. They are divided into three parts. The first contains letters from Akbar to various sovereigns, and also certain royal mandates and circulars; the second, some personal letters of Abū 'l-Faẓl; the third, miscellaneous writings.

In the *Akbar Nāma*, Abū 'l-Faẓl states that, as poetry is the salt-cellar of prose, he has freely sprinkled his writings with quotations from the poets.

that more than one university has retained the "*Inshā*" as a text-book.

The following letter has been selected, partly on account of its simplicity, and partly for a certain human interest. A few words of preface, however, are needed to make it intelligible.

In India and Persia, should a friend express admiration for anything possessed by another friend, etiquette requires that it should be offered as a present. Not to present the coveted article is a sign of want of breeding; while to refuse a friend a present openly asked for is a mark of a mean and ungenerous spirit -- or else of pride and indifference to public opinion.

As an example of the tyranny of this custom, I will cite two examples that came under my personal notice. A certain Indian Nawab, by suborning a friend's falconer, succeeded in substituting his own inferior hawk for one of a much-coveted colour that was on its way as a present to another Nawab. An influential Mulla, possessed of some intuition and a considerable knowledge of his neighbours, obtained an inkling of the matter, and wrote next day: "As we are friends and our houses are one, and what is mine is thine, I make no scruple in asking you to send me by the bearer of this letter, a certain white falcon that came into Your Honour's possession yesterday. Your slave more especially makes this request as he hears that Your Honour did not gain possession of the said falcon *thus*, but *thus*."

As soon as the honoured messenger had departed with the hawk and the politest of replies, the bereft owner expressed his unqualified disapproval of Indian etiquette, the dishonesty of his friends, and the shamelessness of the black-mailing Mulla. He, however, consoled himself by adding that the Mulla was now under an obligation to him, and that he would later extract a *quid pro quo*. As this very ordinary 'white' falcon now got much talked about in the bazar, it acquired an extraordinary reputation. In the course of a month, six friends had demanded it from each other. It might have continued changing hands indefinitely and remaining untrained, had not its last temporary possessor spitefully killed it.

The same Nawab was presented with a copy of "Falconry in the British Isles," a work with delightful coloured plates. Letters at once began to arrive: "As there is no disgrace in making requests to friends, etc., etc." The Nawab clung to his possession and had recourse to the usual subterfuges. When letters and messengers failed to extract the book, the friends began to call personally. Frequently, when I was on my way to parade, I would be stopped by the confidential servant of the Nawab, who would commit to my charge the precious volume concealed in wrappings, with a request that it might be guarded till a certain imminent danger had passed. Years after, I revisited the station and enquired the fate of the book. "I still have it," said the Nawab, "for I told everybody you had demanded your present back when your regiment left the station." "But they did not believe you?" "Oh no; but I saved my honour as well as the book."

Now Akbar like so many Easterns, Muslims¹ and Hindus, was a great pigeon-lover and had obtained a certain breed of pigeons, from whom is not clear. He stood in considerable awe of the *Khān-i Khānān*, his 'Commander-in-Chief,' and was nervously anxious that the latter should not ask for any or all of the pigeons. Consequently he wrote to the *Khān-i Khānān*, the following letter, composed by his minister, Abū 'l-Faḡl. It is intended to convey the hint that the probable request of the *Khān-i Khānān* for some of these pigeons would not meet with a cheerful compliance:—

Translation.

ORDER OF HIS MAJESTY THE KING OF KINGS TO THE
 KHĀN-I-KHĀNĀN,² COMMANDER-IN-CHIEF.

To the Support of Our Great Empire, the Mainstay of God's Great Viceregency, the Pillar of the Mighty State, the Prop of the Glorious Kingdom, endowed with noble qualities and most excellent virtues, the possessor of outward and inward perfection, the Pattern to all Chiefs of exalted rank, Our Faithful Friend and Dutiful Son, the Champion of the Faith, the *Khān-i-Khānān*, the Commander-in-Chief, ever rejoicing in Our Royal Favours and the plenitude of the loving kindness of this Shadow of God—be it known, that at this auspicious season, from beginning to end delightful, this budding season of spring, which begins when the sun vacates [enters?] the mansion of Pisces, and the nights and days are equal in length, all people should make their God-favoured hearts the receptacle of every kind of gladness and the source of every form of joy. The freshness and salubrity of spring are now perfect and the smiling and joyful stirring in the Garden of Spring-growth are at their height; for the drum of *Nawrūz* has made its tucket resound in the dome of the revolving sky, as a signal for the dressing and adornment of the world; while the world-warming Sun has begun to shower his bounty on the four elements and the three kingdoms.³

The stirring of the morning breeze has roused love's fancy in dormant being; the balmy air has revived the withered hearts of all lovers of nature; and the spring-breeze has breathed the breath of vegetable life into the dead⁴ bodies of the offspring⁵ of land and water.

The March showers have washed off the dust of the road

¹ It is a Muslim superstition that the breeze from a pigeon's wing wafts away sickness.

² There are several well-known persons who bore the title of *Khān-i-Khānān*. The person referred to here is 'Abdu'r-Rahīm, son of Bayrām Khān; born A.H. 964; died about 1036; vide Blochmann's translation of the *Ā'in-i Akbari*, Vol. i., page 334.

³ i.e., the whole earth.

⁴ Apparently *بی* has been omitted before *حیات*; it is, however, omitted in two lithographed editions. In a third, the word *مہات* is also omitted.

⁵ *Naw-bāna* is properly "first-fruits."

from the feet of the newly-come hordes of spring, and the murmur of water has revealed thousands of bright secrets to the ear of preception of those that have deep and understanding minds. All heaven has renewed its bond with this earth, by granting her young life. Those Celestial Fathers, the seven planets,¹ and the four elements who are the Terrestrial Mothers, have again come together in wedlock, and the telluric brides have made a fresh alliance with the astral spheres.

The powers of growth have created a thousand fair forms in the world's workshop.

The tongue of the new-grown plants addresses with mute signs the dour and hypocritical circle of hermits, saying:—

“Oh recluse! the bud blossoms and art thou withered still?

The wind is away and art thou halted in thy hut still?

In the bosom of the hills the heat of the sun has boiled a thousand springs, and art thou cold still?

The tongues of the leaves of the heart-entrancing trees, in song suited to this season, have chorused the following chant to the dull ears of those who cower in the corner of austerity:—

The sun, whose bounty grants the flower of desire, has yielded the fruit of happiness from the branch of pleasure.

Observe the fruits² and see how the branch

Yields fresh sweetmeats from a smokeless fire.

It is known to, and well observed by, people of wisdom and preception, how much, the pity and compassion of the holy beings of the World-Above increase towards the dust-soiled dwellers of this poor earth, at this glad season when the Greater Luminary enters the Vernal Equinox. How many a humble prayer of these holy supplicants at the Throne of God will be accepted by the Eternal Being in return for the various favours He has showered on them! How many a meek petition will be heard at the Threshold of Grandeur!

Let not my head alone be lowly bowed in prayer.

But rather let every hair of my body prostrate itself.

In this pleasant season and joyous happy time, when the nostrils of all living things are perfumed by the odours of Our Royal Justice and the organ of smell of earth's creation is scented by the sweet savours of Our Kingly Equity, when all things necessary for general rejoicing are made ready and the doors of light-heartedness lie open before us, when Fortune hourly brings favourable intelligence of victory to Our Ear that ever hears glad tidings, when the Sky out of its favour continually grants good news of Our Conquests to the auricle of all the world, at such a time the King-Protected messenger of 'Abd' 'llah Khān³ reached Our Heaven-

¹ The Sun, the Moon, Mars, Mercury, Jupiter, Venus, and Saturn.

² A kind of oratorical syllepsis. The word *fruit* is used first metaphorically and then literally. There appears to be no term in Arabic Rhetoric for this not uncommon figure.

³ There were two Uzbaks, in Akbar's time, of the name A'bd' 'llah

exalted Court and passed before Our most noble Eyes various rarities and presents and many kinds of curiosities, adding also to these proofs of 'Abd^u 'llah Khān's attachment and love to Us various strains of the Diwān Begī pigeon and likewise certain of the Sulṭān Ḥusayn Mirzā breed. In truth the sight of these fairy-fliers, and the arrival of the young pigeon-fancier sent by him, was a source of gladness to Our most noble Mind. Especially so was the arrival of this Habib, who is the chief leader of all the fanciers of Mā-warā^ʿa 'n-Nahr, nay, rather the prince of artists of Our Day; for such a pigeon-lover is he, that, even before the yolk of the egg merges into ¹ the white, he can discover how many summersaults the future pigeon will turn in its flight; while, before even the Great Educator of Nature has, without making any aperture in the shell, cast animal life into the mould of the young bird imprisoned within, he knows to what height the bird to be will soar. He is a very Galen in pigeon-anatomy, a very Plato in his own art. He knows more about the ramifications of the breeds and crosses of pigeons than Naqib Khan² does of the various races and tribes of man. Can one compare him to Qul 'Alī³ ?—why, Ḥabib is an Avicenna in his own art!

'Abd^u 'llah Khān has collected all the Diwan-Begī pigeons from Anjān and its neighbourhood, and sent them by Mir Quraysh⁴. We wonder if there are any pigeons left in those parts! All the birds arrived safely. The pigeon of Our Pen is unable to flutter a feather in the air of the description of their beauty, neither can the brilliant peacock of Our Tongue show off in the park of their description:—

Each fairy form, in beauty-display, and amorous grace.
 Resembles the Bird of Love when it flies.
 Hot-tempered are they like the brain of youth,
 Far-soaring are they like the thoughts of the wise;
 They traverse earth and sky;
 They pick up the grain of even the Clustered⁵ Pleiades.

All are eager in soaring high
 All, in twisting and turning, bear the polo-ball of victory from the sky.

Since that time when the bird-winged Angels left the nest of the Throne⁶ of God, no pigeons like them have been produced

Khān; vide *Āḡin-i Akbarī*, Blochmann's translation, Vol. i., page 320. and Beale's *Biographical Dictionary*. The officer in the letter is apparently identical with the one mentioned by Beale.

¹ It is a popular idea that the white and yolk of an egg mix gradually as the embryo develops.

² *Ghiyāṣ* 'l-Dīn received the title of Naqib Khān in the twenty-sixth year of Akbar's reign (A.D. 1581). He died at Ajmere in A.D. 1614, in the reign of Jehangir; 'vide' *Āḡin-i Akbarī*, Blochmann's translation, Vol. i., p. 448.

³ Qul 'Alī; unknown.

⁴ Mir Quraysh; unknown.

⁵ One would have expected here Virgo, in Persian and Arabic *Sumbalah*, which literally means "Ear of Corn"; but the writer probably had in his mind the phrase *من الثرى الى الثريا*

⁶ That is, since the beginning of the world.

by any fancier; nor dare any of the famous pigeons of to-day flap the wing of equality with these circling tumblers. Although the Faithful Friend¹ is apparently excluded from the honour of Our Converse and the felicity of Serving Us, still he is, in all seasons (especially in those of joy and rejoicing) present in Our Sun-Glorious Mind; in such times we recall to memory that Pillar of the State more than ever: so, when the above mentioned pigeons were passing in presentation before Our most noble Sight, and while Our heaven-seeing Mind was being delighted and rejoiced by reviewing them, We continually recollected that Prop of our Great Empire and his converse on the subject of pigeons. Now, while writing, a thought has just struck the mind of these nimble birds of fairy race, and in their mute language they have entreated Us to convey to you certain messages. Agreeably to their entreaties, their representations will be committed to writing by Our pearl-dropping Pen:—All the queens of the pigeons send you squadrons of salams, and messages:—

The accepted of Solomon
How should he not know the speech of birds?

Especially does the lady *Par-Nigār*² (old in years but young in actions, a lady of unrivalled energy) send words such as would madden even the heart of those fancy-free and possessing peace of mind. She says: "Since, in conformity to the sincerity of our love and the purity of our intentions and in response to our morning prayers, Good Fortune has taken pity on our plight; and, by bringing us, through heavenly guidance, to the Royal Court—a refuge to the whole world—of a monarch, God-fearing and Appreciative, has cast the riot of youth's joy into the mansion of the brain of these longers for this boon, bestowing thereby fresh life and boundless delight on us—therefore the well-wishers of the Royal Court and the votaries of the Audience-Chamber (especially that God-fearing lover³ who is one of the chief disciples and chosen followers of this our King, the Refuge of the World) are hereby petitioned that they should not by hint or sign ask for the recall⁴ of any one of us or of our belongings, nor cast the stone of separation at the united assembly of our noble tribe; for the highest aspiration and desire of all of us is, that, by God's grace, we should compensate ourselves for the past by remaining in attendance on His Majesty The Shadow of God, exhibiting our exquisite grace and displaying all our varied and magic arts."

Another pigeon, a descendant of the family of Grace, and of the quintessence of the race of Fortune, a dispeller of burdensome care, that is to say Madame *Sabz Kūhī* who, outwardly old but inwardly young, is the immediate descendant of that *Sar-Sabz* known to fame in every region, one whose mere name is a sufficient description—she, too, sends a message fraught with love and says:

¹ i.e., you.

² Not to be confused with *Par-Nigār* mentioned afterwards.

³ i.e. you, the addressee.

⁴ *براهت الحسن طلبی* is perhaps the Figure *الطلب*

[N.S.]

"After great longing and the lapse of much time, I have been favoured with the felicity of kissing the Threshold of our King, and have been rejuvenated like Zulaykhā."¹ She, with all her children and relatives, desires² to remain in Attendance, performing those pleasing offices that are the source of delight to Our Mind, and a cause of outward and inward happiness. Although for a lengthened period she² was famed as being the object of general love, yet now, God be praised, she has at last become honoured by falling in love with such a Beloved Object as the King. She hopes that all the adorers and suitors of Our Court (and especially the chief³ of all of those likely to summon the pigeons away⁴) will cover the head of their desire with the skirt of patience and restraint, refraining from giving rein to their hankerings and longings, for otherwise the good fellowship of our sociable party will be destroyed. Instead, it is better for you³ to put up with the burning of separation and to give no further thought to us.

Another lady pigeon, the gallant chieftainess Short-wing⁵ (who bears a Ma-warā^{2a} 'n-Nahr name, though she is of Kḥurāsān descent, being the most eminent of the well-known Kam-par⁶ breed and who is an exalted high-flier, though her name means short-feathered) thus chants with mute tongue:—

The lightlier laden moves the quicker.
On light wings the bird flies faster.

Next, the chief of the famous Mash'al Kalān⁷ breed, she, who in mounting high vies with a flame of fire and is ever hot in the desire to kiss Our Threshold, and 'Black-tail' too, a very human in intelligence—(can it be that her black tail is smoke from the burning hearts of pigeon-lovers?)—and that charming little pet *Par-Nigār*⁸ (she of the white⁹ wings, whose tinkling bells calling up visions of the anklets of Layla¹⁰ rivet the fetters of madness¹⁰ on the feet of all pigeon-lovers) and all the rest of those famous sweet-tongued, smooth-cheeked pigeons that are noted for their noble lineage and high descent—some of them join *Pur-Nigār*, while others agree with *Sabz-Kūhī*. In short, since each feather of every light-hearted¹¹ pigeon is a mute tongue, therefore all these newly arrived veterans, with a thousand tongues, expect from the justice of the Prop¹² of the Kingdom that the following petition of

¹ Zulaykhā, in love with Joseph. God restored to her her youth and commanded Joseph to marry her.

² Change from direct to indirect narration.

³ The writer seems to have here confused the direct and indirect narration.

⁴ That is, the addressee.

⁵ *Kalta-par*, "short-winged."

⁶ *Kam-par*, either short-winged or of little flight.

⁷ Said to be a breed with certain white feathers in its tail.

⁸ *Par-Nigār*, lit. a pigeon with spots on the wing.

⁹ *Kimāra-dār*, said to be a pigeon with white wings.

¹⁰ Laila and Majnūn, and *junūn*; a play on the words.

¹¹ A play on *bāl* "feather; wing; and heart."

¹² That is, you, the addressee.

theirs will be granted, viz :—“ Now ¹ that we, with our children and relations, have in our old age been exalted by reaching that Court which is the rest of Angels, that Court whose threshold is the roof of our Good-Fortune and the palace of our Exaltation, we hope that until we have exhibited our arts and displayed our delight to the King, you ² will not scatter our united assembly, nor turn us who are now clustered like Pleiades into a far-flung constellation like the Great Bear.

“ Further, the families of the pigeons, one and all, humbly request that, should any one be starting ³ on the Mecca Pilgrimage, you will send through him our greeting to those pigeons of the Sacred Sanctuary, who circle round the holy *Ka'ba*.”

Moreover, as that Support of the *Khilāfat* ⁴ is expecting a little guest, he must make proper arrangements for his arrival; for in this case, Please God, some good pigeons will be sent to the guest; that is, his share will be some of Our young pigeons that have just made their appearance in the world; but should the little stranger tarry in his coming We will give that Prop of the Kingdom ⁵ fewer pigeons than he is expecting to receive.⁵

¹ *Mā dām* in colloquial Arabic, means “ now that, ” and this seems to be the meaning here, and not the Persian and correct Arabic “ as long as.”

² In the original, third person plural.

³ *Mi-raftā bāshad* “ have been starting ”; wrong tense.

⁴ That is, the addressee.

⁵ That is, “ We will keep back the little stranger's share.” This is merely puerile jocosity: there is no special meaning.

MARCH, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 4th March, 1908, at 9-15 P.M.

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.Li., President, in the chair.

The following members were present :—

Maulavi Abdus Salam, Babu Muralidhar Banerjee, Miss R. Cohen, M.D. ; Mr. D. Hooper, Dr. W. C. Hossack, Mr. T. H. D. LaTouche, Lieut.-Colonel F. P. Maynard, I.M.S. ; Hon. Mr. J. O. Miller, Dr. Girindra Nath Mukhopadhyaya, Babu Umapati Datta Sharma, Mr. G. Thibaut, C.I.E. ; Pandit Vanamali Vedantatirtha, Mahamahopadhyaya Satis Chandra Vidyabhusana, Rev. A. W. Young.

Visitors :—Captain F. C. Hirst and Mr. H. McPherson.

The Minutes of the last meeting were read and confirmed.

Twenty-seven presentations were announced.

The General Secretary reported that Mr. J. Wyness had expressed a wish to withdraw from the Society.

The General Secretary also reported the deaths of Sir Richard Strachey (an Honorary Member) and Lieut. R. E. Bate (an Ordinary Member) of the Society.

The President announced that Dr. E. D. Ross had undertaken the duties of Philological Secretary and resumed charge from Lieut.-Colonel D. C. Phillott of the Arabic and Persian Search for MSS.

The proposed changes in Rules 4 and 44(g) of the Society's Rules, of which intimation had already been given by circular to all members under Rule 65, was brought up for final disposal. The votes being unanimous, the proposal was carried.

The rules should consequently be amended as follows :—In Rule 4, for the words "three Vice-Presidents" read "*four Vice-Presidents*"; and in Rule 44(g) delete the words a *Vice-President* and *Vice-President*.

The following seven candidates were balloted for as Ordinary Members :—

Mr. D. Quinlan, Civil Veterinary Department, Bengal, proposed by Major L. Rogers, seconded by Dr. W. C. Hossack ; *Mr. J. W. Mollison*, Inspector-General of Agriculture, India, proposed by Major L. Rogers, seconded by Mr. I. H. Burkill ; *Mr. James H. Hyde*, proposed by Lieut.-Colonel D. C. Phillott, seconded by Lieut.-Colonel W. J. Buchanan ; *M. Shajooat Ali Khan*, Consul and Acting Consul-General for Persia, proposed by Lieut.-Colonel

D. C. Phillott, seconded by Dr. N. Annandale; *Babu Manmathanath Moitry*, Landholder, Serampore, proposed by Babu Annadaprasad Bose, seconded by Babu Amritalal Bose; *Mr. H. G. FitzGerald*, Superintendent, Indian Police, proposed by Lieut.-Colonel D. C. Phillott, seconded by Mr. Harinath De; and *Babu Satis Kumar Banerjee*, Head Master, Mittra's Institution, Calcutta, proposed by Mr. Harinath De, seconded by Dr. A. Suhrawardy.

The following papers were read :—

1. *Translation of a letter by Abū 'l-Fazl.*—By LIEUT.-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*

2. *The Seven Sahajata of Buddha.*—By H. C. NORMAN.

3. *Quotations in the Bhashapariccheda.*—By PANDIT VANAMALI CHAKRAVARTI.

4. *Certain disputed or doubtful events in the History of Bengal, Muhammadan Period, Part I.*—By MONMOHAN CHAKRAVARTI.

5. *Certain unpublished drawings of Antiquities in Orissa and Northern Circars.*—By MONMOHAN CHAKRAVARTI.

These papers will be published in a subsequent number of the *Journal*.

6. *The Exact Determination of the Fastness of the more common Indigenous Dyes of Bengal, and comparison with typical synthetic Dye-stuffs, Part II.—Dyeing on Silk.*—By E. R. WATSON.

This paper will be published in the *Memoirs*.

7. *Oil of Lawsonia alba.*—By D. HOOPEE.

This paper has been published in the *Journal* for February, 1908.

8. *A General Theory of Osculating Conics.*—By PROF. SHAMADAS MUKHOPADHAYAYA, M.A. *Communicated by the President.*

This paper will be published in a subsequent number of the *Journal*.

—o—

The Adjourned Meeting of the Medical Section was held at the Society's Rooms on Wednesday, March 11th, 1908, at 9-15 p.m.

LIEUT.-COLONEL G. F. A. HARRIS, I.M.S., in the chair.

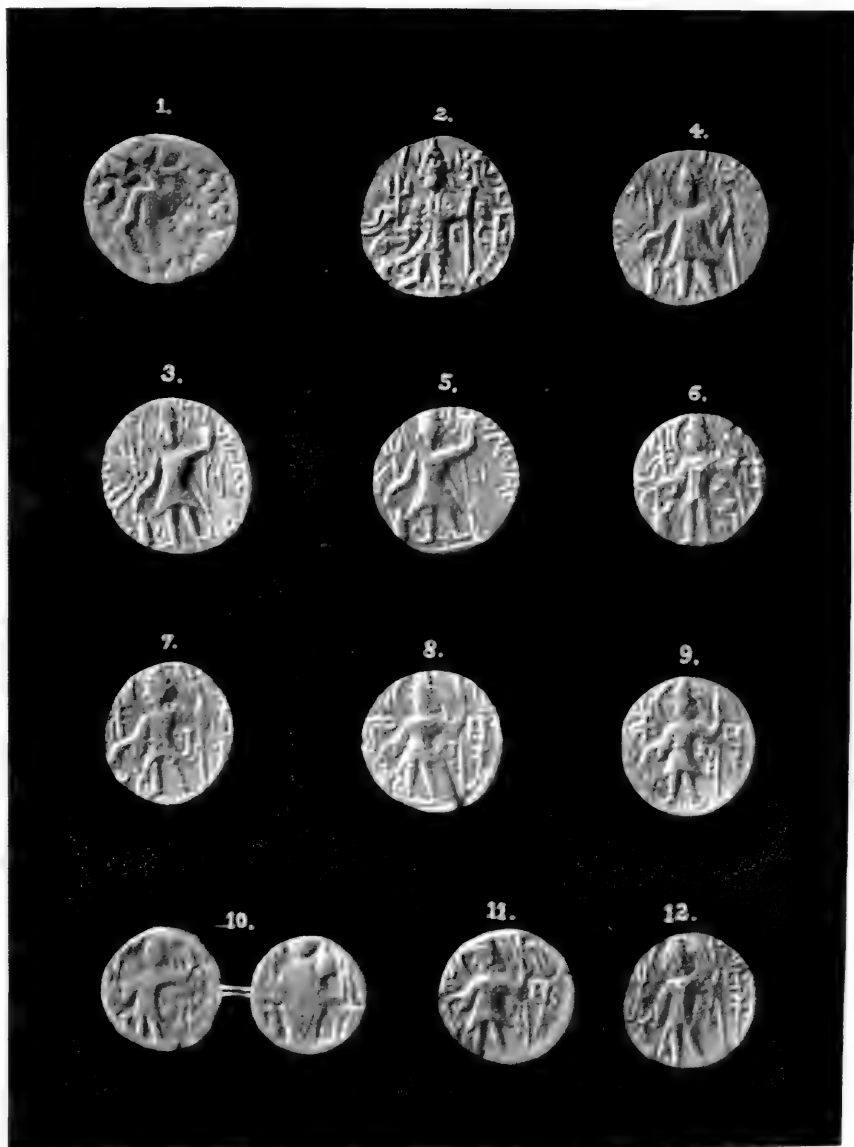
The following members were present :—

Dr. A. S. Allan, Lieut.-Col. W. J. Buchanan, I.M.S.; Dr. Gopal Chandra Chatterjee, Dr. H. M. Crake, Col. J. G. Harwood, R.A.M.C.; Dr. W. C. Hossack, Dr. E. A. Housman, Captain M. Mackelvie, I.M.S.; Lieut.-Col. F. P. Maynard, I.M.S.; Captain D. McCay, I.M.S.; Dr. Girindra Nath Mukhopadhyaya, Major J. Mulvany, I.M.S.; Captain J. G. P. Murray, I.M.S.; Major F. O'Kinealy, I.M.S.; Dr. J. E. Panioty, Dr. T. F. Pearse, Major L. Rogers, I.M.S., Honorary Secretary.

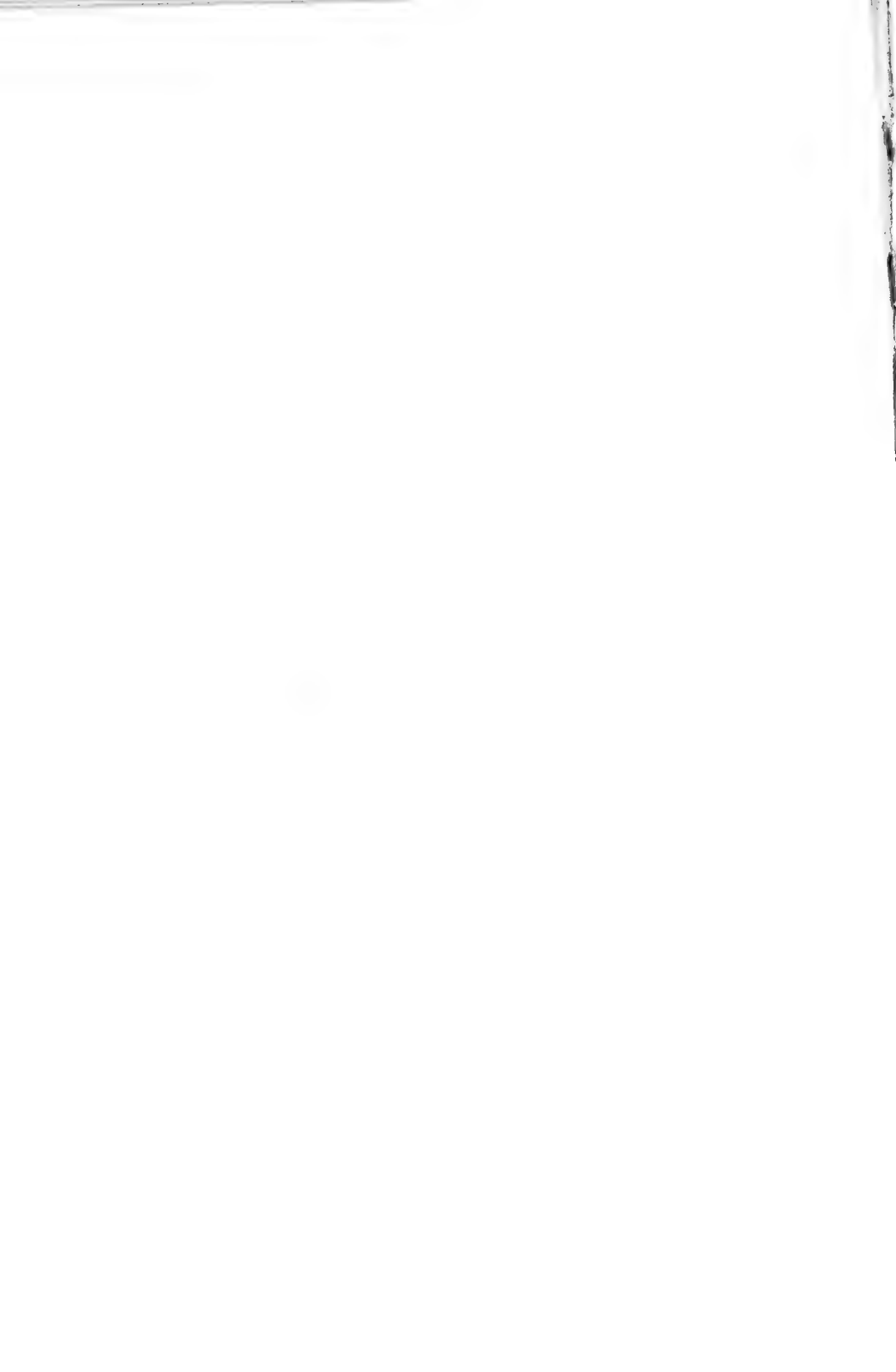
Visitors.—Miss Baumlér, M.D.; Lieut.-Col. F. C. Clarkson, I.M.S.; Asst.-Surgeon F. J. Daley, Dr. W. M. Haffkine, Dr. Satyasaran Mitra, Dr. D. Price, Lieut.-Col. W. B. Thomson, R.A.M.C.; and four others.

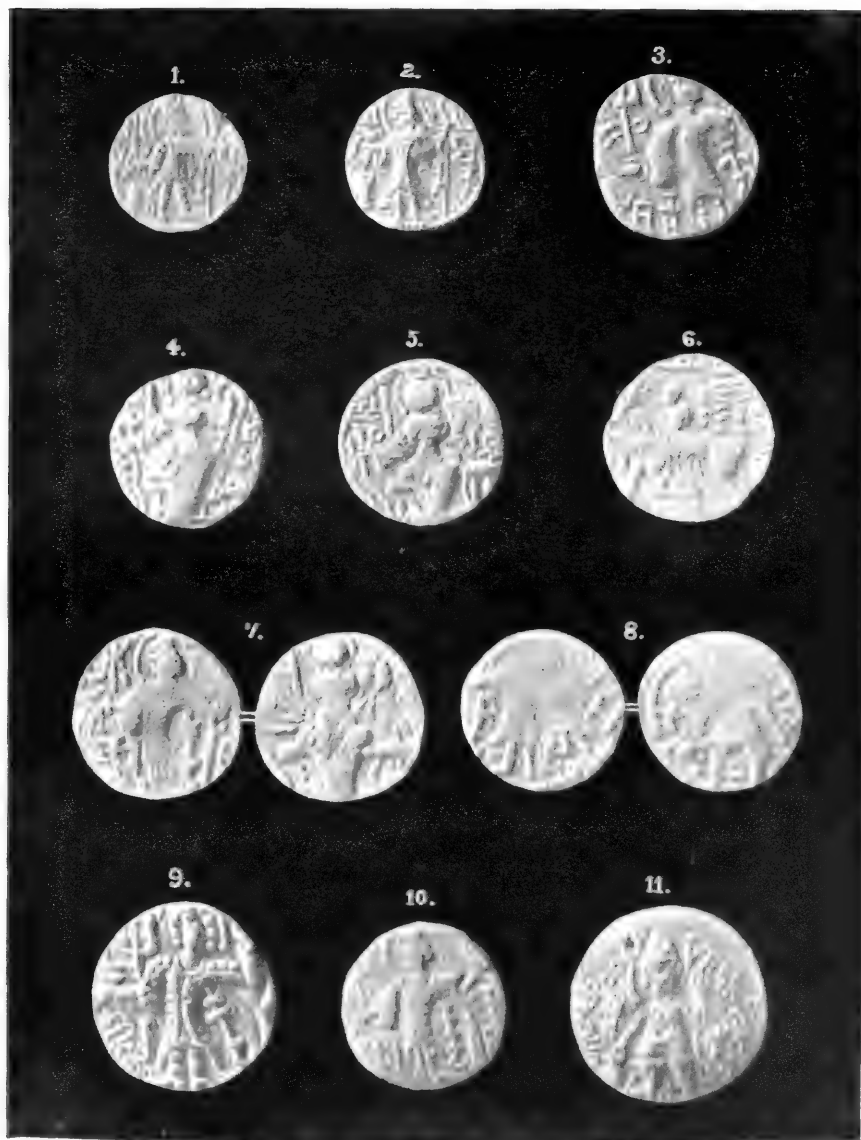
The Minutes of the last meeting were read and confirmed.

A discussion took place on the recent outbreak of epidemic dropsy or Beri-beri, when papers on the subject were read by Dr. T. Pearse, Captain Munro, I.M.S.; and the discussion was continued by Captain Mackelvie, Captain McCay, Dr. G. C. Chatterjee, Lieut.-Col. Buchanan, Lieut.-Col. Harris, and Major L. Rogers, and was adjourned to the next meeting.



Indo-Scythian Coins.





Indo-Scythian Coins.

१ श्रीमन्नदीपाल
 वनाकासभूरा
 अक्षिमाद्यज्ञप
 तस्यमवस्थाप्यं पुरन
 मानायानयाग्निः पर
 न्नापामकः श्रीमन्निगाठ
 कीयज्ञाविषकीगाम्नी
 वनिर्हस्तमाह्वयत्तु
 ः श्रीमन्मन्त्रीवालो
 न्नाम्नामद्वयं प्राणित
 तुम्हवत्तुत्तुत्तुत्तुत्तु
 वृत्तैरज्ञोत्रोप्यं निना

Inscription of the 11th year of Mahipala.

२६ श्रीमन्नदीपाल
 वनाकासभूरा
 अक्षिमाद्यज्ञप
 तस्यमवस्थाप्यं पुरन
 मानायानयाग्निः पर
 न्नापामकः श्रीमन्निगाठ
 कीयज्ञाविषकीगाम्नी
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 तुम्हवत्तुत्तुत्तुत्तुत्तु
 वृत्तैरज्ञोत्रोप्यं निना

Inscription of the 26th year of Dharmmapala.

Fragment of an inscription in Brahmi script, showing several lines of text.

Fragment of an inscription in Brahmi script, showing a few characters.

Fragment of an inscription in Brahmi script, showing several lines of text.

Fragment of an inscription in Brahmi script, showing several lines of text.

Inscription of the 2nd year of Surapala.

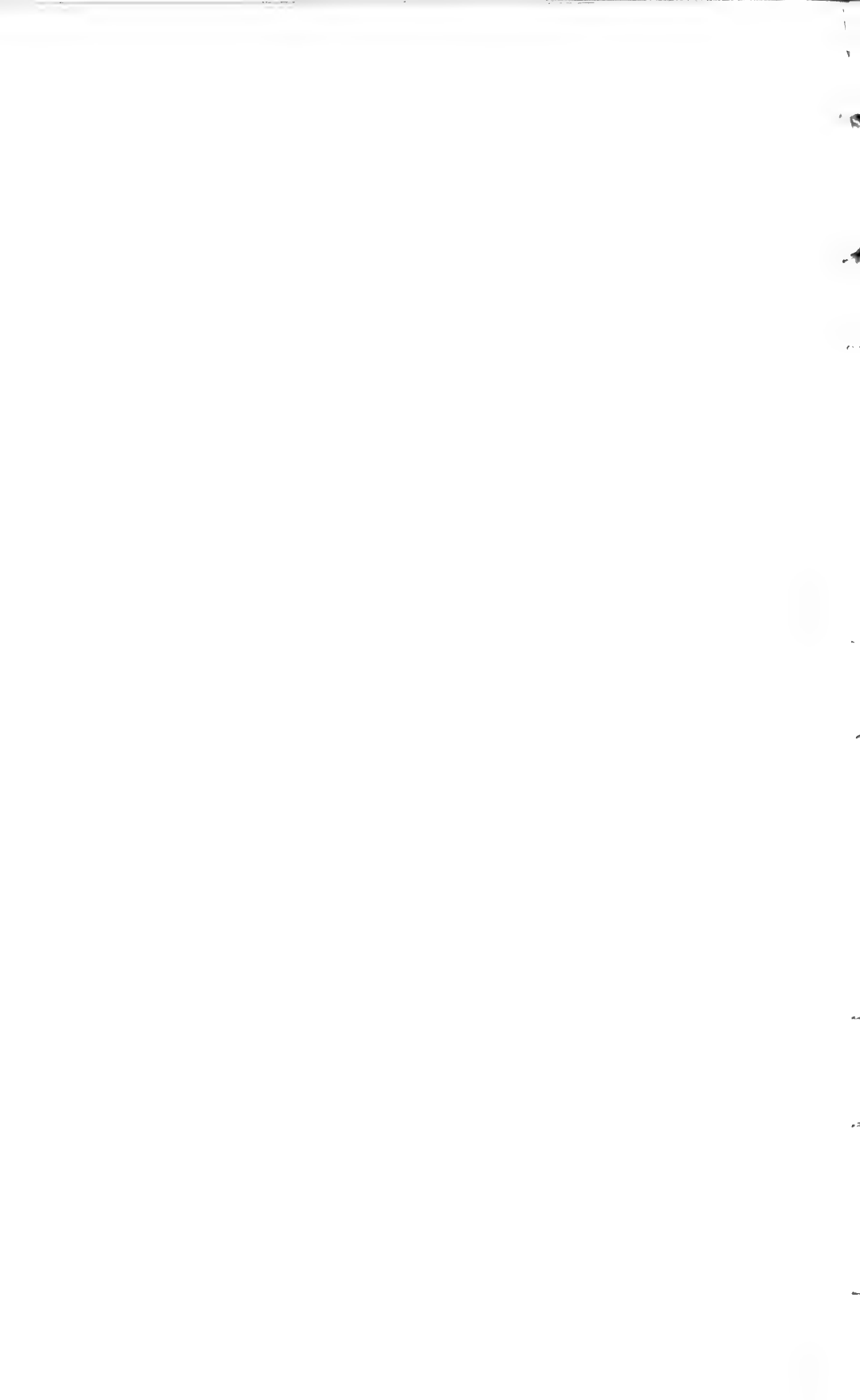
Fragment of an inscription in Brahmi script, showing several lines of text.

Nalanda inscription of Gopala—the year 1.

Fragment of an inscription in Brahmi script, showing several lines of text.

Inscription of the 2nd year of Ramapala.

Fragment of an inscription in Brahmi script, showing several lines of text.



Handwritten text in Devanagari script, likely a mathematical or astronomical treatise, with several circular diagrams interspersed.

Handwritten text in Devanagari script, continuing the treatise, featuring circular diagrams.

Handwritten text in Devanagari script, further sections of the manuscript, with circular diagrams.

Handwritten text in Devanagari script, concluding sections of the manuscript, with circular diagrams.

Part of a palm-leaf manuscript of Aryabhata's works.

The four leaves reproduced contain the whole of the Ganita.



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- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
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- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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OF THE

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19. Certain Disputed or Doubtful Events in the History of Bengal, Muhammadan Period.

PART I.

By MONMOHAN CHAKRAVARTI, M.A., B.L., M.R.A.S.

A large number of facts and events in the pre-Mughal period of Bengal history still remain doubtful or unsettled. A few of them have been selected here for discussion, in the hope of drawing attention to them prominently. Their importance is undoubted, and their solution will help in giving a clearer idea of the period.

I. THE KHALI MALIKS OF LAKHAṆAWATĪ.

(i) *Ikh̄tiyār-ud-dīn, Muḥammad-i Bakht-yār Khaljī.*

His expedition to Nūdiah is well known as the first Mussalman invasion of Bengal. But about its date considerable difference of opinion exists, making it vary from 590 H. to 600 H.¹ The main authority for the period in Bengal is *Ṭabakāt-i Nāṣiri* of Minhāj-i Sarāj.² It was composed sixty years later, facts of 658 H. having been mentioned therein. Though not a contemporary, having lived in Lakhaṇawatī two years, and having held high posts at Dihli, he had special opportunities of consulting men and documents of the time.

On this work as basis, the two later dates are to be put out of court. Firstly, the events narrated in the career of Muḥammad-i Bakht-yār (a summary of which is given at the end of this article), are more consistent with the earlier dates than the later ones. Secondly, the dominion of Sultān Ghiyās-ud-dīn Muḥammad-i Sām, the elder brother of Sultān Muizzuddīn (who defeated Pṛthvī Rāi), is said to have extended "from the east of Hindūstān, from the frontier of Chīn and Mā-chīn as far as 'Irāk" (p. 383). This statement can hold good only if Bengal be included, as Bengal only was thought to adjoin Chīn. The expedition to Bengal, by virtue of which Bengal is included in this Sultān's Empire, must, therefore, have taken place before 598 H., on the 27th Jumādi I of which

¹ 600 H. in Stewart's *History of Bengal*, ed. 1847, p. 27, and Thomas, J.R.A.S. VI, 340; 599 H. in Thomas' *Chronicles of the Pathan Sultans of Delhi*, p. 110; 594 or 595 H., Blochmann's contributions, Part III, J.A.S.B. 1875, pp. 134, 135; 590 H., Raverty's translation of *Ṭabakāt-i Nāṣiri*, p. 573, note 9, and App. D.

² Major Raverty's translation (Bibl. Ind.) is quoted here throughout; besides which extracts thereof have been translated in Sir H. Elliot's *History of India*, Vol. II, 266-383.

year he died (p. 383). Thirdly, the statement that when Muḥammad-i Bakht-yār captured the Fort of Bihār, Rāi Lakhmañah of Bengal had been on the throne for eighty years" (pp. 554, 555). helps us in fixing the date. The year evidently refers to the era

Date : 596 H.

of Lakṣmaṇasena, which began on 7th October, 1119 A.D. As the expedition to Nūdiāh took place "the year following that" (p. 557), its date falls in La. Saṃvat 81 or A.D. 1199—1200 (596 H.).¹ The expedition took place probably in winter, the best time for horsemen and merchants to move about.

Against this conclusion there is one serious objection, viz., a

Objection.

statement in the *Tājul Maāsir* of Hasan Nizami,² a work more contemporaneous, having been begun about 602 H. with the history carried down to 626 H. After narrating the capture of Kalinjār on 20th Rajab, 599 H., and Kuṭb-ud-dīn's march to Budāūn, it goes on to say:—

"Shortly afterwards Ikhtiyār-ud-dīn Muḥammad Bakht-yār, "one of the chief supports of the State, the splendour of Islām, and "celebrated throughout Hind for his religious wars, joined the "auspicious stirrups and came to pay his respects from the direction "of 'Adwand Bihār. He presented twenty elephants and various "kinds of jewels and moneys. He was received with royal kind- "ness and beneficence, and he was exalted above the leaders of the "time; and when he took his audience of leave, the blessed com- "mands, investing him with authority, were renewed and augment- "ed, and a tent, a *naubat*, a drum, a standard, and magnificent robe "of honour, a horse and trappings, a waistband, sword, and a vest "from the private wardrobe were conferred upon him."

A similar event is narrated in the *Tabakāt-i Nāṣiri* just after the capture of Bihār Fort, and before the expedition to Nūdiāh (pp. 552-4). Joining the two, the capture of Bihar would then fall in 599 H. and of Nūdiāh in 600 H., both the dates thus differing from those deduced above. It is, however, just possible that the offering of the presents might refer to the despatching of a large portion of the booty after the sack of Nūdiāh (p. 560). *Tabakāt-i* is silent as to whether Muḥammad-i Bakht yār himself came to Dilhī this time. If he did, then 600 H. would not be inconsistent. It might also be argued that the year of *Tājul Maāsir* might be incorrect, for in the four MSS. examined by Major Raverty the date was written ambiguously, and might be read as 597 or 599 H.³ and between the immediately preceding date (13th Rabi I, 693 H.) and this one the gap is rather suspiciously long. On the present state of facts, therefore, the probability lies in favour of 596 H.

The nature of Muḥammad-i Bakht-yār's conquest appears to

Conquest in Bengal.

have been much exaggerated. The expedition to Nūdiāh is only an inroad, a dash

¹ See this point discussed in my article, J.A.S.B., 1905, pp. 47, 49.

² Elliot, II, 232. *Adwand* is a correction for "Oudh and" (Raverty, App. D., p. xxvi), and is apparently a corruption of *Danda-bhūkti*, the old name of Bihār.

³ Translation, Appendix D, p. xxiii; for four, see also App. A, p. v.

for securing booty natural to these Turkish tribes. The troopers looted the city with the palace and went away. They did not take possession of that part: and, if they had tried, they would have most likely failed, as their base in Bihār was too far off and too recent to be of much avail. On removing the seat of government to Lakhanawāṭi, there was an attempt to secure permanent possession of some part of Bengal. On the north Diw-koṭ, where he died on his return from the disastrous inroad to Tibbat, was evidently in possession of the Mussalmans. On the south Lakhan-or was outside their jurisdiction, because Muḥammad-i Sherān had been deputed with a force towards it at that time. Diw-koṭ is identified with Dandamma, about 70 miles N E. of Gaur: Lakhan-or is identified with Nagor by Stewart and with Lacarcondah by Blochmann; but neither identification is satisfactory, both being far away from the river Bhāgirathi. Even if either of these identifications be accepted, it would be not more than 90 miles from Gaur. The tract between the two is thus hardly large and forms an insignificant part of the Bengal province. *Ṭabakāt-i* itself carefully speaks of Lakhanawāṭi only; it is only the later writers who dilate on the vaunted conquests of Bengal. In fact, if such plundering inroads be magnified into conquests, and the Hindus of Bengal blamed and vilified for allowing the so-called easy conquests, then Maḥmūd of Ghaznī has better claims for being credited with the conquest of entire Hindūstān.

(ii) *Ghiyās-ud-dīn Huṣām-ud-dīn 'Iwaz Khaljī.*

The date of his actual accession is not free from doubts. He was defeated and killed in 624 H., after a reign of twelve years (p. 595). According to this statement, therefore, his accession took place at the earliest in 612 H. This does not agree with the date deducible from his predecessor's death. His predecessor, 'Alī-i Mardān, had accompanied Kuṭb-ud-dīn in his expedition to Ghazni in 605 H., and was captured. On his release he came to Dihli and was put in charge of Lakhanawāṭi. He was in charge for some time when Kuṭb-ud-dīn died in 607 H. He was, therefore, in possession probably in 606 H., at the latest in 607 H. His reign lasted "two years, more or less." If this means two years and some months, then, counting from 607 H., he must have been killed by the Khalj Amīrs at the latest in 610 H. Who then ruled in the intervening years 610--612 H.? It is possible that the Khalj Amīrs fought amongst themselves until Huṣām-ud-dīn 'Iwaz got the upper hand in 612 H.¹

It is said in the *Ṭabakāt-i*: "His affairs reached such a point that the coin of the territory of Lakhanawāṭi was stamped, and the *khutbah* thereof read in his name, and they styled him

Time of his independence.

¹ Similar doubts exist as regards the date of death of Muḥammad-i Sherān; see the summary at the end.

by the title of Sultān Ghiyās-ud-dīn" (p. 581). Unfortunately, *Ṭabakāt-i* is silent as to when and under what circumstances these important steps of complete independence were taken. His predecessor, 'Alī-i Mardān, had done all these things, excepting coining the money (p. 578).¹

Luckily a number of silver coins, discovered in 1872 in a hoard at Bihār, throw some light.² The earliest of these Bengal coins is dated 614 H., with the name of I-yal-timish, the slave freedman, as the suzerain. A gold half-mohur, 70·6 grs (not of this hoard, but of Kuchbihār), gives the earliest mint-name of Bengal "struck at Gaur" with the year 616 H., while two more silver coins of this year show I-yal-timish's suzerainty. Seven more specimens of 616 H. show for the first time the regnal name of Ghiyās-ud-dīn, with the title *Nāṣir Amīr al Mūminīn*, defender of the Commander of the Faithful.³ In four coins of 617 H., *Al Muazzam*, the great, is superseded by the superlative *Al 'Azam*, the highest. Furthermore, in seven specimens of 620 H., he calls himself Sultān of Sultāns, by direct appointment of the Khalif, and even stamps the month and the date, 20th Rabi-ul Akhir, probably the date of Khalif's order. Lastly in a coin of 622 H. in the same hoard, I-yal-timish's name reappears. So the following four stages are revealed: first, the acceptance of I-yal-timish's suzerainty; second, the assumption of complete independence in 616 H.; third, the gradual increase in the pomposity of the titles and the strengthening of his claims to independence by Khalifat orders; and, lastly, the re-acknowledgment of I-yal-timish's suzerainty in 622 H., as the result of latter's invasion.

His territory extended from Dīw-koṭ to Lakhaṇ-or, a distance

Extent of his territory.

of about 150 miles or "ten days' journey," and included a part of Rāḥ and Vārendra. He was in possession of Bihār also for several years. He was not in possession of Vaṅga or Tirhut (or apparently Sātgaón too); but in the usual way they, with Jāj-nagar and Kāmṛup, are said to have sent him tribute (pp. 587-8).

(iii) *Ikhtiyār-ud-dīn Daulat Shāh-i Balka Khaljī.*

This name does not appear in the Standard History of Bengal (Stewart). But his existence is proved

Daulat Shāh.

from the *Ṭabakāt-i* and a coin. According to *Ṭabakāt-i* he was son of Huṣām-ud-dīn 'Iwaz (pp. 617, 626): but the coin gives a different name of his father, and according to

The events of his Rule.

other histories, he was only a kinsman of Huṣām-ud-dīn. On the death of the latter's successor, Nāṣir-ud-dīn, the eldest son of I-yal-timish, Daulat took possession of Lakhaṇawaṭī and

¹ *Ṭabakāt-i Akbari* and *Budāoni* speak of his coining money, but no coin of his time has yet been found.

² Thomas, J.R.A.S. VI (N.S.), 348 *et seq.*, coins 1 to 7a and 9.

³ Raverty reads it as *Kasimī Amīr al Muminīn*, the Lord of the Faithful's handsome [one], note 9, p. 770 (772) and p. 316.

revolted, striking coin in his name. In 628 H. I-yal-timish proceeded against him in person and captured him. He was the last Khalj ruler of Lakhanawati.

The coin attributed to him is dated 627 H. (which may be read as 629 H. also), and bears the name Abū-l-Ma'ālī-i Daulat Shāh bin Maudūd,

Coin.

with the title Shāhan-Shāh.¹

For facility of reference, the main facts of this obscure period are given below in a tabulated form, with dates and references in separate columns.

Summary of Events.

The pages refer to Major Raverty's translation of the *Tabakāt-i Nāṣirī*, unless otherwise stated.

Date.	Main Events.	References.
<i>I. Muḥammad-i Bakht-yār.</i>		
Some time after 589 H. ? 590 H.	Rejected by the Muster-master in Dihli (which had been finally occupied in 589 H). Proceeded to Malik Huṣām-ud-dīn Aghūl-Bak in Awadh; was put in charge of the fiefs Bhagwat and Bhiūli. Gathered bodies of <u>Khaljas</u> . Got a robe of distinction from Kutb-ud-dīn Ī-bak of Dihli. Ravaged Bihār for a year or two.	p. 549. pp. 549-550. p. 551. p. 551, and App. D, p. xxv. pp. 551-2.
80 La. Saṁ., 1198-9 A.D. (595 H.)	Captured and sacked the fort of Bihār ... At that time Rai Lakhmaṇiāh had been on the throne for eighty years ...	pp. 554, 555.
"The year following that" 1199-1200 A.D. (596 H.)	Paid respect to Kutb-ud-dīn with much booty, and received great honour and distinction from him. From Bihār pressed on to Nūdiāh, the capital; entered the city sedately as merchants bringing horses for sale, and then suddenly attacked the palace. Rae Lakhmaṇiāh, about to dine, fled by the back part to Sankanāt and Bang. The city with the palace looted. Leaving Nūdiāh in desolation, removed the seat of government to Lakhanawati, and brought the different parts of it under his sway.	pp. 552-4; cf. <i>Tājul Maāsir</i> , Elliot, II, 232, pp. 557-8.
? 600 H.	Despatched a portion of the booty and wealth to Kutb-ud-dīn Ī-bak.	p. 559. p. 560; cf. <i>Tājul Maāsir</i> , Elliot, II, 232.
"After some years." 602 H.	Invasion of Tibbat. With 10,000 horse marched to Burdhan-koṭ; went up the river Begmati for ten days, crossing it by a bridge of more than 20 arches and leaving a part of the army to guard it; went on through mountains, for 15 days, attacked a fort and had a whole-day	pp. 560-572.
Expedition lasting		

¹ Coin No. 13, Thomas, J.R.A.S. VI, 367; Raverty, note 9 to p. 770 (774).

Date.	Main Events.	References.
probably three months	battle in which a good many of his army were killed; the next day retreated, reaching in 15 days the bridge and found it destroyed; took refuge in an idol-temple and was being stockaded, to avoid which tried to ford the river, but excepting a few hundred all drowned. He escaped and retired to Dīw-koṭ.	
Shaban, 602 H. March-April, 1206.	Through excessive grief fell ill and died, shortly after the death of Sulṭān Muizz-ud-dīn (on 3rd Shāban, p. 486). According to some, murdered by 'Alī-i Mardān, the feejee of Nārangoe. No coins yet discovered; masjids, colleges, monasteries founded by him and his Amirs in Lakhaṇawaṭī.	p. 572-3. p. 560.
<i>II. Izz-ud-dīn Muḥammad-i Sherān.</i>		
596 H.	Captured eighteen elephants alone in a jungle, at the time of looting Nūdiḥ.	p. 574.
602 H.	Despatched with a force towards Lakhaṇ-or and Jājnagar, at the time of Muḥammad-i Bakht-yār's mad invasion of Tibbat.	p. 573.
602 H.	On hearing his death, came back to Dīw-koṭ and performed mourning ceremonies, apparently as a near relative	p. 574.
602 H.	Imprisoned 'Alī-i Mardān at Nārangoe, placing him under the charge of its Koṭwāl, Bābā, the Şafāhānī. As head received homage from the Khalj Amirs and kept each in his fief.	p. 574. p. 575.
	On the complaint of 'Alī-i Mardān who had escaped to Dīhli, Kutb-uddin deputed Kāe-maz, the Rūmī, from Awadh.	p. 575.
	Kāe-maz joined by Husām-ud-dīn, the feudatory of Ganguri, whom he put in charge of Dīw-koṭ. A battle between Kāe-maz and Muḥammad-i Sherān, ending in the latter's defeat.	p. 576.
Year not given. (If 603 H., there is a gap).	Dissensions among the Khalj Amirs, in which he was killed.	p. 576.
<i>III. 'Alā-ud-dīn 'Alī-i Mardān.</i>		
602 H.	By secret compact with the koṭwāl escaped from imprisonment at Nārangoe to Dīhli.	pp. 575, 577.
605 H.	Accompanied Kutb-ud-din in his invasion of Ghaznin, but after his forty days' rule captured.	p. 577; for the invasion, pp. 503, 506, 526-7.
606 H. (1208-9 A.D.)	Released by the Turks, and came back to Kutb-ud-din at Dīhli, who assigned him Lakhaṇawaṭī, of which he took possession.	p. 578.

Date.	Main Events.	References.
607 H.	On the death of Kutb-ud-din (in 607 H., p. 528, cf. <i>Tāj Ma.</i> , Elliot, II, 237), assumed a canopy of State, read the <i>Khutbah</i> in his own name, and was styled Sultān 'Alā-ud-din.	p. 578.
609 H., (at the latest 610 H.), 1212-3 A.D.	Sent armies in different directions and put the greater number of <i>Khalj</i> Amirs to death.	p. 578.
? 609 (or 610 H). 612 H.	A party of the <i>Khalj</i> Amirs conspiring slew him, after a reign of "two years, more or less."	p. 580.
? 609 (or 610 H). 612 H.	IV. <i>Ghiyās-ud-dīn, Huṣām-ud-dīn 'Iwaz-i Huṣain</i>	
? 609 (or 610 H). 612 H.	Placed on the throne by the party of <i>Khalj</i> Amirs that slew 'Alī-i Mardān.	p. 580.
? 609 (or 610 H). 612 H.	Began to rule, nominally acknowledging the suzerainty of Sultān I-yal-timish.	pp. 594-5; coins of 614, 616 H., J.R.A.S., VI, 348-352, Nos. 1 to 3a, p. 581; coins Nos. 4, 5, 6, 6a, Do.352-6.
616 H.	Assumed complete independence under the title Sultān <i>Ghiyās-ud-dīn</i> , read the <i>Khutbah</i> and coined money in his own name (for date, see the coins).	p. 581; coins Nos. 4, 5, 6, 6a, Do.352-6.
20th Rabiul- Akhīr, 620 H.	Got <i>firman</i> from the <i>Khalifa</i> of Baghdād	Coins Nos. 7, 7a, Do.357-8,
	Bihār taken possession of by the forces of I-Yal-timish.	p. 591.
622 H.	The Dihli Sultān marched against him and forced him to conclude a treaty, by which he paid 38 elephants (30 in p. 610 and eighty lakhs of treasure, and agreed to read the <i>Khutbah</i> and to coin money in the name of the Dihli Sultān.	pp. 593, 610, 627; coin No. 9, J.R.A.S. VI, 359-360.
622 H.	On the withdrawal of the Sultān, drove out his governor of Bihār, 'Izz-ud-dīn Jānī, and took repossession of it.	p. 594.
624 H.	Invaded Kāmṛūd and Bang, leaving the city of Lakhanaṭī unprotected.	pp. 594, 595, 629.
624 H.	Nāṣir-uddīn Maḥmūd Shāh, the eldest son of I-yal-timish, from Awadh invaded Lakhanaṭī, and captured the city and the fort Basan-koṭ.	pp.594-5,627, 629.
11th month (?) 624 H., (Nov. 1227).	<i>Ghiyās-ud-dīn</i> hurried back, was defeated and killed.	pp. 595, 629.
	<i>Works</i> :—	
	Built the fortress of Basan-koṭ; founded <i>jāmi</i> and other <i>masjids</i> ; caused an embankment (<i>pul</i>) to be constructed from Lakhanaṭī to Diw-koṭ on one side, and to Lakhā-or on the other, about ten days' journey, because in the rains the whole of that tract becomes inundated, and the route is filled with mud-swamps and morass.	pp. 582, 583. p. 586.

Date.	Main Events.	References.
<i>V. Nāṣir-ud-dīn, Maḥmūd Shāh.</i>		
Zilkadah (?), 624 H.	On the defeat and capture of Sultān <u>Ghiyās-ud-dīn</u> , appropriated his treasuries. Sent money to the 'ulamā, sayyids and pious men of Dihlī and other cities.	p. 629. p. 629.
Rabī-ul Awwal, 626 H, after 22nd.	When dresses of distinction reached his father from <u>Khalīfah</u> 's capital, <u>Baghdād</u> , he selected one dress of great value and despatched it to him with a red canopy of State.	pp. 629-630, cf. p. 616.
In or before Jumādi I, 626 H. (April 1229). 624 H.	Fell sick and died " a year and half " after accession, the news reaching Dihlī in Jamādi-ul Awwal, 626 H.	pp. 630, 616-7.
626 H.	Coins :— (1) Nos. 10 and 11 of the <u>Bihār</u> hoard, dated 624 H. (2) No. 12, with the name of <u>Khalīfah Al Mustansir billah</u> , apparently on receipt of the <u>Khilāfat</u> dress. His tomb at Mallickpur Koyi, three miles west of Kutb Minār, with an inscription of 629 H.	J.R.A.S. VI, 360-1. Do., p. 365. J.R.A.S. VI, Note 2 to p. 367.
<i>VI. Iḥtiyār-ud-dīn Daulat Shāh-i Balkā.</i>		
626 H.	Son of <u>Ḥuṣām-ud-dīn 'Iwaz</u> (No. IV); son of <u>Maudūd</u> , according to coin No. 13; and kinsman of <u>Ḥuṣām-ud-dīn</u> .	p. 626, J.R.A.S. VI, 367.
627 H. (coin).	On the death of <u>Nāṣir-ud-dīn</u> , took possession of <u>Lakhanawāṭī</u> and rebelled (striking coin, the existing specimen of which, however, acknowledges the suzerainty of <u>I-yal-timish</u>).	pp. 617-8. J.R.A.S. VI, 367.
628 H., (before Rajab), Jumāda II(?), April, 1230 A. D.	<u>Sultān Shams-ud-dīn I-Yal-timish</u> proceeded against him in person and captured him. After conferring the throne of <u>Lakhanawāṭī</u> on 'Alā-ud-dīn <u>Jānī</u> , the Sultān returned to Dihlī in Rajab.	pp. 586, 618-9.

20. Note on the Drum in Falconry.

By LIEUT.-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*

What the precise use of the drum in falconry was it is difficult to determine. The drum does not appear to be now used in India, but probably it is still used by the Turks of Central Asia. In Hyderabad, Deccan, so say old men, it was used up till the time of Nawāb Nāṣir^u 'd-Dawla, called Aṣaf Jāh the Fourth, who, succeeding his father as Nizām of the Deccan in 1829 A.D., died in A.D. 1857. Nāṣir^u 'd-Dawla's hawking parties are said to have been conducted with all the old-fashioned pomp and circumstance that distinguished Eastern potentates. Drums, part of the insignia of rulership, appear to have been used by him, not so much to flush quarry and excite the hawk, as to inform his numerous and scattered retinue that a hawk had been cast off, and that it therefore behoved them to stop chattering and to keep a good look-out. The present Nizām, it is said, has discarded the pomp of his ancestors, and, as a concession to modernism, substituted a bugle.

The following extracts, which throw some light on the subject, are translated, the first two from Persian MSS. written in India, and the last from a modern Urdu lithographed work on sport:—

From a Bāz-Nāma written for Muhammad Bayrām Bahādur Khān, Khān-i-Khānān, by Muhibb 'Ali-Khālifa.¹

“ CHAPTER XXVI.²

“ ON THE METHOD OF BEATING THE DRUM, HOW IT SHOULD BE BEATEN, AND ON WHICH SIDE OF THE SADDLE IT SHOULD BE SUSPENDED.

“ It is usually suspended from the right side. Now several points are to be observed in beating the drum for the goshawk. First, attention should be paid to the flight of the hawk, that is, it should be noted whether the hawk flies high or low, and also whether it is raw or thoroughly entered; next, attention should be directed to the water, to see whether the extent is little or great; next to the species of duck to be flown at; and next to the wind, to see if it is strong or slight.

“ If the goshawk is new, it must first, for some days, be

¹ From a new and perfect MS. in the Library of the Board of Examiners, Calcutta, copied from one in the Library of Sir Salar Jang, Bahadur, Haiderabad, Deccan, and presented by Shams^u-l-'Ulamā, Nawāb 'Aziz Jang.

² In another imperfect copy in the Library of the Asiatic Society of Bengal (an inferior copy in fair preservation), this chapter is numbered 28.

trained to the sound of the drum. Next, when the hawk is cast off, the drum should be beaten more or less according to the powers of flight of the hawk; for it is probable that the duck will rise too high for a new hawk to reach them. The drum should be beaten only so much that the duck may delay sufficiently to allow the new hawk to reach them, and may not make off at once.

“If the hawk is trained to take quarry right away in the air¹ and is a high flier, the falconer should not be hasty in beating the drum. He should let his hawk go before the ducks rise from the water, and then, when it has reached half-way to where the ducks are, he should begin beating the drum; for the hawk will, in this case, certainly fly low, and for a hawk that naturally flies low the drum should be beaten with regard to the extent of the water, the species of water-fowl and their wildness or tameness, and the high or low condition of the hawk. If the water-fowl have been scared and have seen the hawk, there is no harm in beating the drum continuously, for it is necessary to beat the drum very quickly to distract the attention of the quarry (made shy on previous occasions) from the hawk. Further, at such wild birds, care should be taken to let the water-fowl first take the air, then to cast off the hawk, and next to beat the drum; for should the hawk be cast off while the ducks are in the water, they will rise on seeing the hawk, and make off elsewhere: then—beat the drum in any manner you choose—it will be of no use.

“It is generally laid down that the drum should not be beaten quickly, but this rule has exceptions, for whether the drum is to be beaten quick or slow depends on the experience of the falconer; in cases of necessity there is nothing for it but to beat very quickly. In other cases, when the ducks are tame and unscared, the drum should be beaten according to custom, with distinct and slow taps. The reason is this, that when the drum is beaten in this fashion, the ducks will not rise to an unusual height. Further, when the ducks hear the sound of the drum repeatedly in one minute, they become assured of danger and wait for no more. Also there is, in Hindustan, a species of duck found during the rains with the neck red like that of the common crane²; this duck never waits for a second beat of the drum; at the first sound it rises to a height that completely baffles the hawk: for this species the drum must be beaten in the ordinary way without haste. However, for the *Amla-bāsh*,³ the *Irka*,⁴ the *Sona*,⁵ the

1 كوردن رو دست, to train a hawk ‘to fly at bolt.’

2 Perhaps the author refers to the Pink-headed Duck (*Anas Ceryle phyllacea*).

3 امله باش: possibly a copyist’s error for ال باش T. “the Teal.”

4 ایرکا; in Turki ایرکه or ارکه is the name of a species of duck.

5 سونه, possibly the mallard, called in Turki سن اوردک *Sun urdak*. Some Panjabi falconers call the mallard *sohna* (or *sona*?) *murghābi*. However, *sohna* in Panjabi means “pretty.”

[N.S.]

Bürchîn,¹ the *Khush-bāng*,² the *Sokhar*,³ the *Ursi*,⁴ the heavier the drum is the better; and further, if the water is extensive and the distance great, the falconer should begin to beat the drum according to the ordinary custom; but, when the hawk has traversed some distance and is close to the duck, he should beat faster, so that the duck may not see the hawk⁵ and may not break away.

“When a strong breeze is blowing, the drum should not be beaten quickly; for in a strong breeze the duck will rise to a great height at the slightest sound of the drum, and the reason is obvious. The smoother⁶ the note of the drum the better; the duck will not stand a dry sound from the drum. The drummer, too, must not beat with force: he must beat somewhat lightly until the hawk reaches the duck.

“The drum is necessary for all ducks; it can be used for the common crane⁷ also. The reason the drum is used for cranes is, that when they hear the drum, they become alarmed and stretch out their legs and the falcon can bind to any spot it chooses, thus coming down to the ground without fear of injury. But in this case, the falcon usually binds to the thigh or to the knee.⁸ If she binds to the head she will be injured by the sharp claw of the crane; if, however, she binds to the back or to the neck, the claw cannot reach her; the reason is evident.⁹ When the falcon seizes the crane by the root of the neck, the crane cannot reach her with its claw; but, generally speaking, the hawk will come to the ground on her back and be injured. When she binds to the knee, the danger is less; but in this case the crane is not quickly brought down to the ground, but flies ahead some distance in the air.

“The danger to the *lāchîn*¹⁰ from a goose taken in the air is greater than that from a crane, for the crane is a long-legged animal and powerful as well; after the *lāchîn* binds to it, it can sustain itself in the air and comes to the ground lightly. The goose, however, is heavy and short-legged; it comes down like a heavy stone from a height when the hawk binds to it; so if the hawk falls below it, the danger is great.

¹ روز چین in one manuscript روز چین

² خوشبانگ; not traceable.

³ سرخر; in one MS. سرخده possibly an error for سرخاب the Ruddy Shieldrake or Brahmini Duck (*Casarca rutila*, Pallas).

⁴ In one MS. قریبی

⁵ Birds habitually look upwards, as beasts habitually look downwards. Perhaps the duck being in the air with the hawk below them would, when alarmed by the drum, look up and not down.

⁶ کلنگ نوز خوب طبل میخورد; P. “smooth.”

⁷ A peregrine often brings down a heron from a height by binding to the feet; in that position it is out of danger from the heron's beak.

⁸ There appears to be some error or omission in the text here.

¹⁰ *Lāchîn* is the Turki name for the *Shāhin* and not for the Peregrine.

“To cure a *lāchīn* from coming to the ground with the goose, keep her in high condition so that she may employ her own peculiar tactics and strike down the goose.¹ Since the goose is very heavy, it cannot protect itself as a crane does; it comes to the ground with such force that its gizzard is forced out of its mouth and it is killed. If a *lāchīn* employs these tactics she may take five or six geese in a day without injury to herself.

If, however, the *lāchīn* strikes down the goose from a height, the goose will recover itself in the air; but if close to the ground, the goose will strike the ground but not with force; if struck down from a height of, say, ten or fifteen yards, it will strike the ground well and in good style. A trained falcon knows from what height to strike² the goose.

“To prevent a goshawk from taking duck while in the water and a *lāchīn* from coming down with a goose, these hawks should be kept in high condition and not worn out with too much stroking. Other matters are left to the intelligence of the falconer. To discuss further this delightful subject is no easy matter, and—God knows everything.”³

From a Bāz-Nāma in the Library of the Asiatic Society of Bengal,⁴ copied from a manuscript⁵ in the Oriental Public Library of Bankipore.

“ON BEATING THE DRUM WHILE IN THE FIELD.

“*Part I.—On sounding the drum for short-winged hawks.*—When flying at duck, geese, common crane, and demoiselle crane, after the hawk is cast off and when she is close to the quarry, the falconer should sit on the ground and beat the drum; for it is better to do so in this position than mounted.

“*Part II.—For falcons or long-winged hawks.*—These do not always require the drum. The drum should be beaten after they have been cast off and have reached their pitch.”

From the “Sayd-gāh-i Shawkatī” by Nawāb Yār Muḥammad Khān Bahādūr, (Shawkat), of Bhopāl, an Urdu work composed in A.H. 1301 (A.D. 1883), the second edition being lithographed in 1305 A.H. in the Rampore State.

“When your goshawk’s training has reached this stage, i.e., when she has been tamed by watching and handling, has been

¹ افشاندہ گزارد ; text incorrect, and meaning not clear.

² *Tāvīdan* ; used by the author as a synonym of *partāb kardān*, an expression used by him elsewhere.

³ i.e., the writer doesn’t profess to have perfect knowledge.

⁴ New and well-bound, but without title.

⁵ In perfect preservation. There is a second and older copy of this manuscript in the same Library, and in it is stated that the author’s name

broken to the hood, trained to the lure, and entered to quarry by live trains, you should tie her tail on both sides to her flight-feathers¹ and go into the jungle and fly her at a rat, or a bandicoot, or else at a puppy-dog. If she take the rat, so much the better; if not, she will settle at the entrance of its hole. Fly her several times at a rat, so that she may acquire the habit of settling on the ground. After that undo the flight-feathers, but let the tail remain tied very loosely. Next fly her at a bagged hare, but the mouth of the hare should be stitched up so that it may not injure the hawk.² The reason for training the hawk to 'fly at the bolt'³ is to teach her the habit of settling on the ground without hesitation. When the hawk has been trained as above, she would be flown at bolt, at duck. The following is the method: First two ducks should be tied together, fluttered before the hawk's eyes at a distance of ten yards, and then released so that she may leave the fist and take them. After this, ducks should be released for the hawk by an assistant in ambuscade. This should be done several times, the hawk being fed on each kill and the distance at which the trains are released being increased. She should afterwards be flown at duck in water, so that she may either take one in the water or else seize one and bear it to land. The falconer should then deprive the hawk of the quarry, but fly her at once at a duck in the air; then when the hawk takes a duck up in the air she should be fed up on it. The goshawk is a very intelligent bird; she will never forget a lesson, but she will learn of her own accord, benefitting by her mistakes.

"Your hawk should now be flown at a duck in the following manner: The falconer should draw near to a pond and put up the duck. He should next beat the drum, and then stop and wait till the duck re-settle. After that he should fly his hawk at those ducks that have been affected by the drum.⁴ Now the

is Muḥammad Rizā, son of Muḥammad Yūsuf, and that it was composed in the reign of Aurangzeb, 1083 A.H., and was called *Dastūr 's-Ṣayd*. The copyist's date is not given.

¹ Meaning not clear. The author probably means that the outside tail-feathers should be bound together so that the hawk cannot spread her tail fully (this checks any inclination to 'soar')—and also that one or two flight-feathers should be tied together (as in the case of pigeons) to prevent her feeling strong on the wing. By pigeon-fanciers the first flight-feather only is called *shāh-par*.

² I never heard of a hare injuring any hawk with its teeth. A Saker falcon will stoop at a hare and knock it about, not binding till the hare is worn out and dazed.

³ دست رو کونا

⁴ طبل خوردۀ *ṭabl-khurda*; presumably this is the meaning of the phrase.

I have been told (but cannot vouch for the accuracy of the information) that the bird-catchers of Patna, when snaring duck at night, beat a tin to induce the duck to lie close. It is stated that the duck, imagining a thunder-storm to be imminent, do not take wing easily.

ducks, after rising, will, on hearing the drum, drop and cast themselves into the water; but the falconer must exercise patience, and, discriminating between these ducks that have been affected by the drum and those that have not, fly his hawk at the former only. It is further necessary that he should not be in a hurry to cast off his hawk when the duck rise, but that he should keep his head and wait until they are at a height and are leaving the water in one direction.

“A new and inexperienced goshawk should not be flown at first at a duck in deep water, for the goshawk is a dweller of the mountains and plains; there is a danger of her getting soaked and sinking. She should, therefore, be first flown at duck in shallow water.”

21. Eastern Hoods for Hawks.

By LIEUT-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*

More than one pattern of hawk-hood is used in India. Persian MSS. on Falconry, written in India, mention two patterns, the "*Mugh'i* or three-cornered pattern," and the "*Shāh-jahānī*." The latter is described as being open down the back.

Plates IX to XII, and Fig. 2, Plate XIII, are patterns and sizes of hoods used in the Panjab. Fig. 1, Plate XIII, is a pattern in use in the Persian Gulf. Plate XIV shows a pattern now used in Hyderabad, Deccan.

The Panjab patterns should be cut out in tin or sheet zinc and used to guide the pencil in tracing.

To make the Panjab hood, a small piece of thin stiff leather is wetted and folded, smooth side outwards. When dry, the pattern is carefully traced on this and cut out. (When opened it is as in Fig. 1, Plate IX). The hood, thus cut out, is reversed, so that the smooth side is inwards, and a narrow strap is then threaded in and out of the slits shown in the open figure, beginning from B, Plate IX, and ending at HH, the points EG and HH being drawn close together. An ornamental button or tuft is attached by means of the slits KK. For detailed instructions as to the making of this pattern and the tools used in the Panjab, *vide* the "Field" of 15th March, 1890. These Panjab hoods, which are less than half the weight of the Dutch hoods, have several advantages. English falconers, however, complain that the hawks easily get rid of them. If, during the first two or three days, the falconer is careless and allows the hawk to cast its hood, the habit is established; but if the hawk is properly handled at the commencement, she will not acquire this objectionable habit. In India, hawks properly broken are left hooded on the perch for hours, and though they will scratch the outside of the hoods vigorously, they will not insert the claw under the edge of the hood.

The two best Peregrine patterns are Figs. 1 and 3, Plate X, the former being the pattern used in the Karpurthala State and the latter that used by H.H. the late Mir 'Alī Murād of Sindh. Figure 1 is a pattern unsuitable for a peregrine with a small flat head. The pattern may be increased in size as shown by the dotted line.

In Plate XI, Figure 1, the pattern for the Lagar Falcon has not been tested by the writer. The pattern for a Lagar is generally used also for a Shahin, the difference, if any, in cutting out the hood being judged by eye. Figure 2 fits a Shahin well.

Figure 3 fits a Shabin-Tiercel well; but for a Peregrine-Tiercel cut outside the line *abcdef*, and inside *ghkm*.

In Plate XII, Figure 1 is a very good pattern. Cut along the inside of the lines with the exception of the curve *de*. Cut along the outside of the line *de* as the beak-aperture is, if anything, too large. If the *chargh* has a small head, be careful to cut well inside from *b* to *c*, and just inside from *a* to *b*. Figure 2 is also a good pattern. If the falcon has a large beak, cut along the inside of the curve *cd*; if she has a small head cut well inside the line from *a* to *b*.

Plate XIII, Figure 1, shows a pattern used in the Persian Gulf, that is, in Bushire, Bahrayn Island, and about Basrah and Baghdad. Slits are made along the edge from *a* to *b* and again from *e* to *d*, and a narrow strap is then threaded in and out of them. The points *bd* and *ae* are joined, and the edges *cd* and *cb* are sewn together; likewise *fa* and *fe*. Along *ab*, the back of the hood, the strap is double and acts exactly like the braces in a Dutch hood; that the back can be drawn tight and made to pucker up like the top of an ordinary sponge-bag, and pulled out straight again. A small ornamental button is woven into the slits at *g*. The hood is, in fact, nothing more than a soft leather bag. The stitching makes that portion that covers the eyes, stand out a little; and perhaps at these spots the leather is wetted and hardened. Strange to say, this hood does not make a hawk hood-shy.

The Hyderabad hood, Plate XIV, is made out of dry stiff goatskin, barely thicker than paper. After the pattern is cut out the dotted line is cut through. The writer has merely seen these hoods in use; he has never made them.

22. A General Theory of Osculating Conics.

By PROFESSOR STAMADAS MUKHOPADHYAYA, M.A.

INTRODUCTION.

Differential Equations and Expressions, relating to Conics, have not, so far as the present writer is aware, received the amount of attention they deserve. It is, however, worthy of note in this connection, that in the pages of the Asiatic Society's *Journal*, some years ago, Dr. Asutosh Mukhopadhyaya brought back to light, almost from oblivion, the differential equation of the general conic, which had been deduced by Monge, and gave a beautiful geometrical interpretation (*Journ. Asiatic Soc. Beng.* Vol. 56, p. 134; Vol. 57, p. 316; Vol. 58, p. 181; Vol. 59, p. 61; *Proc. Asiatic Soc. Beng.* 1888, pp. 74, 165, 199).

In the following paper, the writer has endeavoured to explain and establish a general theory of osculating conics, by methods both geometrical and analytical. The osculating equilateral hyperbola holds an important place in this theory, and, therefore, has been first considered. The method of deducing the equation of an osculating conic, as well as its differential equation, from first principles and in general differentials, the implied independent variable being any quantity whatever, is a new departure. Two interesting theorems about the loci of centres of osculating equilateral hyperbolas to a given conic have been obtained and applied. They suggest an important relation among the system of conics which have contact of third order with any given curve at a given point. These conics carry with them a system of director circles which are co-axial, and which have for their limiting points, the given point and the centre of the osculating equilateral hyperbola. From the above considerations, the general equation of the system of osculating conics, involving one arbitrary constant λ , has been deduced, and finally λ has been so determined that the conic may have a contact of the fourth order. A remarkable relation subsisting between radius of curvature, *latus rectum* of osculating parabola and the semi-axis of the osculating equilateral hyperbola, has been pointed out. Finally, several more illustrations have been given of the method of general differentials, including the determination of the differential equation of the general conic. As a large number of equations and expressions have been deduced; it has been thought proper to omit the simpler details of calculation in each case and thus prevent the paper from running into an unreasonable length.

1. The general equation of a conic, passing through two given points (x, y) and (x_1, y_1) , must be of the form

$$\lambda(X-x)(X-x_1) + \mu(Y-y)(Y-y_1) + \nu(X-x)(Y-y_1) + \rho(X-x_1)(Y-y) = 0 \quad (1).$$

as is evident from the number of arbitrary constants involved.

Therefore, the equilateral hyperbola through (x, y) and (x_1, y_1) is of the form

$$\lambda\{X-x)(X-x_1) - (Y-y)(Y-y_1)\} + \nu(X-x)(Y-y_1) + \rho(X-x_1)(Y-y) = 0 \quad (2).$$

Therefore, the equilateral hyperbola, through (x, y) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) , is

$$\begin{vmatrix} (X-x)(X-x_1) - (Y-y)(Y-y_1) & (X-x)(Y-y_1)(X-x_1)(Y-y) \\ (x_2-x)(x_2-x_1) - (y_2-y)(y_2-y_1) & (x_2-x)(y_2-y_1)(x_2-x_1)(y_2-y) \\ (x_3-x)(x_3-x_1) - (y_3-y)(y_3-y_1) & (x_3-x)(y_3-y_1)(x_3-x_1)(y_3-y) \end{vmatrix} = 0 \quad (3).$$

or,

$$\begin{vmatrix} (X-x)(X-x_1) - (Y-y)(Y-y_1)(X-x)(Y-y_1) \\ (x_2-x)(x_2-x_1) - (y_2-y)(y_2-y_1)(x_2-x)(y_2-y_1) \\ (x_3-x)(x_3-x_1) - (y_3-y)(y_3-y_1)(x_3-x)(y_3-y_1) \end{vmatrix} \begin{vmatrix} (Y-y)(x_1-x) - (X-x)(y_1-y) \\ (y_2-y)(x_1-x) - (x_2-x)(y_1-y) \\ (y_3-y)(x_1-x) - (x_3-x)(y_1-y) \end{vmatrix} = 0 \quad (4).$$

Now if (x, y) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) be four consecutive points on a curve, then evidently

$$\left. \begin{aligned} x_1 &= x + dx, \quad x_2 = x_1 + dx_1, \quad x_3 = x_2 + dx_2 \\ \text{Therefore, } x_2 &= x + dx + d(x + dx) = x + 2dx + d^2x, \quad x_3 = x \\ &+ 2dx + d^2x + d(x + 2dx + d^2x) = x + 3dx + 3d^2x + d^3x \text{ with cor-} \end{aligned} \right\} (5).$$

On making substitutions (5) in equation (4), we have, after simplifying the determinant by subtracting three times the second row from the third and ultimately neglecting all infinitesimals of a higher order,

$$\begin{vmatrix} (X-x)^2 - (Y-y)^2 & (X-x)(Y-y) & (Y-y) dx - (X-x) dy \\ 2dx^2 - 2dy^2 & 2dx dy & d^2y dx - d^2x dy \\ 6(d^2x dx - d^2y dy) & 3(d^2y dx + d^2x dy) & d^3y dx - d^3x dy \end{vmatrix} = 0 \quad (6).$$

Equation (6) is the equation of the osculating equilateral hyperbola, at any point (x, y) of a curve. The coefficients are general differentials, the implied independent variable being any quantity whatever.

If the independent variable be x , then $d^2x = 0$, $d^3x = 0$, and if we write p, q, r for

$$\frac{dy}{dx}, \quad \frac{d^2y}{dx^2}, \quad \frac{d^3y}{dx^3},$$

the equation (6) becomes

$$\{(X-x)^2 - (Y-y)^2\} (2pr - 3q^2) - 2(X-x)(Y-y) \{(1-p^2)r + 3pq^2\} + 6 \{(Y-y) - (X-x)p\} q (1+p^2) = 0 \quad (7).$$

2. As another illustration of the method of last article, we may determine, in general differentials, the equation of the circle of curvature.

The equation of a circle passing through (x, y) , (x_1, y_1) , is evidently of the form $(X-x)(X-x_1) + (Y-y)(Y-y_1) = \lambda \{(Y-y)(x_1-x) - (X-x)(y_1-y)\}$ (8).

Therefore the equation of a circle passing through any three points, (x, y) , (x_1, y_1) , (x_2, y_2) is $(X-x)(X-x_1) + (Y-y)(Y-y_1)$

$$= \frac{(x_2-x)(x_2-x_1) + (y_2-y)(y_2-y_1)}{(y_2-y_1)(x_1-x) - (x_2-x)(y_1-y)} \{(Y-y)(x_1-x) - (X-x)(y_1-y)\} \quad (9).$$

If now (x, y) , (x_1, y_1) , (x_2, y_2) be three consecutive points on any curve, then as in equations (5), $x_1 = x + dx$, $x_2 = x + 2dx + d^2x$, with corresponding expressions for y_1 and y_2 .

Therefore, equation (9) gives

$$(X-x)^2 + (Y-y)^2 = \frac{2(dx^2 + dy^2)}{dx d_2 y - dy d_2 x} \{(Y-y)dx - (X-x)dy\} \quad (10).$$

Equation (10) is the equation of the circle of curvature in general differentials. Hence, the co-ordinates of the centre of curvature and the radius of curvature are given by

$$\left. \begin{aligned} X &= x - \frac{(dx^2 + dy^2) dy}{dx d_2 y - dy d_2 x} \\ Y &= y + \frac{(dx^2 + dy^2) dx}{dx d_2 y - dy d_2 x} \\ \rho &= \frac{\{dx^2 + dy^2\}^{\frac{3}{2}}}{dx d_2 y - dy d_2 x} \end{aligned} \right\} \quad (11).$$

If x be the independent variable equations (11) become

$$\left. \begin{aligned} X &= x - \frac{(1+p^2)p}{q} \\ Y &= y + \frac{(1+p^2)}{q} \\ \rho &= \frac{(1+p^2)^{\frac{3}{2}}}{q} \end{aligned} \right\} \quad (12).$$

3. The co-ordinates of the centre of the osculating equilateral hyperbola (7), as determined by differentiating (7) with respect to X and Y , are

$$\left. \begin{aligned} X &= x + \frac{3qr(1+p^2)}{(pr-3q^2)^2 + r^2} \\ Y &= y + \frac{3q(pr-3q^2)(1+p^2)}{(pr-3q^2)^2 + r^2} \end{aligned} \right\} \quad (13).$$

If R be the radius vector of the osculating equilateral hyperbola, drawn from the centre to the point of osculation, then, from (13),

$$R = \sqrt{(X-x)^2 + (Y-y)^2} = \frac{3q(1+p^2)}{\sqrt{(pr-3q^2)+r^2}} \quad (14).$$

If P be the perpendicular from centre on the tangent at the point of osculation, then, from (13),

$$P = \frac{p(X-x) - (Y-y)}{\sqrt{1+p^2}} = \frac{9q^3\sqrt{1+p^2}}{(pr-3q^2)+r^2} \quad (15).$$

The axis of the equilateral hyperbola bisects the acute angle between R and P . If a be the length of the semi-axis, then

$$a^2 = R \cdot P = \frac{27q^4(1+p^2)^{\frac{3}{2}}}{\{(pr-3q^2)+r^2\}^{\frac{3}{2}}} \quad (16).$$

4. *Theorem I.*—The locus of centres of equilateral hyperbolas osculating a given parabola, is an equal parabola, which is the reflexion of the former on the directrix.

For, taking the parabola to be $y = \frac{x^2}{4a}$, we have $p = \frac{x}{2a}$,
 $q = \frac{1}{2a}$, $r = 0$.

Therefore from (13), $X = x$, $Y = y - 2a$ whence the theorem.

Theorem II.—The locus of centres of equilateral hyperbolas, osculating a given central conic, is the inverse of the conic with respect to the director circle. (Noticed by Wolstenholme).

For, taking the conic to be $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, it is easily shewn, by (13), that

$$X = \frac{x(a^2+b^2)}{x^2+y^2}, \quad Y = \frac{y(a^2+b^2)}{x^2+y^2} \quad (17).$$

whence the theorem.

5. If an equilateral hyperbola and a parabola both osculate a given curve at a given point they osculate each other, for, each of them passes through the same four consecutive points on the curve.

Hence, from Theorem I, we conclude that—(i) The directrix of the osculating parabola at a point P of a curve bisects at right angles, the line joining P with the centre Q of the osculating equilateral hyperbola; (ii) If O be the middle point of PQ , and S the focus of the osculating parabola, then S is the reflexion of O on the tangent at P .]

Hence, from (13), we easily deduce the equation for the directrix of the osculating parabola to be

$$r(X-x) + (pr - 3q^2)(Y-y) - \frac{3}{2}q(1+p^2) = 0 \quad (18).$$

And if (α, β) be the co-ordinates of the focus S of the osculating parabola, then, from (13), we easily deduce

$$\left. \begin{aligned} \alpha &= x + \frac{3q}{2} \cdot \frac{(1+p^2)r - 6pq^2}{(pr - 3q^2)^2 + r^2} \\ \beta &= y + \frac{3q}{2} \cdot \frac{p(1+p^2)r + 3q^2(1-p^2)}{(pr - 3q^2)^2 + r^2} \end{aligned} \right\} \quad (19).$$

The equation, of the osculating parabola itself, is therefore

$$(x-\alpha)^2 + (y-\beta)^2 = \frac{\{r(X-x) + (pr - 3q^2)(Y-y) - \frac{3}{2}q^2(1+p^2)\}^2}{(pr - 3q^2)^2 + r^2} \quad (20).$$

which, after substitutions (19) for α, β , becomes

$$\{(X-x)(pr - 3q^2) - (Y-y)r\}^2 = 18q^3 \{(Y-y) - p(X-x)\} \quad (21).$$

The semi latus rectum (l), of the above parabola, is the perpendicular from the focus (α, β) on the directrix (18). Therefore,

$$l = \frac{27q^5}{\{(pr - 3q^2)^2 + r^2\}^{\frac{3}{2}}} \quad (22).$$

It may be noticed here that the focal distance of P and the focal perpendicular on the tangent at P , are respectively $\frac{1}{2}R$ and $\frac{1}{2}P$, given by (14) and (15).

6. If two central conics, one of them being an equilateral hyperbola, osculate a given curve at a given point, then they evidently osculate each other; hence, from Theorem II of article (4), we draw the following conclusions:—

(i) The locus of centres of osculating conics, to a given curve at a given point, is a straight line.

For, the given point P and the centre Q , of the osculating equilateral hyperbola, are, from equations (17), in one straight line with the centre C , of any other osculating conic. The equation of this line of centres PQ is evidently from (13),

$$(pr - 3q^2)(X-x) - r(Y-y) = 0 \quad (23).$$

(ii) The director circles of the osculating conics to a given point of a curve form a co-axial system, having two real limiting points P and Q .

For, $CP \cdot CQ = a^2 + b^2$, from equations (17), C being the centre of the osculating conic and therefore of its director circle.

The foregoing conclusions might have been arrived at from simple geometrical considerations. The system of osculating conics, at a given point, have been looked upon, analytically, as having four consecutive points common with the curve. This is not, however, the best way of looking from the geometrical standpoint. Geometrically we may consider the system of osculating conics as having four consecutive tangents common with the curve. Hence—

- (a) All osculating conics at a given point of a curve may be conceived as having been inscribed to the same vanishing quadrilateral, formed by four consecutive tangents. Therefore, from well-known properties of a system of conics inscribed to the same quadrilateral, we have,
- (b) The locus of centres of conics, osculating a given curve at a given point, is a straight line.
- (c) The director circles of this system of conics form a co-axial system.
- (d) The radical axis of this co-axial system is the directrix of the osculating parabola.
- (e) The limiting points of this co-axial system are the given point P and the centre Q of the osculating equilateral hyperbola.

For, the director circle vanishes only if the conic vanishes or is an equilateral hyperbola.

- (f) If C be the centre of any osculating conic, then $CP \cdot CQ$ is equal to the square of the radius of the director circle.
- (g) If CD be the semi-diameter, conjugate to CP , of the osculating conic whose centre is C , then $CP^2 + CD^2 = a^2 + b^2 = CP \cdot CQ = CP^2 + CP \cdot PQ$.
Therefore $CD^2 = CP \cdot PQ$. (24).

Evidently the locus of D is a parabola whose focus bisects PS , where S is the focus of the osculating parabola.

7. If we compare the values of ρ , R , P , a and l already obtained (12, 14, 15, 16, 22), we notice a number of obvious relations, of which the most remarkable is

$$a^2 = l\rho \quad (25).$$

Again if ψ be the angle between the normal and line of centres at P ,

$$\cos \psi = \frac{P}{R} = \frac{R}{\rho} = \left(\frac{a}{R}\right)^2 = \left(\frac{a}{\rho}\right)^{\frac{2}{3}} = \left(\frac{l}{a}\right)^{\frac{2}{3}} = \left(\frac{l}{\rho}\right)^{\frac{1}{3}} \quad (26).$$

Therefore if $\psi = 0$, then $P = R = a = \rho = l$.

N.B.—The angle ψ has been discussed by Transon (Liouville, vol. vi). It is easily shewn $\tan \psi = p - \frac{(1+p^3)r}{3q^2} = \frac{1}{3} \frac{d\rho}{ds}$.

8. To determine the axes of any conic of the system we may proceed as follows:—

From the form of the equation of the line of centres (23), the co-ordinates (X, Y), of the centre O , of any osculating conic of the system, can evidently be written as

$$X = x - \frac{3qr}{\lambda}, \quad Y = y - \frac{3q(pr - 3q^2)}{\lambda} \quad (27).$$

where λ is an arbitrary constant.

$$\text{Whence, } CP = 3q \{r^2 + (pr - 3q^2)^2\}^{\frac{1}{2}} \frac{1}{\lambda} \quad (28).$$

$$\text{and by (14) } PQ = \frac{3q(1+p^2)}{\{(pr - 3q^2)^2 + r^2\}^{\frac{1}{2}}}$$

$$\text{Therefore by (24) } CD^2 = CP \cdot PQ = 9q^2 (1+p^2) \cdot \frac{1}{\lambda} \quad (29).$$

The equation of CD is evidently, by (27),

$$(Y - y) - p(X - x) = \frac{9q^3}{\lambda} \quad (30).$$

Therefore, if PM be the perpendicular from P on CD ,

$$PM = \frac{9q^3}{\lambda(1+p^2)^{\frac{1}{2}}} \quad (31).$$

Hence, if a and b be the semi-axes of the osculating conic,

$$\left. \begin{aligned} a^2 + b^2 &= CP^2 + CD^2 = \frac{9q^2}{\lambda^2} \{r^2 + (pr - 3q^2)^2 + \lambda(1+p^2)\} \\ a^2 b^2 &= CD^2 \cdot PM^2 = 729 \frac{q^3}{\lambda^3} \end{aligned} \right\} \quad (32).$$

The equation of the director circle follows from (27) and (32). It is

$$\begin{aligned} \left\{ X - x + \frac{3qr}{\lambda} \right\}^2 + \left\{ Y - y + \frac{3q(pr - 3q^2)}{\lambda} \right\}^2 \\ = \frac{9q^2}{\lambda^2} \{r^2 + (pr - 3q^2)^2 + \lambda(1 + \end{aligned}$$

or

$$\lambda \{ (X - x)^2 + (Y - y)^2 \} + 9q \{ (X - x)r + (Y - y)(pr - 3q^2) - \frac{3}{2}q(1+p^2) \} = 0 \quad (33).$$

9. To determine the equation of any conic of the system, let V be any point (XY) on the conic, and ξ, η its co-ordinates referred to CP and CD , which are conjugate semi-diameters. Draw VH and VK perpendicular from V on CD and CP , respectively.

Then
$$\frac{\xi^2}{CP^2} + \frac{\eta^2}{CD^2} = 1.$$

But
$$\frac{\xi^2}{CP^2} = \frac{VH^2}{PM^2} = \frac{\left\{ (Y-y) - p(X-x) - \frac{9q^2}{\lambda} \right\}^2}{\frac{(1+p^2) \cdot 81q^6}{\lambda^2(1+p^2)}} \text{ by (30, 31)}$$

$$= \frac{[\{(Y-y) - p(X-x)\} \lambda - 9q^2]^2}{81q^6}$$

and
$$\frac{\eta^2}{CD^2} = \frac{\eta^2}{VK^2} \cdot \frac{VK^2}{CD^2} = \frac{CP^2}{PM^2} \cdot \frac{VK^2}{CD^2} =$$

$$= \frac{9q^2(r^2 + (pr - 3q^2)^2)}{\lambda^2 \cdot 81q^6} \cdot \frac{\{(Y-y)r - (X-x)(pr - 3q^2)\}^2}{\{r^2 + (pr - 3q^2)^2\} 9q^2(1+p^2)} \cdot \frac{1}{\lambda}$$

by (28, 31, 23, 29)

$$= \frac{\lambda \{(Y-y)r - (X-x)(pr - 3q^2)\}^2}{81q^6}.$$

Therefore

$$[\lambda \{(Y-y) - p(X-x)\} - 9q^2]^2 + \lambda \{(Y-y)r - (X-x)(pr - 3q^2)\}^2 = 81q^6 \quad (34).$$

$$\text{or } \lambda \{(Y-y) - p(X-x)\}^2 + \{(Y-y)x - (X-x)(pr - 3q^2)\}^2 = 18q^2 \{(Y-y) - p(X-x)\} \quad (35).$$

which is the general equation of any conic of the system.

If $\lambda=0$, it is a parabola.

If $\lambda(1+p^2) + r^2 + (pr - 3q^2)^2 = 0$, it is an equilateral hyperbola.

10. The conic of closest contact has evidently for its centre the point common between two consecutive lines of centres. Let X, Y be the co-ordinates of its centre, so that

$$X = x - \frac{3qr}{\lambda}, \quad Y = y - \frac{3q(pr - 3q^2)}{\lambda}$$

where λ has to be determined.

Then we must have $\frac{dX}{dx} = 0$ and $\frac{dY}{dx} = 0$, as the two centres cor-

responding to x, y, λ and $x + dx, y + dy, \lambda + d\lambda$ must be identical.

Hence
$$\frac{dX}{dx} = 1 - \frac{3(r^2 + qs)}{\lambda} + \frac{3qr}{\lambda^2} \frac{d\lambda}{dx} = 0$$

$$\frac{dY}{dx} = p - \frac{3(pr^2 + pqs - 8q^2r)}{\lambda} + \frac{3qr(pr - 3q^2)}{\lambda^2} \frac{d\lambda}{dx} = 0.$$

Eliminating $\frac{d\lambda}{dx}$ between the above two equations, we have

$$\lambda = 3qs - 5r^2 \quad (36).$$

Therefore the co-ordinates of the centre of the conic of closest contact are

$$X = x - \frac{3qr}{3qs - 5r^2} \quad Y = y - \frac{3q(pr - 3q^2)}{3qs - 5r^2} \quad (37).$$

and the equation of the conic of closest contact is

$$(3qs - 5r^2) \{ (Y - y) - p(X - x) \}^2 + \{ (Y - y)r - (X - x)(pr - 3q^2) \}^2 = 18q^3 \{ (Y - y) - p(X - x) \} \quad (38).$$

Therefore the conic of closest contact is an ellipse, hyperbola or parabola, according as $3qs - 5r^2$ is positive, negative or zero.

II. It may be interesting to deduce the equation of the conic of closest contact directly by the method of general differentials.

The general equation of a conic through (x, y) and (x_1, y_1) is of the form, already given (1), *viz.*,

$$\lambda (X - x)(X - x_1) + \mu (Y - y)(Y - y_1) + \nu (X - x)(Y - y_1) + \rho (Y - y)(X - x) = 0$$

Therefore the conic through any five points (x, y) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) , (x_4, y_4) , is

$$\begin{vmatrix} (X-x)(X-x_1) & (Y-y)(Y-y_1) & (X-x)(Y-y_1) & (Y-y)(X-x_1) \\ (x_2-x)(x_2-x_1) & (y_2-y)(y_2-y_1) & (x_2-x)(y_2-y_1) & (y_2-y)(x_2-x_1) \\ (x_3-x)(x_3-x_1) & (y_3-y)(y_3-y_1) & (x_3-x)(y_3-y_1) & (y_3-y)(x_3-x_1) \\ (x_4-x)(x_4-x_1) & (y_4-y)(y_4-y_1) & (x_4-x)(y_4-y_1) & (y_4-y)(x_4-x_1) \end{vmatrix} = 0$$

or

$$\begin{vmatrix} (X-x)(X-x_1) & (Y-y)(Y-y_1) & (X-x)(Y-y_1) \\ (x_2-x)(x_2-x_1) & (y_2-y)(y_2-y_1) & (x_2-x)(y_2-y_1) \\ (x_3-x)(x_3-x_1) & (y_3-y)(y_3-y_1) & (x_3-x)(y_3-y_1) \\ (x_4-x)(x_4-x_1) & (y_4-y)(y_4-y_1) & (x_4-x)(y_4-y_1) \\ (Y-y)(x_1-x) - (X-x)(y_1-y) \\ (y_2-y)(x_1-x) - (x_2-x)(y_1-y) \\ (y_3-y)(x_1-x) - (x_3-x)(y_1-y) \\ (y_4-y)(x_1-x) - (x_4-x)(y_1-y) \end{vmatrix} = 0 \quad (39).$$

Now if (x, y) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) , (x_4, y_4) be five consecutive points on a curve, then, as in (3),

$$\left. \begin{aligned} x_1 &= x + dx & x_2 &= x + 2dx + d^2x & x_3 &= x + 3dx + 3d^2x + d^3x \\ & & x_4 &= x + 4dx + 6d^2x + 4d^3x + d^4x \end{aligned} \right\} \quad (40).$$

with corresponding expressions for y_1, y_2, y_3, y_4 .

On making substitutions (40) in (39), we have, after simplification of the determinant by adding to the third row, the second

row multiplied by (-3) , and to the fourth row, the third row multiplied by (-4) and the second row multiplied by 6, and by ultimately neglecting all higher orders of infinitesimals

$$\begin{vmatrix} (X-x)^2 & (Y-y)^2 \\ 2(dx)^2 & 2(dy)^2 \\ 6dx d^2x & 6dy d^2y \\ 6(d^2x)^2 + 8dx d^3x & 6(d^2y)^2 + 8dy d^3y \\ (X-x)(Y-y) & (Y-y)dx - (X-x)dy \\ 2dxdy & d^2ydx - d^2xdy \\ 3dxd^2y + 3dyd^2x & d^3ydx - d^3xdy \\ 6d^2xd^2y + 4(dx d^3y + dy d^3x) & d^4ydx - d^4xdy \end{vmatrix} = 0 \quad (41).$$

which is the equation of the conic of closest contact in general differentials.

Equation (41) reduces to (38) when the independent variable is x .

12. It is not difficult to extend the method of general differentials to the direct determination of the equation of the osculating parabola.

The equation of a curve passing through (x, y) , (x_1, y_1) which reduces to a parabola if (x, y) and (x_1, y_1) coincide, is evidently of the form

$$\begin{aligned} & \lambda \sqrt{(X-x)(X-x_1)} + \mu \sqrt{(Y-y)(Y-y_1)} \\ & = \nu \sqrt{(X-x)(y_1-y) - (Y-y)(x_1-x)}. \end{aligned}$$

Therefore, the equation of such a curve passing through any four points (x, y) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) is

$$\begin{vmatrix} \sqrt{(X-x)(X-x_1)} \sqrt{(Y-y)(Y-y_1)} \sqrt{(Y-y)(x_1-x) - (X-x)(y_1-y)} \\ \sqrt{(x_2-x)(x_2-x_1)} \sqrt{(y_2-y)(y_2-y_1)} \sqrt{(y_2-y)(x_1-x) - (x_2-x)(y_1-y)} \\ \sqrt{(x_3-x)(x_3-x_1)} \sqrt{(y_3-y)(y_3-y_1)} \sqrt{(y_3-y)(x_1-x) - (x_3-x)(y_1-y)} \end{vmatrix} = 0 \quad (42).$$

Now if (x, y) , (x_1, y_1) , (x_2, y_2) , (x_3, y_3) be four consecutive points on a curve, then, from (5),

$$\begin{aligned} & \sqrt{(x_2-x)(x_2-x_1)} = \sqrt{(2dx + d^2x)(dx + d^2x)} = \sqrt{2} (dx + \frac{1}{2}d^2x) \\ & \sqrt{(x_3-x)(x_3-x_1)} = \sqrt{(3dx + 3d^2x + d^3x)(2dx + 3d^2x + d^3x)} \\ & \quad = \sqrt{6} (dx + \frac{5}{2}d^2x) \\ & \quad \text{etc.} \\ & \sqrt{(y_2-y)(x_1-x) - (x_2-x)(y_1-y)} = \sqrt{d^2ydx - d^2xdy} \\ & \quad \sqrt{(y_3-y)(x_1-x) - (x_3-x)(y_1-y)} \\ & = \sqrt{3(d^2ydx - d^2xdy) + (d^3ydx - d^3xdy)} = \sqrt{3} \sqrt{dx d^3y - dy d^3x} \\ & \quad \times \left(1 + \frac{1}{6} \frac{d^3ydx - d^3xdy}{d^2ydx - d^2xdy} \right) \end{aligned} \quad (43).$$

substituting (43) in (42) and simplifying, we have

$$\begin{vmatrix} X-x & Y-y & 3\sqrt{2}(dx d^2y - dy d^2x)^{\frac{1}{2}} \sqrt{(Y-y) dx - (X-x) dy} \\ dx & dy & 3(dx d^2y - dy d^2x) \\ d^2x & d^2y & (dx d^2y - dy d^2x) \end{vmatrix} = 0 \quad (44).$$

$$\begin{aligned} \text{or, } (Y-y) \{ dx(d^2y dx - d^2x dy) - 3d^2x(d^2y dx - d^2x dy) \} \\ - (X-x) \{ dy(d^2y dx - d^2x dy) - 3d^2y(d^2y dx - d^2x dy) \} \\ = 3\sqrt{2}(d^2y dx - d^2x dy)^{\frac{3}{2}} \sqrt{(Y-y) dx - (X-x) dy} \quad (45). \end{aligned}$$

which is the equation of the osculating parabola in general differentials. It reduces to (21) if x be the independent variable.

From (45) it is evident that the equation of the line of centres in general differentials is

$$\begin{aligned} (Y-y) \{ dx(d^2y dx - d^2x dy) - 3d^2x(d^2y dx - d^2x dy) \} \\ = (X-x) \{ dy(d^2y dx - d^2x dy) - 3d^2y(d^2y dx - d^2x dy) \} \quad (46). \end{aligned}$$

13. The differential equation of a conic is the condition that the conic of closest contact is stationary. We may determine this condition in general differentials easily.

The condition that any six points $(x, y), (x_1, y_1), (x_2, y_2), (x_3, y_3), (x_4, y_4), (x_5, y_5)$ may lie on a conic is, evidently,

$$\begin{vmatrix} (x_2-x)(x_4-x_1)(y_2-y)(y_4-y_1)(y_4-y_1)(x_2-x) \\ (x_3-x)(x_5-x_1)(y_3-y)(y_5-y_1)(y_5-y_1)(x_3-x) \\ (x_4-x)(x_6-x_1)(y_4-y)(y_6-y_1)(y_6-y_1)(x_4-x) \\ (x_5-x)(x_7-x_1)(y_5-y)(y_7-y_1)(y_7-y_1)(x_5-x) \\ (y_2-y)(x_1-x) - (y_1-y)(x_2-x) \\ (y_3-y)(x_1-x) - (y_1-y)(x_3-x) \\ (y_4-y)(x_1-x) - (y_1-y)(x_4-x) \\ (y_5-y)(x_1-x) - (y_1-y)(x_5-x) \end{vmatrix} = 0 \quad (47).$$

Now if $(x, y), (x_1, y_1), (x_2, y_2), (x_3, y_3), (x_4, y_4), (x_5, y_5)$ be six consecutive points on a curve, then as in (5),

$$\left. \begin{aligned} x_1 &= x + dx & x_2 &= x + 2dx + d^2x & x_3 &= x + 3dx + 3d^2x + d^3x \\ x_4 &= x + 4dx + 6d^2x + 4d^3x + d^4x \\ x_5 &= x + 5dx + 10d^2x + 10d^3x + 5d^4x + d^5x \end{aligned} \right\} \quad (48).$$

with corresponding expressions for y_1, y_2, y_3, y_4, y_5

On substituting (48) in (47), we have, after simplification of the determinant by adding to the second row, the first row multiplied by -3 , to the third row, the second row multiplied by -4 , and first row multiplied by 6 , and to the fourth row, the third row multiplied by -5 , the second row multiplied by 10 and the first row multiplied by -10 , and ultimately neglecting all infinitesimals of higher orders,

dx^2	dy^2	
$3dxd^2x$	$3dyd^2y$	
$3(d^2x)^2 + 4dxd^2x$	$3(d^2y)^2 + 4dyd^2y$	
$10d^2xd^3x + 5dxd^4x$	$10d^2yd^3y + 5dyd^4y$	
$2dxdy$	$dx d^2y - dy d^2x$	= 0 (49).
$3(dx d^2y + dy d^2x)$	$dx d^3y - dy d^3x$	
$6d^2xd^2y + 4(dx dy^2 + dy dx^2),$	$dx d^4y - dy d^4x$	
$10(d^2xd^3y + d^3xd^2y) + 5(dx d^4y + dy d^4x),$	$dx d^5y - dy d^5x$	

which is therefore the condition that the conic of closest contact at any point of a curve may be stationary.

If the independent variable be x , then equation (49) reduces to

$$40r^5 - 45grs + 9q^2t = 0 \tag{50}$$

which is the differential equation of the general conic, as has been deduced by Monge.

For further information on the Mongean equation, reference may be made to Dr. Asutosh Mukhopadhyaya's paper, mentioned in the introduction.



23. Notes on the Pollination of Flowers in India.
 Note No. 5.—Some Autumn Observations
 in the Sikkim Himalaya.

By I. H. BURKILL.

In 1904, and again in 1906, I marched from Darjeeling to Phallut and back, and I utilised the opportunity in making the observations here recorded.

Phallut is on the long ridge which runs south from the mountain Kinchinjunga, and makes the boundary between Sikkim and Nepal. The road taken was the same on both occasions, *viâ* Ghum and Simana to the southern end of the ridge, and thence along it as follows:—

	1904.	1906.
Between the southern end and Tonglu (10,074 ft.)	Oct. 16—cloudy.	Sept. 25—some rain.
Between Tonglu and Sandakphu (11,930 ft.)	Oct. 17—mist and later rain.	Sept. 26—intervals of mist.
On Sandakphu.	Oct. 18—sleet all day.	Sept. 27—fine.
Between Sandakphu and Phallut (11,600 ft.)	Oct. 19—intervals of mist.	Sept. 28—rain after noon.
On Phallut and Singlela— (12,110 ft.)	Oct. 20—fine.	Sept. 29—rain all day.
On Phallut.	Oct. 21—intervals of mist.	Sept. 30—intervals of mist.
Between Phallut and Sandakphu.	Oct. 22—some mist.	Oct. 1—rain nearly all day.
Between Sandakphu and Tonglu.	Oct. 23—intervals of mist.	Oct. 2—intervals of mist.
Between Tonglu and the southern end of the ridge.	Oct. 24—mist and rain.	Oct. 3—overcast.

I have given with my dates above, the state of the weather that I met with on these wet mountains.

Sir Joseph Hooker was the first botanist to visit the ridge. In the end of May, 1848, he reached the summit of Tonglu, where it rained persistently; and camp-life must, indeed, have been uncomfortable. What he saw of the spring vegetation of the mountain he described in his father's *Journal of Botany*, ii., 1850, pp. 112-118, 145-151, and his own *Himalayan Journals*, chapter vii. Thomas Thomson visited Tonglu and Phallut in October, 1857, but wrote nothing about his journey. Thomas Anderson went *via* Phallut to Jongri in October, 1862; Kurz was on Phallut in October, 1868; and C. B. Clarke in October, 1870. Sir George King visited Tonglu in April, 1875. None of these journeys are described.

Up to 1875 every one had used the path to Tonglu which ascends by its eastern spur: but, when in that year the new bridle-path from Ghum to Phallut was made, C. B. Clarke took immediate advantage of it in order to botanise along my route as far as Tonglu (Sept. 13th—17th). It then rained persistently with wind and thunder. His account of the vegetation may be found in the *Journal of the Linnean Society of London, Botany, xv.*, 1876, pp. 116-159.

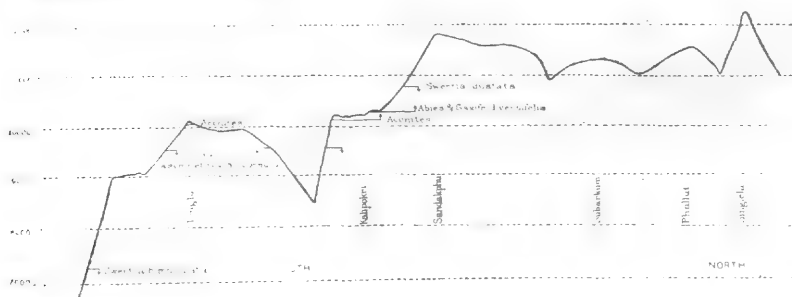
Several times after this Clarke botanised on the ridge; and in an interesting vivid introduction to a second paper in the same *Journal, xxi.*, 1885, p. 384, he described the vegetation as seen in June, 1884. The weather was then wet, "poor even for Tonglu," and the collection made not so good as that made in September. The June flora, which is the spring flora, he found to be less rich than the autumn flora.

Gammie, who journeyed in 1889 over Sandakphu and Phallut to the country close under Kinchinjunga, has just touched on the vegetation of the ridge, as seen in June, in a paper printed in the *Records of the Botanic Survey of India, i.*, no. 2, 1893, pp. 2-3.

Lastly Waddell (*Among the Himalayas, London, 1899, pp. 301-340*) well describes the road as he found it in early spring before the snow had gone from Sandakphu and Phallut.

The references that I have given, together with a brief note of my own (*Kew Bulletin, 1907, p. 92*) comprise all the pertinent literature existing.

My observations begin about 7,000 ft.—just above the upper limit of tree-ferns—on the very end of the ridge, south of Tonglu. From this point the road ascends to 10,050 ft., descends to about 8,500 ft., ascends again to 11,900 ft., and then, falling and rising slightly, continues between 11,000 and 11,800 ft., until it rises on Singla to 12,100 ft.



There are five chief vegetative-formations along the road. First of all there is the mixed oak forest, which, muffled in moss, clothes the damper slopes at 7000—9000 ft. Above it is a belt where moss gives place to grey lichens, and the trees are smaller. Breaking the continuity of these two, chiefly on southern hill-faces, are the bamboo brakes—uniform dense thickets of *Arundi-*

[N.S.]

naria, 10 to 15 feet high, owing their origin in a large measure to fire, and where little grows except the bamboo. Above the mixed lichen-clad forest are the woods of *Abies webbiana*, and the open grassy pastures.

The season of my visits is the end of the rains. At that time there are great contrasts within my limits: high up winter is coming on; red and yellow leaves are abundant; and the grass is tumbled and partly dead. But low down there are plants only just at the height of their flowering: and just at my lowest limit, which the tree-ferns reach, the tall *Gynura angulosa* bears its first showy orange flowers among the under-shrubs. In the forest above this limit, under oaks and other trees, *Impatiens asymmetrica* makes great beds, covered with yellow flowers; mingling with it stands claret *Strobilanthes pentstemonoides*: here and there is an inconspicuous *Swertia Chirata* or a plant of *Corydalis chærophylla* covered with yellow blossoms. A claret-coloured *Lactuca* stands in the shade; and at the back of the beds of balsams, and so a yard or two from the edge of the path, the big intensely blue bells of *Crawfordia speciosa* hang on the bushes. At the end of September, so far is the belt near my lowest limit from winter, that all these plants are at the height of their flowering: but where, at about 9,500 feet, the moss ceases to clothe the trees and lichen replaces it, flowers become less abundant.

Above 10,000 ft. most of the common flowers of the lower belt give place to other forms, which are in the end of September not at their best, but beyond it. *Saxifraga diversifolia* is one of the commonest and most generally distributed; *Aconitum spicatum* is common in places, and so are *Heracleum sublineare*, *Polygonum campanulatum* and *Anemone obtusiloba*. Here and there sheets of *Eriogonum multicaulis*, or of *Anchusa sikkimensis*, or of *Dracocephalum speciosum*, or *Bupleurum Candollii* stand in fruit with just a few flowers left; in hollows *Oniscus involucratus* and *Senecio diversifolius* carry flowers and fruits equally; under the *Rhododendrons*, *Paracaryum glochidiatum* bears its last bright blue blossoms. *Anaphalis triplinervis*, *A. cinnamomea* and *A. contorta* are everywhere, but more in fruit than in flower; so also are *Geranium polyanthes*, *Thalictrum Chelidoni* and several of the Umbelliferae.

I recorded every plant that I found in flower, and the following is a list of them, classified for my purpose according to the biological type of the flower. Italics are used to indicate a plant practically over. The words 'above' and 'below' are used to signify that the plant grows above the height of 10,000 ft. or below it: and where neither word occurs the plant grows both above and below. I shall follow the enumeration by an analysis of the flora.

PENDULOUS FLOWERS.

Pendulous flower, with little foothold, tube 15 mm. long. (Class H).

Dicentra scandens, Wulp. (below).

Pendulous flower, with little foothold, tube 7 mm. long. (Class H.)

Plectranthus scrophularioides, Wall. (below).

Open bell-flower, with tube 10—12 mm. long above the bell. (Class H.)

Crawfordia speciosa, Wall. (below).

Open bell-flower, with short tube above. (Class H.)

Campanula colorata, Wall.

Narrow-mouthed bell-flower requiring tongue 9 mm. long. (Class H.)

Anchusa silkimensis, C. B. Clarke (above).

Composites of Class B' (upper part); tube 15—20 mm. long.

Lactuca macrantha, C. B. Clarke (above).

Composites of Class B' (upper part); tube 10—15 mm. long.

Lactuca Dubyæa, C. B. Clarke (above).

Composites of Class B' (upper part); tube 5—10 mm. long.

Cremanthodium reniforme, Benth. (above).

Senecio graciliflorus, D.C. (above).

Senecio tetranthus, D.C. (below).

Senecio acuminatus, Wall. (flowers often horizontal),
(above).

Saussurea deltoidea, C. B. Clarke (below).

Lactuca graciliflora, D.C. (above).

Lactuca hastata, D.C.

Composites of Class B' (upper part); tube 3—5 mm. long.

Senecio alatus, Wall. (below).

Composites of Class B' (lower part); tube under 3 mm. long.

Carpesium cernuum, Linn. (below).

Regular pendent flowers of Class B.

Clematis buchananiana, D.C. (below).

Clematis connata, D.C.

Rubus niveus, Wall. (above).

Rubus lineatus, Reinw. (below).

Neillia rubiflora, Don, (below).

Begonia gemmipara, Hook. f. (below).

Triplostegia glandulifera, Wall. (below).

Swertia Chirata, Buch.-Ham. (below).

Swertia tongluensis, *Burkill*.
Cynoglossum furcatum, *Wall.*
Cynoglossum Wallichii, *G. Don.*
Paracaryum glochidatum, *Benth.* (above).
Polygonum delicatulum, *Meissn.* (above).
Polygonum campanulatum, *Hook. f.*

Shallower dependent flowers.

Polygonum polystachyum, *Wall.* (above).
Polygonum paniculatum, *Blume*, (below).

Regular honeyless flower simulating Class B, pendent.

Rose sericea, *Lindl.*

HORIZONTAL FLOWERS.

*Horizontal or obliquely depressed flower, obviously suited for
Lepidoptera, irregular, with honey buried 25 mm. deep.*

Impatiens falcifera, *Hook. f.* (below).

Irregular, tunnel Bombus-flower requiring a tongue 10—15 mm. long.

Strobilanthes pentstemonoides, *T. Anders.* (below).
Strobilanthes Wallichii, *Nees.*

*Irregular, tunnel Bombus-flowers, requiring from a bee a tongue of
5—10 mm. long.*

Impatiens discolor, *Wall.* (below).
Impatiens Gagei, *Hook. f.* (below).
Impatiens Gamblei, *Hook. f.*

*Irregular, bucket Bombus-flower, requiring from a bee a tongue of
5—10 mm. long.*

Impatiens bicornuta, *Wall.* (below).

*Irregular, hooded Bombus-flowers, requiring from a bee a tongue of
5—10 mm. long.*

Aconitum spicatum, *Stapf*, (above).
Aconitum laciniatum, *Stapf*, (above).
Aconitum heterophylloides, *Stapf*, (above).

Well suited to Bombi, irregular, Class H., 20—25 mm. deep.

Impatiens longipes, *Hook. f. et Thoms.* (below).
Impatiens asymmetrica, *Hook. f.* (below).

Crawfordia affinis, Wall. (below).

Pedicularis flexuosa, Hook. f. (below).

Well suited to Bombi, irregular, Class H, 15—20 mm. deep.

Lonicera glabrata, Wall. (above).

Salvia campanulata, Wall. (above).

Dracocephalum speciosum, Benth. (above).

Well suited to Bombi, irregular, Class H, 10—15 mm. deep.

Aconitum luridum, Hook. f. et Thoms. (above).

Corydalis chærophylla, D.C.

Corydalis juncea, Wall. (above).

Parochetus communis, Buch.-Ham. (below).

Lonicera acuminata, Wall. (above).

Lobelia stimulans, Buch.-Ham. (below).

Mimulus nepalensis, Benth. (below).

Well suited to Bombi, irregular, Class H, 5—10 mm. deep.

Corydalis longipes, D. C. (above).

Corydalis casimiriana, Prain et Duthie, (above).

Impatiens gammiciana, Hook. f.

Lobelia erecta, Hook. f. et Thoms. (above).

Cyananthus inflatus, Hook. f. et Thoms. (above).

Calceolaria mexicana, Benth.

Pedicularis gracilis, Wall. (above).

Prunella vulgaris, Linn. (above).

Notochæta hamosa, Benth. (below).

Well suited to Bombi, irregular, Class H, 3—5 mm. deep.

Viola biflora, Linn. (above).

Mazus surculosus, D. Don, (below).

Plectranthus Coetsa, Buch.-Ham. (below).

Craniotome versicolor, Reichb. (below).

Calamintha umbrosa, Benth. (below).

Elsholtzia strobilifera, Benth. (above).

Habenaria urceolata, C. B. Clarke, (below).

Satyrrium nepalense, Don, (below).

Irregular flowers of such small size that they are excluded from
Class H, and put into Class B.

Herminium angustifolium, Benth. (below).

Utricularia brachiata, Oliv. (above).

Goodyera repens, R. Br. (below).

Regular horizontal flowers of Class B.

Bœninghausenia albiflora, Reichb. (below).

Tiarella polyphylla, D. Don, (below).

Circæa alpina, Linn.
Polygonum emodi, Meissn. (above).
Polygonum amplexicaule, D. Don, (above).
Polygonum chinense, Linn. (below).
Polygonum filicaule, Wall. (above).

Pollen-flowers, *simulating AB, obliquely pendent.*

Meconopsis paniculata, Prain.
Hypericum hookerianum, Wight et Arn.

Regular flowers of Class A, horizontal or slightly pendent.

Galium Mollugo, Linn. (*G. asperifolium*, Wall.) (below).
Swertia dilatata, C. B. Clarke.

ERECT FLOWERS.

Obliquely erect, funnel 20—25 mm. long, belonging to Class F, (or H).

Herpetospermum caudigerum, Wall. (below).

Composite, Class B', with a very long tube, tube 25—30 mm. long.

Cnicus involucratus, D.C. (above).

Composite, Class B' (upper part), tube 10—15 mm. long.

Saussurea uniflora, Wall. (above).

Composite, Class B' (lower part), tube 3—5 mm. long.

Brachyactis menthodora, Benth. (above).
Erigeron multiradiatus, Benth. (above).
Aster sikkimensis, Hook. f. et Thoms. (above).
Senecio diversifolius, Wall. (above).

Composite, Class B' (lower part), tube under 3 mm. long.

Myriactis Wallichii, Less. (below).
Myriactis nepalensis, Less.
Gnaphalium hypoleucum, D.C. (above).
Gnaphalium luteo-album, Linn.
Anaphalis triplinervis, Sims.
Anaphalis cinnamomea, C. B. Clarke.
Anaphalis contorta, Hook. f.
Galinsoga parviflora, Cav.

Flowers of Class B.

Geranium polyanthes, Edgew. et Hook. f. (above).
Geranium nepalense, Sweet, (below).
Epilobium roseum, Schreb.

Valeriana Hardwickii, Wall.
Polygonum tortuosum, D. Don, (above).
Polygonum runcinatum, Buch.-Ham. (above).
Allium Wallichii, Kunth, (above).

Flowers of Class AB.

Ranunculus flaccidus, Hook. f. et Thoms (above).
Ranunculus diffusus, D.C.
Cardamine circæoides, Hook. f. et Thoms. (above).
Stellaria sikkimensis, Hook. f.
Stellaria paniculata, Edgew.
Cerastium no. 27682, (above).
Potentilla fruticosa, Linn. (above).
Potentilla fulgens, Wall. (above).
Potentilla mooniana, Wight, (above).
Saxifraga hispidula, D. Don.
Saxifraga diversifolia, Wall. (above).
Dichroa febrifuga, Lour. (below).
Sedum trifidum, Wall.
Streptolirion volubile, Edgew. (below).

Honeyless flowers, simulating Class AB.

Anemone obtusiloba, D. Don, (above).
Thalictrum javanicum, Blume, (above).

Flowers of Class A'.

Hydrocotyle javanica, Thunb. (below).
Sanicula europæa, Linn. (below).
Bupleurum Candollii, Wall. (above).
Pimpinella bella, C. B. Clarke, (above).
Pimpinella diversifolia, D.C. (above).
Pimpinella sp. no. 27612, (above).
Pleurospermum sikkimense, C. B. Clarke, (above).
Pleurospermum sp. no. 27662, (above).
Selinum tenuifolium, Wall. (above).
Selinum Candollii, D.C. (above).
Heracleum sublineare, C. B. Clarke, (above).

Flowers of Class A.

Saxifraga strigosa, Wall. (above).
Rubia cordifolia, Linn. (above).
Swertia bimaiculata, Hook. f. et Thoms. (below).
Lecanthus Wightii, Wedd. (below).

ANEMOPHILOUS.

Thalictrum Chelidonii, D.C. (perhaps simulating AB)
 (above).

Juncus chrysocarpus, *Buch.* (above).
Juncus Grisebachii, *Buch.* (above).
Deyeuxia pulchella, *Hook. f.* (above).
Agrostis Clarkei, *Hook. f.* (above).
Agrostis myriantha, *Hook. f.* (above).

WITH CLEISTOGAMIC FLOWERS ONLY.

Ainsliaea pteropoda, *D.C.* (below).
Ainsliaea aptera, *D.C.* (above).

The insect-fertilised flowers are:—

	Classes F. & H.	Class B'	Class B.	Class AB.	Class A'	Class A.	TOTAL.
Pendulous	5	11	17	...	...	...	33
Horizontal	41	...	10	2	...	2	55
Erect	1	14	7	16	11	4	53
TOTAL ...	47	25	34	19	11	5	141

There are 149 species in my list, of which 141 are insect fertilised. Though the mountains are so clad in forests, none of the species in flower is a tree: almost all are herbs. There are a few small shrubs like the *Loniceras*, and species of *Rubus*, and two woody climbing species of *Clematis*. Most of the shrubs found were out of flower.

One of the chief interests of the flora is that an unusual percentage of the flowers are pendulous. To show this I take for comparison the flora of a small area in the Grampians of Scotland, which has been studied in detail by Dr. J. C. Willis and myself,¹ and I give the very marked result in the adjoined table:—

Percentage of insect-fertilised flowers which are pendulous, horizontal or erect.

Singlela ridge.			Clova in the Grampians of Scotland.		
Autumn.			Whole year.		Autumn.
Pendulous	...	33 = 23·40%	20 = 8·00%	...	6 = 4·84%
Horizontal	...	55 = 39·01	71 = 28·40	...	37 = 29·84
Erect	...	53 = 37·59	159 = 63·60	...	81 = 65·32

¹ See the *Transactions of the Botanical Society of Edinburgh*, 1901, p. 109.

Dr. Willis and I have been among those to show¹ that pendulous flowers are visited by higher types of insects than similarly shaped erect flowers; and we believe this to be due to the greater amount of honey that adroit insects can obtain from them, because (i) the rain does not dilute it, and (ii) other insects do not readily find it. It seems as if this ridge from Tonglu to Singlela produces such an unusual amount of pendent flowers in consequence of its wet climate. Sir Joseph Hooker, long ago, attributed the adoption of a pendent position in the flowers of *Rosa sericea* to the need of protecting the pollen.

The insects abroad at the season of my visits are relatively few. Butterflies, dull of hue, are scarce, and were never seen on flowers; a humming-bird hawk-moth (*Sphingid*) was seen on Sandakphu sucking honey from the flowers of *Saxifraga diversifolia*, and keeping to that one species alone at 11,900 feet, though lower down it was seen on *Strobilanthes*. *Apis* was absent. Bombi were fairly common, and diligent even in rain, unless heavy. The commonest *Bombus* is *Bombus funerarius*. It visited the *Aconites* particularly; and below their level it visited *Impatiens* and other flowers. Occasionally it was seen biting corollas to get at honey which it found difficult of access, e.g., those of *Impatiens bicornuta*, *Crawfordia speciosa* and *Strobilanthes pentstemonoides*. Next in abundance to *Bombus funerarius* was *Bombus vallestris*. I suspect that it does not ascend quite as high as the first. It was chiefly seen in the mixed forest, and not on *Aconitum* nor on *Impatiens*. *Bombus trifasciatus* ascends high and was seen on the flowers of *Elsholtzia strobilifera* upon the very summit of Singlela, busy in steady and rather heavy rain.

Of other Hymenoptera several were seen. The wasps, which were among them, went to the flowers of *Swertia Chirata*.

The Syrphid fly—*Eristalis himalayensis*—was frequent, ascending to the top of Singlela, and visiting Composites. Another *Eristalis* occurred with it. One or two species of *Syrphus* visited *Saxifraga diversifolia* flowers. A *Rhingia* occurred about 9,500 feet on Composites and on a *Polygonum*.

In the mixed forest a tawny and remarkable *Lycastris*² with a tongue 22 mm. long, was common. It visited *Senecio tetranthus* and *S. alatus* very persistently, and was twice seen on *Impatiens asymmetrica*. Within my experience it did not ascend to the *Abies* zone.

A large Dexid fly visited *Anaphalis* and *Swertia* in the mixed forest. Countless Bibionids of the genus *Plecia* swarmed with *Calliphora* and other flies on the flowers of *Anaphalis* to 10,000 feet or a little higher; and a Cistelid beetle was very common in some places, chiefly on Composites and at the higher elevations.

Some of the types of flower suited for the visits of the Bumble bees are markedly specialised, notably the larger species

¹ *Annals of Botany*, xvii., 1903, p. 568.

² *Lycastris flavihirta*, Brunetti in *Records, Indian Museum*, ii., 1908, p. 85.

of *Impatiens*; but in the genus we have a wide series extending from *Impatiens gammieana* up to *I. Gagei* and *I. bicornuta*. *Impatiens gammieana* is the species of *Impatiens* which occurs highest, and it is the least conspicuous. It grows under trees and chiefly on up-turned tree-roots; it produces first chasmogamic flowers and then cleistogamic flowers. The flowers are flesh-coloured; and if fully chasmogamic they have a spur (see fig. 7 below); but if cleistogamic

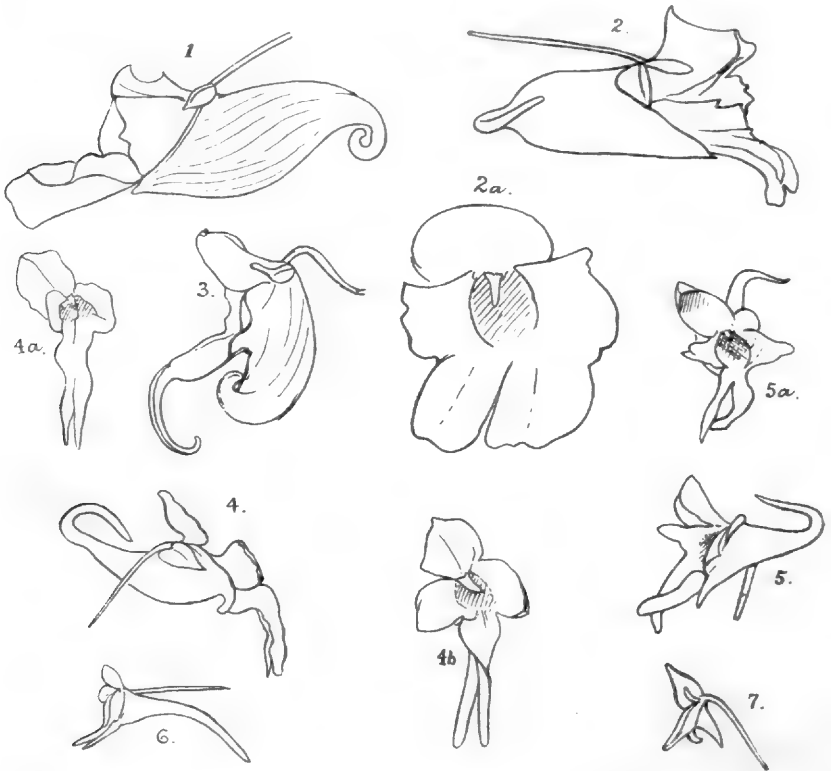


Fig. 1.—*Impatiens discolor*, Wall. 2.—*I. Gagei*, Hook. f. 3.—*I. bicornuta*, Wall. 4.—*I. longipes*, Hook. f. et Thoms. 5.—*I. asymmetrica*, Hook. f. 6.—*I. trigonopteris*, Hook. f. 7.—*I. gammieana*, Hook. f.

are without one: there are intermediate stages. *Impatiens Gamblei* occurred with *I. gammieana* and extended below it. Its hooked spur lies in the median line. The colour is rose-pink. *I. discolor*, which does not grow at quite so great an altitude, is very like *I. Gamblei* in the structure of the flower, but the spur is rolled upon itself in the median line (see fig. 1 above). Just at my lowest limit occurs *Impatiens Gagei* with violet flowers of the same size as those of *I. Gamblei*, but oblique in mouth and spur as

drawn (see fig. 2 above). They were seen to be diligently visited for honey (on 3-x-06) by a very handsome sulphur-belted *Bombus*. The commonest balsams are three yellow ones: *I. asymmetrica*, *I. longipes* and *I. bicornuta* (see figs. above). The first two are oblique in flower: they differ in the foliage, curl of the spur, and in the one having red spots on the side petals and red blotches on the spur, while the other has neither. The flowers are more numerous on *I. asymmetrica* than on *I. longipes*. They were visited by the big Bombyliid fly *Lycastris flavihirta*.

Impatiens bicornuta has a bucket ending in a spur: in appearance it suggests a *Cypripedium*. *Bombus funerarius* was seen to visit its flowers.

There is yet another *Impatiens* at Kalipokri and on Tonglu—*Impatiens falcifera*,—with an *Oncidium*-like flower, yellow, blotched with brown. Its spur is 22—25 mm. long. No visitors were seen on it, but its flat flower is evidently suited for the visits of Sphingid moths.

It is interesting to note how the flowers of these *Impatiens*—if oblique—are always oblique towards the same side, both in the spur and in the twist of the mouth of the corolla. Twisted likewise always to the same side are the flowers of the two species of *Pedicularis* (*P. flexuosa* and *P. gracilis*). The former has a tube 20 mm. long; the latter 7—8 mm. long.

Twists like these would seem to lead to such right-handedness or left-handedness in bees as I observed in the behaviour of *Bombus hæmorrhoidalis* visiting *Scutellaria linearis* in the Simla hills.¹

Just outside my limit at Simana on the Ghum and Jorpokri ridge occurs the little yellow *Impatiens* (*I. trigonopteris*) represented in fig. 6.

Aconitum possesses *Bombus*-flowers²; and I have seen many visits of bees to *A. spicatum* and some to *A. heterophylloides*. The Aconite flowers are imperfectly protandrous, the style growing through the stamens, and the stamens bending outwards after dehiscing. Every carpel sets fruit: and, as an average spike of *A. spicatum* produces 40 flowers, a flower 5 carpels, and a carpel about 12 seeds, there are produced $40 \times 5 \times 12$ or 2,400 seeds per plant. I have counted 192 flowers on a large spike. *A. laciniatum* produces 15 flowers upon a spike, 3 carpels in a flower and 15 seeds in a carpel; and thus $15 \times 3 \times 15$ or 675 seeds per plant. *A. heterophylloides* produces about twice as many seeds as *A. laciniatum*.

The gregariousness of *Aconitum spicatum* may be judged from the plate of it on Sandakphu published in the *Kew Bulletin*, 1907, facing p. 92.

Strobilanthes possesses bee-flowers. There are at least two

¹ See Journal Asiatic Society Bengal, 1906, p. 524.

² A paper by Kronfeld, interesting but perhaps too conclusive, on the similarity of the distribution of Aconite and *Bombus* through the world is to be found in Engler's *Bot. Jahrbucher*, xi., p. 19.

species of this genus on the Singlela ridge. One of them grows chiefly in the grass high up; the other grows in the mixed forest, and for the present must be put under the polymorphic *S. pentstemonoides*. The flower of the first stands as here drawn. A visiting bee crawls first over the filamentous stigma: just behind



Strobilanthes
Wallichii.
 Flower in
 natural position.

the stigma is the anther of one of the long stamens and then of the other, each in its turn brought to the middle line: over them next the bee passes, and then further back over the paired shorter stamens. The flower of *S. pentstemonoides* is more inclined in position and less hooded than that of *S. Wallichii*. Its longer stamens are of equal length and the anthers stand side by side. An individual of *Bombus vallestis* was seen to visit its flowers regularly, and an individual of *Bombus fucaricus* to be busy as regularly in robbing them by biting the corolla on the upper side near the base. A humming-bird hawk-moth (*Sphingid*) went for honey to its flowers on October 3rd, 1906, at 9,000 feet.

Corydalis is another genus with bee-flowers. On October 3rd, 1906, a *Bombus* was seen very diligently visiting flowers of *C. chærophylla*. No insects were seen on the flowers of *Corydalis juncea*, *C. longipes* and *C. cachemiriana*, but every flower sets fruits, probably by self-pollination, as the anthers and stigma are in contact. Their flowers all face obliquely downwards.

The little Labiate—*Elsholtzia strobilifera*—which is very common, is visited by *Bombus trifasciatus*. I saw (29-ix-06) one of these bees going constantly to its flower on the summit of Singlela in the rain, and another near the summit of Sandakphu (1-x-06) in the rain.

Crawfordia speciosa is visited by Bombi which, hanging on to the cone formed by the stamens, visit each nectary in turn. The mechanism is typical of the *Gentianeaceæ* except that the flower is nearly vertically pendulous. There are five channels in the flower, one to each of the five green bilobed nectaries. The greenish white smaller flowers of *Crawfordia luteoviridis* are often rather more horizontal than those of *C. speciosa*. Every flower of it seems to set fruit.

Among the Composites of the mixed forest are several long-tubed species; and they are diligently visited by *Lycastris flavhirta*. *Senecio tetranthus* was particularly sought after by this long-tongued fly. The big *Unicus involucreatus*, found in hollows about 11,000 ft., was visited by Bombi: but it would seem rather to be a butterfly-flower.

The Composites of the pastures are not long-tubed. *Aster sikkimensis* is the commonest: a patch of it with white flowers occurs near the summit of Singlela, and such white flowers (according to my leпча plant collector) are to be seen nowhere else along the ridge. The species of *Anaphalis* must have a very

long list of fly-visitors. *Eristalis ursinus* was taken on *Anaphalis contorta*.

Of flowers with short tubes or bells the species of *Polygonum* are most conspicuous. *Polygonum campanulatum* is abundant everywhere, its rose-pink flowers directed downwards in clusters. *Polygonum amplexicaule* has its flowers horizontal and was seen upon Sandakphu on 2-x-06 to be visited by *Bombus vallerstris*.

Of *Swertia* there are three types, the first represented by the greenish livid flowers of *S. Chirata* and *S. tongluensis*,¹ the second by *S. dilatata*, and the third by the white flowers of *S. bimaculata*.

The *Swertias* of the first type are wasp-flowers. Their flowers face obliquely downwards before fertilisation, and I saw those of *S. Chirata* to be frequented for honey by a rather small orange and black *Vespa*, and by a large tawny and yellow wasp. The four anthers of *S. Chirata* and *S. tongluensis* are distant from the stigma 2 mm.

The stamens of *S. dilatata* form a cone round the ovary and the anthers touch in the centre of the flower, while the stigma grows up through them. Self-pollination is inevitable and most likely self-fertilisation is the rule. The nectaries of *S. dilatata* are exposed surfaces with little honey. The nectaries of *S. Chirata* and *S. tongluensis* have a well-fringed brow over them, and hold a considerable quantity of honey.

The flowers of *S. bimaculata* face the sky vertically. The nectaries secrete very freely, and are exposed in the very middle of the petals. The anthers are inclined outwards and downwards at the time when they are dehiscing grudgingly at the margins: they are all equidistant from each other and from the stigma. Flies were seen to settle on them and to walk over them from nectary to nectary. This species does not ascend beyond 8,000 feet. Its flowers stand open in the rain. The last flowers, especially on cut-down plants, are often small and female, the stamens having completely disappeared.

Geranium polyanthes lives on the pastures, and it has the imperfect proterandry, typical of *Geranium*, wherein the longer stamens first shed their pollen, after which their anthers drop off; and then during the maturity of the anthers of the shorter stamens, the stigmas expand. Self-pollination is not, however, insured. Its flowers do not close when rain begin to fall.

A *Cerastium*, which I have not yet been able to name,—my no. 27682,—has the same mechanism. Its latest flowers have three or no stamens. The flowers nod and close when rain begins.

Saxifraga diversifolia behaves as a typical *Saxifraga*. The anthers are brought to the middle of the flower in succession; and after they have dehisced, the stigma is raised to the position that they occupied. The buds are directed downwards. But the open flowers stare upwards in sunshine or rain. I have already mentioned that a *Sphingid* moth was twice seen on the flowers on Sandakphu; a few other visitors were seen.

¹ See this Journal, 1906, page 319; and 1907, page 33.

Cyananthus inflatus and the species of *Anaphalis* close very promptly when rain begins to fall.

By the kindness of Dr. N. Annandale, Lieut.-Colonel C. T. Bingham and Mr. E. Brunetti, to whom I offer my sincere thanks, I am able to give the following list of insect-visitors.

VISITORS OBSERVED.

Aconitum spicatum, *Stapf.*

HYMENOPTERA. *Apidæ*. (1) *Bombus funerarius*, Smith, sh. persistent, 10,000—11,800 ft.; 23-x-04, 26-ix-06 and 2-x-06. *Vespidæ* (2) 1 sp. 10,000 ft., 26-ix-06. COLEOPTERA. (3) A Cistelid beetle, 11,000 ft., 28-ix-06.

Aconitum heterophylloides, *Stapf.*

HYMENOPTERA. *Apidæ*. (1) *Bombus funerarius*, Smith, sh., 11,800 ft., 21-x-04; 30-ix-06. COLEOPTERA (2) A Cistelid beetle, sh. 11,300 ft., 30-ix-06.

Corydalis chærophylla, *D.C.*

HYMENOPTERA. *Apidæ*. (1) *Bombus funerarius*, Smith, sh. very persistently, 9,000 ft., 3-x-06.

Geranium polyanthes, *Edgew. et Hook. f.*

HYMENOPTERA. *Ichneumonidæ*. (1) Three individuals, 11,800 ft., 30-ix-06.

Impatiens bicornuta, *Wall.*

HYMENOPTERA. *Apidæ*. (1) *Bombus funerarius*, Smith, sh., and once biting spur, 9,000—9,400 ft., 26-ix-06, 2—3-x-06. COLEOPTERA. (2) One sp. fp., 8,500 ft., 23-x-04.

Impatiens asymmetrica, *Hook. f.*

HYMENOPTERA. *Apidæ*. (1) *Bombus funerarius*, Smith, sh., and once biting spur, 8,000—9,000 ft., 26-ix-06, 2—3-x-06. DIPTERA. *Bombyliidæ*. (2) *Lycastris flavihirta*, Brunetti, sh. diligently, 8,500 ft., 25-ix-06, 3-x-06. *Syrphidæ*. (3) *Syrphus* sp., 8,500 ft., 25-ix-06.

Impatiens Gagei, *Hook. f.*

HYMENOPTERA. *Apidæ*. (1) *Bombus* sp., sh., 6,500 ft., 3-x-06.

Rosa sericea, *Lindl.*

DIPTERA. *Muscidæ*. (1) One sp., 11,000 ft., 26-ix-06.

Saxifraga diversifolia, *Wall.*

HYMENOPTERA. *Apidæ*. (1) *Halictus* sp., sh., 11,500 ft., 1-x-06. *Parasitica*. (2) A small *Ichneumon*, sh., 11,800 ft., 30-ix-06. LEPIDOPTERA. *Heterocera*. (3) *Sphinxid.*, sh. constant, 11,000—11,900 ft., 26—27-ix-06. DIPTERA.

Syrphidae. (4 & 5) *Syrphus* 2 spp., 11,000—11,900 ft., 20-x-04, 26-ix-06 and 2-x-06. Muscidae. (6) One sp., sh. standing on anthers to do so, 11,500 ft., 19-x-04. Scatophagidae. (7) One sp., sh. in rain, 11,000 ft., 17-x-04; sh. 11,900 ft., 2-x-06. COLEOPTERA. (8) One Cistelid, 11,300—11,500 ft., 28—29-ix-06.

Selinum Candollii, D.C.

COLEOPTERA. (1) Cistelid beetle, 11,500 ft., 29-ix-06.

Anaphalis cinnamomea, O. B. Clarke.

DIPTERA. Bombyliidae. (1) *Lycastris flavihirta*, Brunetti, 8,500 ft., 3-x-06. Syrphidae. (2) *Eristalis* sp., fp., 9,000—10,000 ft., 26-ix-06, 3-x-06. Tachinidae. (3) *Plecia* sp., 9,500 ft., 3-x-06; very abundant, 9,000—10,000 ft., 26-ix-06, 2-x-06. Anthomyiidae. (4) *Parellia* sp., 9,500 ft., 2-x-06.

Anaphalis contorta, Hook. f.

HYMENOPTERA. Sphegidae. (1) *Psen orientalis*, Cam., sh., 11,000 ft., 2-x-06. DIPTERA. Syrphidae. (2) *Eristalis himalayensis*, Brunetti (E. ursinus, Big.), 11,800 ft., 3-ix-06. (3) *Eristalis* sp., 11,000 ft., 2-x-06. (4) *Rhingia angusticincta*, Brunetti, 9,500 ft., 2-x-06. (5) *Syrphus* sp., 11,000 ft., 2-x-06. Tachinidae. (6) *Dexid*, 11,000 ft., 2-x-06. Muscidae. (7) *Lucilia* sp., 11,000 ft., 2-x-06.

Saussurea deltoidea, C. B. Clarke.

DIPTERA. Syrphidae. (1) *Rhingia angusticincta*, Brunetti, fp., 9,500 ft., 2-x-06.

Saussurea uniflora, Wall.

HYMENOPTERA. Apidae. (1) *Bombus* sp., 11,500 ft., 29-ix-06.

Senecio alatus, Wall.

DIPTERA. Bombyliidae. (1) *Lycastris flavihirta*, Brunetti. Syrphidae. (2) *Rhingia angusticincta*, Brunetti. Both sh., 9,500 ft., 2-x-06.

Senecio tetranthus, D.C.

DIPTERA. Bombyliidae. (1) *Lycastris flavihirta*, Brunetti, twice sh., 9,000 ft., 2-x-06.

Senecio diversifolia, Wall.

HYMENOPTERA. Apidae. (1) *Bombus funerarius*, Smith, sh., 11,600 ft., 28-ix-06. DIPTERA. Syrphidae. (2) *Eristalis himalayensis*, Brunetti, 10,900 ft., 2-x-06. Anthomyiidae. (3) One sp., 11,800 ft., 21-x-04. Scatophagidae. (4) One sp., 11,800 ft., 29-ix-06. COLEOPTERA. (5) A Cistelid beetle, sh., 11,300 ft., 30-ix-06.

Cnicus involucratus, D.C.

HYMENOPTERA. *Apidae*. (1) *Bombus funerarius*, Smith, sh., 11,200—11,800 ft., 23-x-04, 29-ix-06. (2) *Bombus vallestris*, Smith, sh., 20-x-04. COLEOPTERA. (3) One Cistellid beetle, 11,500 ft., 29-ix-06.

Swertia Chirata, Buch.-Ham.

HYMENOPTERA. *Vespidae*. (1) *Vespa* sp. sh., 8,500 ft., 3-x-06. (2 and 3) *Crabro*? 2 spp. sh., 8,500—9,000 ft., 28-ix-06, 2-x-06.

Swertia bimaculata, Hook. f. et Thoms.

HYMENOPTERA. *Apidae*. (1) One sp., 7,000 ft., 3-x-06. DIPTERA. *Tachinidae*. (2) One *Dexid.*, sh., 7,000 ft., 24-ix-06, 3-x-06. *Muscidae*. (3) One sp. sh., 8,000 ft., 24—25-ix-06. *Chironomidae*. (4) One sp. sh., 8,000 ft., 24-ix-06. COLEOPTERA. (5) One sp. sh., 8,000 ft., 24-ix-06.

Strobilanthes pentstemonoides T. Anders.

HYMENOPTERA. *Apidae*. (1) *Bombus funerarius*, Smith, biting the corolla at the back just above calyx, 9,000 ft., 2-x-06. (2) *Bombus vallestris*, Smith, sh., 9,400 ft., 3-x-06. LEPIDOPTERA. *Heterocera*. (3) A *Sphingid* moth, sh., 9,400 ft., 3-x-06.

Crawfurdia speciosa, C. B. Clarke.

HYMENOPTERA. *Apidae*. (1) *Bombus funerarius*, Smith, biting corolla, 9,000 ft., 17-ix-04.

Cynoglossum furcatum, Wall.

DIPTERA. *Muscidae*. (1) One sp., 9,500 ft., 25-ix-06.

Elscholtzia strobilifera, Benth.

HYMENOPTERA. *Apidae*. (1) *Bombus vallestris*, Smith, sh., 11,000 ft., 19-x-04. (2) *Bombus trifasciatus*, Smith, sh. in rain, 11,600 ft., 1-x-06; sh. in rain, 12,100 ft., 29-ix-06.

Polygonum amplexicaule, D. Don.

HYMENOPTERA. *Apidae*. (1) *Bombus vallestris*, Smith, 10,800 ft., 2-x-06.

Polygonum campanulatum, Hook. f.

DIPTERA. *Syrphidae*. (1) One sp., 9,000 ft., 3-x-06.

Polygonum runcinatum, Buch.-Ham.

DIPTERA. *Syrphidae*. (1) *Rhingia angusticincta*, Brunetti, 9,500 ft., 2-x-06.

24. Notes on the Pollination of Flowers in India. Note
No. 6. The Spring Flora in the Simla Hills.

By I. H. BURKILL.

In this paper I put together wayside notes made between May 6th and May 24th, 1906, on a journey from Simla *via* Erki to Bilaspur on the Sutlej and to Suket, and (ii) between April 24th and May 11th, 1907, on a second journey from Simla to Kodiai near Narkanda, and again from Simla *via* Sabathu to Kalka at the foot of the hills. The daily marches, though undertaken for quite other purposes than the collecting of observations on flowers, afforded abundant opportunities for making them. The climates passed through ranged from spring with melting snow to the heat of the Panjab approaching its greatest. At 8,000 feet wheat was not in ear: at 2,000 feet the wheat-harvest was over: at 8,000 feet *Fragaria indica* was just in flower and *Rubus ellipticus* in bud: at 2,500 feet both were in fruit. *Datura Stramonium*, which, at 3,000 feet, bore nearly ripe fruits, at 8,000 feet was but germinating. The weather at this season is bright, with occasional thunder-showers, and with dry south winds from the hot plains.

I put before the reader only a few facts, hoping to be able to add to them at some future date, but not knowing when a third opportunity may occur of marching through the same hills. In the first part of my second trip I had the good fortune to be accompanied by Dr. N. Annandale, and to him I owe some of the observations and the determinations of many of the insects. To Colonel C. T. Bingham I am very greatly indebted for the names of *Hymenoptera*, and for the names of *Syrphids* to Mr. E. Brunetti.

Hill-slopes about Simla that face in different ways show great differences. As Thomson says (*Kashmir and Western Tibet*, 1852, page 44), if one gazes from Hattu southwards, one gazes onto northern slopes dark with pine and deodar forests; but if from Simla northwards onto the southern slopes of the same hills, one gazes onto stretches that impress one by their bareness. The contrast arises from exposure to dry hot winds and to sun—most particularly to sun; for where it rising licks up the dew, the slopes are not only treeless but in the lower hills are without the thickets of *Carissa* and other spiny plants which exist on the slopes that face more towards the sunset.

On April 29th, 1907, I reached 9,500 feet over Matiana: this was my highest. There, among the snow patches, were in bloom *Primula denticulata* and *Viburnum foetens*. The *Primula*

comes into flower as the snow melts from off it, and dots the ground in great abundance. The tube of the corolla is 10—14 mm. long: each plant is either long-styled or short-styled, the corolla-tube of the short-styled being on the average about 2 mm. longer than that of the long-styled. The flowers were seen to be visited by a *Hymenopteron* and two *Lepidoptera*, though somewhat sparingly. They contain a very little honey. *Apis indica* ascends to the places where it grows; but it does not visit the flowers, whose tubes are too long for its tongue; however, twice this bee was seen to hesitate before an inflorescence, examining it, and then to turn away without settling.

The flowers of *Viburnum fœtens* are scented and contain a moderate quantity of honey. They chiefly face downwards. On their own then leafless branches and among the still leafless *Acers* of the forests, they are very conspicuous. A large *Bombus* was seen diligently visiting them.

No other flowers that I saw make quite such a close approach to the snow as these two.

In the forests at 9,000 feet made up of *Taxus*, deodars and several deciduous trees, there are a number of herbs that flower, taking advantage of the sunshine which reaches the ground through the leafless trees above them. These plants are *Viola serpens*, *Gagea lutea*, *Corydalis rutæfolia*, *Ranunculus hirtellus* and *Trillium govaniatum*.

On *Gagea lutea* a small *Halictus* was twice seen collecting pollen at 9,000 feet.

Lower down, the evergreen pine woods are full of *Valeriana Wallichii*, with more sparingly *Ainsliea pteropoda* and locally *Mertensia racemosa*, all three being white-flowered. *Viola serpens* is associated with them; it is very common and of a pale lilac.

These pine woods are full of Syrphid flies. There is a hum through the middle of the day due to them; and it is they that visit the white flowers of the herbs in the shade. *Valeriana* was seen to attract *Syrphus balteatus*, *Platycheirus albimanus*, *Eristalis tenax* and another species; *Ainsliea* to attract *Rhingia angusticincta*; and *Mertensia* to attract *Platycheirus albimanus*. The tongue of the *Rhingia* I find to measure 6 mm. in length, so that it can reach honey where *Apis indica* finds it.

On the edge of the pine forest occurs plentifully another white-flowered plant—*Lonicera angustifolia*. It gets the visits of the Bombi, which do not penetrate much into the shade: *Bombus tunicatus* was several times seen on its flowers, going from one to another and from one bush to another without changing to any other plant: it was seen at work from sunrise to sunset. *Apis indica* was also a common insect upon the *Lonicera* flowers.

The *Lonicera* flowers are pendent, most commonly obliquely so, as represented in my figure (fig. 1), but varying in some degree between being horizontal and vertically pendent. Their duration is some time more than 48 hours. They open for the most part towards evening, the anther towards the twin flower dehiscing first, and the others following in pairs, the more remote

pair last. Spontaneous self-pollination is impossible, and judged by the abundance of insect visitors unnecessary. Honey is plentiful, but well guarded by the hairs within the corolla.



Fig. 1.—Flower of *Lonicera angustifolia* with half of the corolla cut away. $\times 2$.

The sunny slopes with their gay flowers are in great contrast to these wooded slopes. In spring at 7,000—9,000 feet, and particularly where the sward is rather even, they are covered with the yellow flowers of the Dandelion (*Taraxacum officinale*), and with bright sky-blue *Gentiana argentea*, budding purple Thyme (*Thymus Serpyllum*) and lilac *Micromeria biflora*. Then below 8,000 feet we get lilac-blue *Salvia lanata*, rose *Scutellaria linearis*, deep blue *Evolvulus alsinoides*, white and pale lilac *Gypsophila cerastioides*, bright yellow *Tragopogon gracile*, and at every little irregularity violets are found. Dry spots, where the branches of a *Cotoneaster* run on the soil, harbour plants of deep-coloured *Viola Patrinii*; and every bank bears the pale lilac-flowered *Viola canescens*.

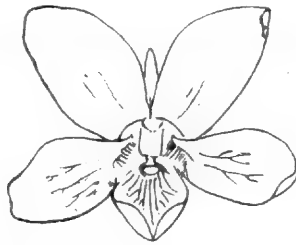


Fig. 2.—*Viola Patrinii*. $\times 2$.

Over these sunny hill slopes fly many butterflies, and *Apis indica* is common: there are on them further a fair number of Bombi, Syrphids and a Bombylius—*Bombylius major*—with a tongue 10 mm. long. The *Gentiana* is very freely visited—chiefly and very persistently by *Apis indica*: however, it seems to me that as *Thymus Serpyllum* comes into flower, *Apis* forsakes the *Gentiana* for it. *Taraxacum* gets many visitors of all classes.

Dr. Annandale pointed out to me that when we visited Matiana, Bombi were only just emerging from their winter sleep, and consequently the *Gentiana* had got the greater part of its flowering over before they emerged.

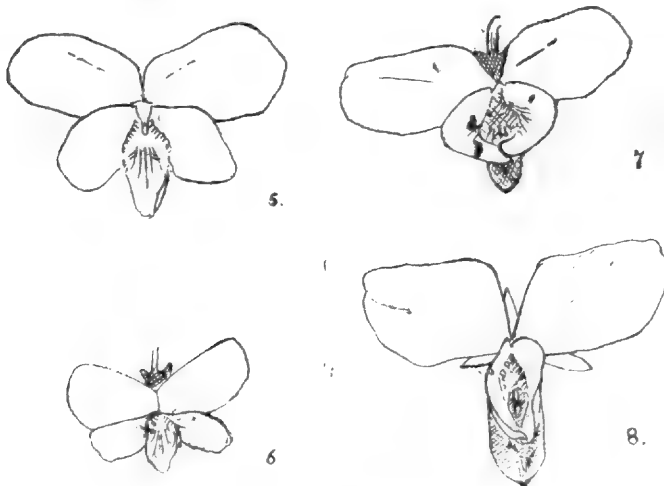
The *Bombus* of 8,000 feet and above is *Bombus tunicatus*, and it is accompanied by *Podalyrius quadrifasciatus*. The *Bombus* was seen to visit *Viburnum foetens*, *Lonicera angustifolia*, *Buddleia paniculata*, *Gentiana argentea*, *Viola serpens*, and *Taraxacum officinale*. The first two of these plants probably depend on it very largely for their pollination. The *Podalyrius* was seen very busily to visit *Lonicera angustifolia*, and on one occasion to visit with some persistency *Primula denticulata*.

I have some remarks to make about the violets. *Viola Patrini* (fig. 2) has an appreciable scent, and its lowest petal projects forward as a landing stage for insect visitors; I do not find it to vary much: but *Viola serpens* and *Viola canescens* vary greatly. Of *Viola serpens*, figure 3 is the flower, as found at 9,000 feet over Matiana on the crest of the ridge, and figure 10 is the spur



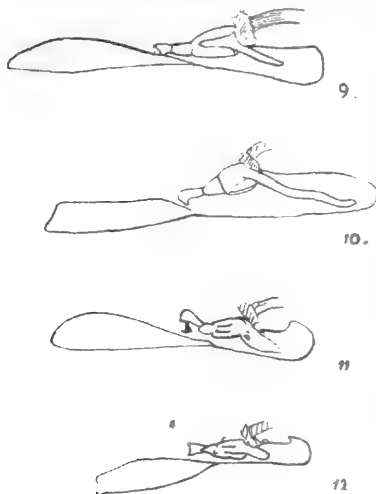
Figs. 3 and 4.—*Viola serpens*. ×2.

of the same flower. The colour of the flower is rich and deep; and the honey is in fair quantity. Figures 4 and 11 are from a flower gathered in the pine woods at Theog, 8,000 feet; in it the colour was lighter, the honey less, the side petals not bearded, the spur shorter and the nectary short and fat, so that it secreted honey not into the base of the spur, but onto its side-walls. After



Figs. 5 to 8.—*Viola canescens*. ×2.

examining a large number of flowers, it seems to me unwise to distinguish these as varieties;

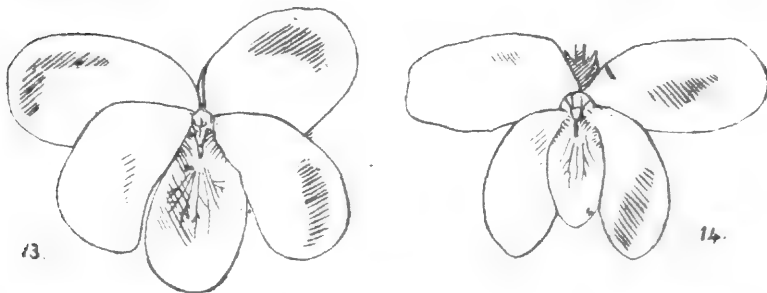


they are rather the result of different conditions. *Viola canescens* is the common violet everywhere; figures 5—8 and 12 represent its flowers: figure 5 is the commonest form: figures 7 and 8 show the position that the side petals take in very many flowers, and which is consistent with the reduction of the lowest petal. The consequence of the projection forward of the side petals is that they serve, instead of the narrow lower petal, as the insects' landing stage; and I have many times observed *Bombylius major* to rest its feet on them while sucking from the flower. Twice or thrice I saw *Bombylius* to rest on the keel, suck or try to suck, and then in each case

Fig.—9. Lowest petal of *Viola Patrinii*.
 Figs. 10 and 11 of *V. serpens*. Fig. 12 of
Viola canescens. $\times 2$.

it withdrew its proboscis and revisited the flower, resting the second time on the side petals.

One of the chief differences between *Viola canescens* and *Viola*



Figs. 13 and 14.—*Viola serpens*—flowers in which the upper petals take the position usual in *V. canescens*. $\times 2$.

serpens is in the reduction of the lowest petal both in length and breadth: another is in the angles at which the upper petals diverge; a third in the pulling forward of the side petals; a fourth in the size of the flower. As there are intermediates (*viz* figures 13 and 14), none of these differences are absolute guides in diagnosis, but still the two species are in a general way distinguishable. The shape

of the spur and the size of the nectaries I find to be more variable than some of the other characters.

When crags break the evenness of the shadier slopes, plants occur that I have not yet mentioned. One of the commonest is *Saxifraga ligulata*. It is conspicuous, but neglected by insects, and apparently self-pollinated in the majority of cases. There is a variability in the flowers, whereby, in some, anthers touch the stigmas upon expansion and in others they do not. Every flower sets seed. *Apis indica* was seen to hesitate before a flower and then to turn away. *Salix elegans* grows on the crags and receives visits from small insects. *Arabis alpina* (fig. 15) occurs on crags. It is not self-pollinating, unless in the withering of the flower. Honey is plentifully present. It was seen to be visited by the *Rhingia* which visits *Amsliwa*. *Thlaspi alpestre*, Linn., grows with it, and it is showy and receives the visits of *Bombylius*.

The woods of *Quercus incana*, Roxb., hardly ascend beyond 8,000 feet. In them occur trees of *Rhododendron arboreum*, whose brilliant flowers are conspicuous at a distance: the *Rhododendron* flowers were seen to be but little visited. On the other hand the flowers of *Pyrus Pashia*, which tree ascends to the same height, were very abundantly visited. When the sun had hardly risen over the hills, *Apis indica* was at its flowers, and busy on them all the day; sometimes it visited 30 flowers in a minute, sometimes 40 and sometimes 45, always settling and scrambling rapidly over the flower, if sucked dry, to another. For a few hours about mid-day *Syrphids* and other flies joined the *Apis*, and they were very largely collected for me by Dr. Annandale (see the list below).

Before passing on to the consideration of lower levels, there is to be mentioned a flora of the waysides, cultivated fields, and waste spots about 8,000 feet and above. It consists of *Oxalis corniculata*, *Cerastium triviale*, *Stellaria media*, *Capsella Bursa-pastoris*, *Cardamine sylvatica*, Crucifer No. 28628,¹ *Thlaspi arvense*, *Veronica biloba*, *Ajuga parviflora*, *Enothera rosea*, and *Galinsoga parviflora*. The flowers of the *Oxalis*, *Stellaria* and *Veronica* close when the sun goes off them, and in closing self-pollinate. The *Cardamine*, Crucifer No. 28628 (see fig. 16) and *Capsella* are self-



Fig. 15.—*Arabis alpina*. Fig. 16.—Crucifer No. 28628. × 2.

¹ A little Crucifer, perhaps introduced, which has not been determined yet.

pollinated not long after opening. *Galinsoga* sets seed at Simla in every flower apparently by self-fertilisation. *Enothera rosea* is apparently self-pollinated, being imperfectly proterandrous.

Below the level of Simla which is 7,000 feet, *Apis indica* occurs as abundantly as above it; but the common spring *Bombus* is *Bombus hæmorrhoidalis* and not *B. tunicatus*. *B. hæmorrhoidalis* is apparently greatly given to biting corolla-tubes in order to steal the honey. It has been seen by me constantly biting the tube of *Scutellaria linearis*, and to bite the tube of *Morinz persica*. The corolla-tube of *Salvia lanata*, the calyx of *Woodfordia floribunda*, and the spur of *Delphinium denudatum* were also found bitten. This bee works long hours, *i.e.*, from before sunrise until sunset.

At low levels *Anthophora cineta* and two species of *Xylocopa* were met with, and as well *Apis florea* and *Apis dorsata*.

Cool, evergreen forests disappear a little below the level of Simla, although, from ridges 6,000 feet high, down sheltered northern slopes, open forests of *Pinus longifolia*, Roxb., may extend to about 4,000 feet. When they are absent, we get on the slopes where the dew lies longest the scrub-thickets of the hills, wherein *Euphorbia royleana* may dominate, or *Carissa spinarum*, or *Dodonæa viscosa*; and occasionally in them *Rosa moschata* is very plentiful, and occasionally *Adhatoda Vasica*, or especially high up species of *Berberis*. The sunniest slopes are grassy with a sprinkling of flowers.

At the lower levels the vegetation shows in April and May signs of both a reawakening and of a sinking to rest: of a re-awakening in the fresh leaves and flowers on trees of *Diospyros montana*, or in the blossoming of *Cassia Fistula*, and of going to rest in the end of the flowering of *Carissa spinarum*, *Euphorbia royleana*, and *Woodfordia floribunda*, and in the way that *Adhatoda Vasica* inflorescences carry much ripe or nearly ripe seed. So do the seasons overlap at the lower levels; but at the lowest the dry hot weather of the bordering plains tells considerably: and there are more signs of going to sleep than of reawakening.

I made a note of every plant seen in flower, and the following is the list; after the enumeration, I proceed to analyse the flora. The words 'above' and 'below' signify found above and found below the level of 6,000 feet. Where neither of these words occur, the plant was seen in flower both distinctly above and distinctly below 6,000 ft.

PENDENT FLOWERS.

Bell with a long tube above, 100—110 mm. long (Class F.)

Datura Metel, Linn. (below).

Regular narrow-tubed flowers, 10—15 mm. deep (Class F.)

Silene inflata, Smith.

Regular narrow-tubed flowers, 10—15 mm. deep (Class H.)

Viburnum fœtens, Decne. (above).

Narrow-mouthed bell-flower, requiring tongue 10 mm. long
(Class H.)

Pieris ovalifolia, Don (above).

Narrow-mouthed bell-flowers, requiring tongue 5—10 mm. long
(Class H.)

Trachelospermum fragans, Hook. f. (below).

Trichodesma indicum, R. Br. (below).

Elæagnus umbellata, Thunb. (above).

Narrow-mouthed bell-flower, requiring tongue 3—5 mm. long,
(Class H.)

Lonicera angustifolia, Wall. (above).

Vallaris Heynei, Spreng. (below).

More or less open pendent flowers, 3—5 mm. deep (Class H.
approaching B.)

Berberis Lycium, Royle.

Berberis aristata, D. C.

Rubus biflorus, Buch.-Ham. (above).

Prinsepia utilis, Royle (above).

Deutzia staminea, R. Br. (often erect) (above).

Saxifraga ligulata, Wall. (old flowers upwards) (above).

Zehneria umbellata, Thw.

Diospyros montana, Roxb. (below).

Dæmia extensa, R. Br. (below).

Ophiopogon intermedius, Don.

Open bell-flower with honey above, easily obtained by tongues
3—5 mm. long (Class H.)

Campanula colorata, Wall. (above).

Nicandra physaloides, Gaertn. (below).

Class B', upper part; tube 15—20 mm. long.

Cnicus argyranthus, D. C. (flowers often erect).

Narrow flowers, less than 3 mm. deep (Class B).

Cryptolepis Buchanani, Roem. et Sch. (below).

Solanum nigrum, Linn. (below).

Cinnamomum Tamala, Nees.

HORIZONTAL REGULAR FLOWERS.

Class H. or F.; tube 10—15 mm.

Jasminum officinale, Linn.

Jasminum humile, Linn.

Jasminum arborescens, Roxb. (below).

Class H. or F.; tube 5—10 mm.

Daphne cannabina, Wall. (above).

Buddleia paniculata, Wall. (above).

Horizontal flowers of Class B', 10—15 mm. deep.

Ainsliea pteropoda, D. C. (above).

Horizontal flowers of Class B., less than 3 mm. deep.

Prunus Padus, Linn. (above).

Without honey, simulating Class AB.

Solanum xanthocarpum, Schrad. et Wendl. (below).

HORIZONTAL IRREGULAR FLOWERS.

A marked moth-flower, 40—50 mm. deep (Class F.)

Morina persica, Linn. (above).

A butterfly-flower with a tube 30 mm. deep (Class F.)

Hemerocallis fulva, Linn. (below).

Tunnel Bombus-flower with spur 10—15 mm. long (Class H.)

Impatiens sulcata, Wall. (below).

Triple tunnel Bombus-flower, with tubes 10—15 mm. deep
(Class H.)

Iris kumaonensis, Wall. (above).

Large open bell Bombus-flower, honey easily reached (Class H.)

Rhododendron arboreum, Smith (above).

Tube 20—25 mm. deep (Class F. or possibly bird-fertilised).

Loranthus longiflorus, Desv. (below).

Tube or spur 15—20 mm. long (Class H.)

Delphinium denudatum, Wall.

Bauhinia variegata, Linn. (below).

Salvia coccinea, Juss. (below).

Tube or spur 10—15 mm. deep (Class H.)

Corydalis rutæfolia, Sibth. (above).

Corydalis ramosa, Wall. (above).

Viola Patrinii, Ging. (above).

Viola serpens, Wall. (above).

Helicteres Isora, Linn. (below).

Adhatoda Vasica, Nees, (below.)

Salvia lanata, Roxb. (above).
Salvia moorcroftiana, Wall. (above).
Scutellaria angulosa, Benth. (above).
Scutellaria linearis, Benth. (above).

Tube or spur, 5—10 mm. long (Class H.)

Viola canescens, Wall. (above).
Parochetus communis. Buch.-Ham. (above).
Lotus corniculatus, Linn. (above).
Indigofera Dosua, Buch.-Ham.
Astragalus trichocarpus, Graham (above).
Lespedeza stenocarpa, Maxim. (above).
Vicia sativa, Linn. (above).
Vicia tenera, Graham (above).
Pueraria tuberosa, D.C. (below).
Rhynchosia Pseudo-cajan, Cambess. (below).
Dalbergia Sissoo, Roxb. (below).
Bauhinia VahlII, W. et A. (below).
Woodfordia floribunda, Salisb. (below).
Lonicera quinquelocularis, Hardw. (above).
Antirrhinum Orontium, Linn. (above).
Mazus surculosus, D. Don.
Lindenbergia urticifolia, Lehm. (below).
Lepidagathis cuspidata, Nees. (below).
Lepidagathis hyalina, Nees. (below).
Dicliptera bupleuroides, Nees. (above).
Caryopteris wallichiana, Schau. (below).
Nepeta spicata, Benth. (above).
Scutellaria repens, Buch.-Ham. (below).
Stachys sericea, Wall. (above).
Lamium petiolatum, Royle (above).
Roylea elegans, Wall. (below).
Iucas lanata, Benth.
Teucrium royleanum, Wall. (below).
Ajuga bracteosa, Wall. (below).

Tube or spur, 3—5 mm. deep (Class H.)

Fumaria parviflora, Lamk. (above).
Crotalaria albida, Heyne (below).
Crotalaria medicaginea, Lamk. (below).
Trifolium repens, Linn.
Trigonella pubescens, Edgew. (above).
Lanaria incana, Wall. (below).
Nelsonia campestris, R. Br. (below).
Vitex trifolia, Linn. f. (below).
Pogostemon plectranthoides, Desf. (below).
Thymus Serpyllum, Linn. (above).
Micromeria biflora, Benth.
Nepeta ruderalis, Buch.-Ham. (below).
Ajuga parviflora, Benth. (above).

Tube or spur, 3 mm. and less (Class H., rather than B.)

- Polygala abyssinica*, Fresen. (below).
- Polygala crotalarioides*, Buch.-Ham. (above).
- Medicago denticulata*, Willd. (below).
- Indigofera linifolia*, Retz. (below).
- Desmodium polycarpum*, D.C. (below).
- Desmodium parvifolium*, D.C.
- Vicia tetrasperma*, Moench (above).
- Loranthus ligustrinus*, Wall. (below).

Tube or spur 3 mm. and less (Class B., rather than H.)

- Verbascum Thapsus*, Linn. (below).
- Celsia coromandeliana*, Vahl (below).
- Veronica serpyllifolia*, Linn. (above).
- Lippia nodiflora*, Rich. (below).
- Verbena officinalis*, Linn. (below).
- Mentha sylvestris*, Linn. (below).
- Habenaria Griffithii*, Hook. f. (above).

Horizontal pollen flowers (but of Class H.)

- Cassia Fistula*, Linn. (below).
- Cassia Tora*, Linn. (below).

ERECT FLOWERS.

Marked moth-flower, 50—65 mm. deep (Class F.)

- Datura Stramonium*, Linn. (below).

Marked butterfly-flower, 25—30 mm. deep (Class F.)

- Dædalacanthus nervosus*, T. Anders. (below).

Marked moth-flower, 20—25 mm. deep (Class F.)

- Enothera stricta*, Steud. (above).
- Plumbago zeylanica*, Linn. (below).

Marked moth-flower, 15—20 mm. deep (Class F.)

- Silene conoidea*, Linn.

Butterfly flowers, 10—15 mm. deep (Class F.)

- Reinwardtia trigyna*, Planch.
- Kalanchoe spathulata*, D.C. (below).
- Enothera tetraptera*, Cav. (above).
- Primula petiolaris*, Wall. (above).
- Primula denticulata*, Smith (above).
- Thevetia neriiifolia*, Juss. (below).
- Nerium Oleander*, Linn. (below).
- Clerodendron infortunatum*, Gærtn. (below).

Ehretia acuminata, R. Br. (below).
Heliotropium strigosum, Willd. (below).
Cynoglossum micranthum, Desf.
Cynoglossum denticulatum, A. D.C. (below).
Mertensia racemosa, Benth. (above).
Herpestis Monniera, H. B. et K. (below).
Veronica Anagallis, Linn. (below).
Veronica agrestis, Linn. (above).
Veronica biloba, Linn. (above).
Veronica verna, Linn. (above).
Lantana Camara, Linn. (below).
Polygonum alatum, Buch.-Ham. (below).
Polygonum capitatum, Buch.-Ham. (above).

Honeyless, but simulating B.

Rosa moschata, Mill.
Evolvulus alsinoides, Wall. (below).

Class AB., with half-hidden honey.

Anemone rivularis, Buch.-Ham. (above).
Ranunculus hirtellus, Royle (above).
Ranunculus sceleratus, Linn. (below).
Ranunculus lætus, Wall.
Ranunculus arvensis, Linn.
Nasturtium officinale, R. Br. (below).
Arabis amplexicaulis, Edgew. (above).
Cardamine sylvatica, Link (above).
 Crucifer no. 28628 (above).
Sisymbrium Sophia, Linn. (above).
Sisymbrium Alliaria, Scop. (above).
Erysimum hieracifolium, Linn. (above).
Brassica nigra, Koch (above).
Brassica campestris, Linn.
Capsella Bursa-pastoris, Mœnch (above).
Thlaspi arvense, Linn.
Thlaspi alpestre, Linn. (above).
Cerastium triviale, Link.
Stellaria media, Cyrill (above).
Arenaria serpyllifolia, Linn. (above).
Sida humilis, Willd. (below).
Oxalis corniculata, Linn. (above).
Celastrus paniculata, Willd. (below).
Sapindus Mukorossi, Gärtn. (below).
Spiræa sorbifolia, Linn. (above).
Spiræa vacciniifolia, Don (above).
Fragaria indica, Andr.
Potentilla fragarioides, Linn.
Potentilla kleiniana, Wight et Arn.
Sedum rosulatum, Edgew. (above).
Sedum adenotrichum, Wall.

Boerhaavia diffusa, Linn. (above).
Polygonum recumbens, Royle (below).
Polygonum plebejum, R. Br. (below).
Thesium himalayense, Royle (below).
Viscum album, Linn. (above).
Jatropha gossypifolia, Linn. (below).
Gagea lutea, Schult. (above).

Willows, placed in class AB., but almost forming a class by themselves.

Salix elegans, Wall. (above).
Salix daphnoides, Villars (above).
Salix oxycarpa, Anders. (above).

Without honey, but simulating class AB.

Clematis montana, Buch.-Ham. (above).
Papaver dubium, Linn. (above).
Argemone mexicana, Linn. (below).
Hypericum cernuum, Roxb. (above).
Hypericum perforatum, Linn. (above).
Hypericum japonicum, Thunb.
Casearia graveolens, Dalz. (below).
Casearia tomentosa, Roxb. (below).
Anagallis coerulea, Linn. (above).

Class A', aggregated flowers with exposed honey.

Bupleurum falcatum, Linn. (below).
Heracleum candicans, Wall. (above).
Psammogeton biternatum, Edgew. (below).

Class A., with exposed honey.

Cocculus laurifolius, D.C. (below).
Stephania hernandifolia, Walp. (below).
Cissampelos Pareira, Linn. (below).
Ilex dipyrrena, Wall. (above).
Zizyphus oxyphylla, Edgew. (below).
Helinus lanceolatus, Brandis (below).
Vitis cordifolia, Roth (below).
Rhus Wallichii, Hook. f. (below).
Galium triflorum, Michx. (above).
Viscum japonicum, Thunb. (above).
Euphorbia pitulifera, Linn. (below).
Euphorbia royleana, Boiss. (below).
Euphorbia Helioscopia, Linn.
Euphorbia Maddeni, Boiss. (above).
Euphorbia nepalensis, Boiss. (below).
Flueggia microcarpa, Blume (below).

Table based on depth at which honey lies.

Honey or base of flower.	In the higher hills.		In the valleys and lower slopes.		Over the whole area.	
	No.	%	No.	%	No.	%
Above 50 mm. deep.	...	...	2	1·14	2	·66
40—50	1	·60	...	...	1	·33
30—40	...	...	1	·57	1	·33
20—30	1	·60	3	1·71	4	1·34
15—20	3	1·80	5	2·81	5	1·67
10—15	22	13·17	15	8·57	31	10·37
5—10	27	16·17	28	16·00	48	16·05
3—5	13	7·79	15	8·57	25	8·36
Up to 3 mm.	90	53·89	106	60·57	182	60·87
Total ...	167	...	175	...	299	...

In regard to the position that the flower takes, 62·88 per cent. of the plants have erect flowers, 28·76 per cent. horizontal and 8·36 per cent. pendulous: there is little difference between the flora of higher elevations and the flora of the valleys in this respect.

Table based on the position of the flower.

	On the higher hills.		In the valleys and on the lower slopes.		Over the whole area.	
	No.	%	No.	%	No.	%
Pendent ...	15	8·98	16	9·14	25	8·36
Horizontal ...	46	27·54	51	29·14	86	28·76
Erect ...	106	63·47	108	61·71	188	62·88
Total ...	167	...	175	...	299	...

But when we class the flora by our flower classes, we get marked irregularities, which I give in the next table, but do not comment on, because, before comment on them can be valuable, similar analyses of the spring flora in other parts of the Himalaya, and indeed elsewhere, must be made.

Table based on flower classes.

	On the higher hills.		In the valleys and on the lower slopes.		Over the whole area.	
	No.	%	No.	%	No.	%
CLASS F. Butterfly & moth flowers	8	4.79	13	7.43	18	6.02
CLASS H. Bee flowers	59	35.33	63	36.00	105	35.12
CLASS B'. long-tubed	12	7.19	7	4.00	15	5.02
CLASS B. short-tubed	31	18.56	29	16.57	58	19.37
CLASS B'. short-tubed	9	5.39	20	11.43	24	8.03
CLASS AB.	38	22.75	23	13.14	51	17.06
CLASSES A' & A.	9	5.39	17	9.72	24	8.03
Figs.	1	.60	7	1.17	4	1.34
Total ...	167	.....	175	.....	299	.....

Dr. Thomas Thomson has remarked how European is the spring flora of Simla, and that with the break of the rains a flora of another type becomes obvious. An analysis of this rains flora, if directed to show whether it contains a greater percentage of pendulous flowers than the flora that prevails in the drier spring season, would prove most interesting.

The Simla spring flora contains some conspicuously long-tubed flowers, far longer-tubed than any of the Singlala ridge autumn flora, but in a broad way the two floras in respect to depth of honey are not very unlike.

	Simla.		Singlala ridge.	
	No.	%	No.	%
Over 30 ...	4	1.34	...	...
Over 20-30 ...	4	1.34	7	4.97
15-20 ...	5	1.67	5	3.55
10-15 ...	31	10.37	12	8.51
5-10 ...	48	16.05	25	17.73
Less than 5 ...	207	69.23	92	65.25
Total ...	299	.....	141	.....

The flora under discussion is the flora of the season when the Broom (*Sarothamnus scoparius*) is coming into flower in Simla gardens, and it is very much higher in type than the flora of the Eastern Grampians at the season when the Broom is there coming into flower. The British mountains are poor in *Lepidoptera* and poor in flowers specially suited to their visits. A comparison of the Simla spring flora with that of any circle in the Swiss Alps is likely to show greater resemblances.

Flower Class.	PERCENTAGE OF FLOWERS.			
	Simla, in the Spring flora.		Clova, in the last ten days of May. ¹	
	No.	%	No.	%
F ...	18	6.02	1	1.15
H ...	105	5.12	24	27.59
B' Upper part ...	15	5.02	0	...
B ...	58	19.37	15	17.24
B' Lower part ...	24	8.03	5	5.75
AB ...	51	17.06	31	35.63
A & A' ...	24	8.03	11	12.64
Figs. ...	4	1.34	.....	.....
Total ...	299	.....	87	...

OBSERVATIONS IN DETAIL.

The observations detailed here are quoted by date. The itinerary for the dates is:—

1906.—May 6, 7 and 8, Simla (7,000 ft.); May 9, Simla to Erki (3,200 ft.); May 10, Erki; May 11, Erki to Namoli (4,000 ft.); May 12, Namoli to Bilaspur (1,600 ft.); May 13, Bilaspur; May 14, Bilaspur to Dihur (1,800 ft.); May 15, Dihur to Suket (4,000 ft.); May 16, Suket; May 17, Suket to Gere (7,000 ft.); May 18, Gere to Jhungi (5,500 ft.); May 19, Jhungi via Pangna (4,000 ft.), to Chindi (6,500 ft.); May 20, Chindi to Alsundi (3,500 ft.); May 21, Alsundi to Suni (2,100 ft.); May 22, Suni to Náldera (5,000 ft.); May 23, Náldera to Simla; May 24, Simla.

1907.—April 24 and 25, Simla; April 26, Simla to Phágn (8,200 ft.); April 27, Phágn to Theog (8,000 ft.); April 28, Theog to Matlána (8,000 ft.); April 29, Matlána to Kodiáli and to 9,500 ft. between the two places; April 30, Matlána; May 1, Matlána to Theog; May 2, Theog; May 3, Theog to Phágn; May 4, Phágn to Simla; May 5, 6 and 7, Simla; May 8, Simla to Sáiri (4,000 ft.); May 9, Sáiri to Kákarhatti (3,000 ft.); May 10, Kákarhatti to Kasáuli (6,000 ft.); May 11, Kasáuli to Kálka (2,000 ft.).

¹ Adapted from the table on p. 123 of the Transactions of the Botanical Society of Edinburgh for 1901.

Ranunculus acris, *Linn.* Visitor. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., sh., 4,000 ft., 10-v-07.

Delphinium denudatum, *Wall.* No insects were seen on this frequent and showy plant. The spur of a number of flowers was observed to have been bitten through, at the left-hand side near to the tip. The flower is proterandrous, and self-fertilisation apparently does not take place.

Berberis Lycium, *Royle.* The stigma stands in the mouth of the pendent flower and the stamens stand under cover of the petals. Visitors plentiful. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., sh., 4,000—6,000 ft., 9—11-v-07. (2) *Halictus* sp., sh., 4,000 ft., 9-v-07; 5,000 ft., 22-v-06. Formicidae. (3) A black ant, 4,000 ft., 9-v-07. LEPIDOPTERA. (4) and (5) Two species, sh., 5,000 ft., 22-v-06. DIPTERA. Anthomyiidae. (6) One species, 4,000 ft., 9-v-07.

Papaver somniferum, *Linn.* Visitors. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., and (2) *Bombus eximius*, Smith, cp., 8,000 ft., 18-v-06.

Corydalis rutæfolia, *Sibth.* The flower has the mechanism typical of *Corydalis*. It is not very conspicuous, but the plant is gregarious.

Arabis alpina, *Linn.* Visitors. DIPTERA. Syrphidae. (1) *Rhingia angusticincta*, Brunetti, sh., 8,000 ft., 1-v-07.

Cardamine sylvatica, *Link.* The anthers dehisce at a very short distance from the stigma, and afterwards come to touch it. Visitors. HYMENOPTERA. Apidae. (1) *Halictus polyctor*, Bingham, ♀, 7,000 and 8,500 ft., 28-iv-07 and 8-v-07.

Capsella Bursa-pastoris, *Moench.* Common and always self-pollinated. Visitors. HYMENOPTERA. Apidae. (1) *Halictus polyctor*, Bingham, ♀, sh. 7,000 ft., 8-v-07.

Thlaspi alpestre, *Linn.* The flowers are honeyed, showy and attract Diptera. Visitors. DIPTERA. Bombyliidae. (1) *Bombylius major*, Linn., sh., 9,000 ft., 30-iv-07. Syrphidae. *Syrphus* sp., sh., 9,000 ft., 30-iv-07.

Viola Patrinii *D.C.* This is the scented *Viola* of the hills; see figure above. Visitors. HYMENOPTERA. Apidae. (1) *Osmia*?, 8,300 ft., 29-iv-07 and 8,500 ft., 28-iv-07. LEPIDOPTERA. Rhopalocera. (2) *Lycaenid* one sp., sh., 8,500 ft., 28-iv-07. DIPTERA. Scatophagidae. (3) *Scatophaga* sp., seeking honey, 8,000 ft., 3-v-07.

Viola serpens, Wall. See figures above. Visitors. HYMENOPTERA. Apidae. (1) *Bombus tunicatus*, Smith, sh., 9,000 ft., 30-iv-07. *Halictus festus*, Bingh. ♀ sh., 8,300 ft., 29-iv-07. LEPIDOPTERA. Rhopalocera. (3) *Vanessa urticae*, Linn., sh., 9,000 ft., 30-iv-07. DIPTERA. Bombyliidae. (4) *Bombylius major*, Linn., two individuals, sh., 8,300 ft., 29-iv-07.

Viola canescens, Wall. See figures above. Visitors. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., sh., 9,000 ft., 30-iv-07. LEPIDOPTERA. Rhopalocera. (2) *Argynnis* sp., sh., 9,000 ft., 30-iv-07. DIPTERA. Bombyliidae. (3) *Bombylius major*, Linn., sh., very diligently and constantly in several individuals, 8,300 ft., 30-iv-07; and 9,000 ft., 30-iv-07. Syrphidae. (4) *Rhingia angusticincta*, Brunetti, 9,000 ft., 30-iv-07. *Syrphus balteatus*, De Geer, 8,000 ft., 2-v-07.

Polygala abyssinica, Fresen. Visitors. HYMENOPTERA. Apidae. One small species, sh., 5,000 ft., 22-v-06; and 6,000 ft. 20-v-06.

Polygala crotalarioides, Buch.-Ham. The mechanism is typical of the genus: the keel returns over the stamens after depression.

Gypsophila cerastioides, D. Don. Visitor. HYMENOPTERA. Apidae. (1) *Ceratina Kali*, Bingh. ♀, 8,000 ft., 28-iv-07.

Cerastium triviale, Link, is gynodioecious, at any rate above 8,000 ft.

Stellaria media, Cyr., is self-pollinated. Visitors. LEPIDOPTERA. Rhopalocera. *Lycænid* one sp., sh., 8,500 ft., 28-iv-07.

Geranium nepalense, Wall., has complete proterandry. Its flowers open about dawn. Visitors. HYMENOPTERA. Formicidae. One species of ant, sh., 6,000 ft., 11-v-07.

Oxalis corniculata, Linn., is self-pollinated in the closing of the flowers in the afternoon. It attracts occasional Hymenoptera. Visitors. HYMENOPTERA. Apidae. (1) *Halictus polyctor*, Bingh., sh., on three occasions, standing on the anthers and stigmas and turning round to each nectary in turn, 7,000 ft., 8-v-07 and 8,300 ft., 26-iv-07. DIPTERA. Syrphidae. (2) *Melanostoma* sp., sp., 7,000 ft., 8-v-07.

Ilex dipyrrena, Wall. There is very little honey in the flowers. The stamens diverge greatly and self-pollination seems impossible or difficult.

[N.S.]

Skimmia Laureola, *Hook. f.* The flowers open very little, and any insects forcing an entry must brush past the stigma and anthers. Visitors. HYMENOPTERA. A p i d a e. (1) *Apis indica*, Fabr., once but very persistently, 8,000 ft., 3-v-07. COLEOPTERA. One species twice, within the flowers, 8,000 ft., 3-v-07.

Murraya Koenigii, *Spreng.* Visitors. HYMENOPTERA. A p i d a e. (3) *Apis indica*, Fabr., sh., 3,000 ft., 9-v-07; and 4,500 ft., 16-v-06.

Sarothamnus scoparius, *Koch.* This introduced plant was seen to be freely visited and exploded by a large *Bombus*, at 7,000, ft., 7-v-06.

Indigofera Dosua, *Buch.-Ham.* The flowers open in the morning and by noon are almost all exploded. Within an hour or so of the exploding, the wings and the keel fall off, leaving no platform for insects to alight on. Visitors. HYMENOPTERA. A p i d a e. (1) *Halictus* sp., frequent sh., 4,000 ft., 22-v-06 and 6,000 ft., 20-v-06. LEPIDOPTERA. R h o p a l o c e r a. *Lycæna* sp., sh., 7,000 ft., 18-v-06.

Trifolium repens, *Linn.* A tongue of 5 mm. will reach the honey of the flowers in these hills. Visitor. LEPIDOPTERA. R h o p a l o c e r a. (1) *Pieris brassicæ*, Schrank, sh., 8,300 ft., 29-iv-07.

Medicago sativa, *Linn.* Cultivated. The flower was very abundantly visited by a little *Lycæna*, sh., 6,000 ft., 28-v-06.

Lotus corniculatus, *Linn.* A tongue of 7 mm. will reach the honey of the flowers in these hills. Visitor. HYMENOPTERA. A p i d a e. (1) *Apis indica*, Fabr., seeking honey, 8,500 ft., 1-v-07.

Lathyrus odoratus, *Linn.* A deep claret race in a garden was seen to be visited by a *Xylocopa*, sh., 6,000 ft., 11-v-07.

Spiræa canescens, *D. Don.* Visitor. LEPIDOPTERA. R h o p a l o c e r a. (1) *Pieris soracta*, F. Moore, 7,000 ft., 17-v-06.

Rubus biflorus, *Buch.-Ham.* The flowers are pendent. Visitor. HYMENOPTERA. A p i d a e. (1) *Halictus* sp., cp., 7,000 ft., 7-v-06.

Rubus lasiocarpus, *Sm.* The flowers are directed upwards. Visitors. HYMENOPTERA. A p i d a e. (1) *Apis indica*, Fabr., sh., 7,000 ft., 17-v-06. LEPIDOPTERA. R h o p a l o c e r a. (2) *Pieris* sp., sh., 7,000 ft., 17-v-06.

Fragaria indica, Anders. Visitors. DIPTERA. Tachinidae. (1) One species, 8,300 ft., 29-iv-07.

Fragaria vesca, Linn. Visitors. DIPTERA. Syrphidae. (1) *Syrphus* sp., 8,300 ft., 29-iv-07.

Potentilla fragarioides, Linn. Visitors. HYMENOPTERA. Apidae. (1) *Halictus* sp., 4,000 ft., 22-v-06. Formicidae. (2) One species 4,000 ft., 15-v-06. DIPTERA. Syrphidae. (3) *Melanostoma* sp., 4,000 ft., 18-v-06, and sp., 6,400 ft., 19-v-06.

Rosa moschata, Mill. Visitors. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., cp., 4,000 ft., 9-v-07; cp., in great abundance 4,000 ft., 10-v-07, and cp., 7,000 ft., 17-v-06. (2) *Bombus hæmorrhoidalis*, Smith, cp., 4,000 ft., 10-v-07 and seeking honey, 7,000 ft., 17-v-06. (3) *Bombus tunicatus*, Smith, seeking honey in just open buds, 7,000 ft., 18-v-06. (4) *Xylocopa* sp., cp. twice and seeking honey once, 4,500 ft., 10-v-07. (5) *Halictus* sp., 4,000 ft., 9-v-07.

Pyrus Pashia Buch.-Ham. Visitors. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., sh., in great numbers, 28-iv-07. 30-iv-07, 1-v-07. (2) *Bombus tunicatus*, Smith, 8,000 ft., 30-iv-07. (3) *Andrena floridula*, Smith, ♀, 28-iv-07. (4) *Andrena* sp., 30-iv-07. (5) *Halictus* sp., 30-iv-07. LEPIDOPTERA. Rhopalocera. (6) *Vanessa urticae*, Linn., sh., 28-iv-07. DIPTERA. Syrphidae. (7) *Eristalis tenax*, Linn., 28-iv-07, 30-v-07. (8) *Eristalis* ? *solitus*, Wall., 30-v-07. (9) *Eristalis* sp., 30-v-07. (10) *Syrphus torvus*, O.-Sack., 30-iv-07. (11 and 12) *Syrphus* 2 spp., 28-iv-07 and 30-iv-07. (13) *Melanostoma ambiguum*, Fall., 30-iv-07. (14) *Melanostoma* sp., 30-iv-07. Anthomyiidae. (15) *Anthomyia* ? 30-iv-07. Sepsidae. (16) *Sepsis* sp., 30-iv-07. Dolichopidae. (17) One species, 30-iv-07. COLEOPTERA. (18) One species, 30-iv-07. All at 8,000 ft.

Cotoneaster microphylla, Wall. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., 7,000 ft., 17-iv-06. (2) *Halictus* sp., 6,300 ft., 20-v-06. DIPTERA. Syrphidae. (3) *Eristalis* sp., 7,000 ft., 17-v-06. (4) *Helophilus* sp., 6,300 ft., 20-v-06. Muscidae. (5) *Calliphora* sp., 6,300 ft., 20-v-06; 7,000 ft., 17-v-06. (6) *Lucilia* sp., abundant, 6,300 ft., 20-v-06. Scatophagidae. (9) *Scatophaga* sp., 6,300 ft., 20-v-06. All at honey.

Prinsæpia utilis, Royle. The flowers contain a little honey and face earthwards.

Saxifraga ligulata, Wall. The neglect by insects of the flowers of this showy *Saxifraga* is remarkable. *Apis indica* I have seen to hover before flowers, and then to turn away. A

black ant is the only insect that I have seen at the small amount of honey present. I observe that the relative height of the anthers and stigma in opening flowers is variable and that self-pollination, though not universal, is frequent. Visitor. HYMENOPTERA. Formicidae. (1) Black ant, sh., 9,000 ft., 30-iv-07.

Deutzia staminea, R. Br. Not freely visited. Visitor. DIPTERA. Syrphidae. (1) *Eristalis* sp., 6,000 ft., 11-v-07.

Kalanchoe spathulata, D.C. The tube of the flower is 13—14 mm. long. The anthers are placed at two slightly different heights in it, the upper being scarcely 1 mm. from the mouth and the lower 1.5 mm. from the mouth. The styles elongating carry the stigmas past the lower anthers up to the lower edge of the upper anthers; and there is considerable probability of self-pollination. Honey is plentiful; and there are five approaches to it down the flutings of the ovary.

Sedum adenotrichum, Wall. The petals are white, striped with pink lines inside and flushed with pink outside. They form a tubular structure 5 mm. deep and 3 mm. across, spreading to 7 mm. above. The outer surface, as well as the stem, is slightly glandular. Honey is freely secreted by the five nectaries at the base of the flower. The open flower is nearly erect. When it first opens, five anthers dehisce, then the other five; at this time the anthers form a ring 1.5 mm. across, the first five being slightly above the others, and the stigmas somewhat drawn together in the centre. As the flower ages the anther-ring becomes 2 mm. across, all the anthers become level, and the stigmas expand close to them, but not normally in contact.

Casearia graveolens, Dalz. Visitors. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., sh., 2,000 ft., 11-v-07.

Oenothera rosea, Sol. Though honey is plentiful in the 5.7 mm. long tube, yet visitors are rare. The deep lip-purple flowers open in the morning, the anthers dehiscing as they expand, and the stigmas, spreading very soon after, come early into contact with them. Visitors. HYMENOPTERA. Apidae. (1) *Xylocopa* settled to suck on several flowers which its weight bore down to the ground and the fall caused it to take to wing again, 6,000 ft., 11-v-07. LEPIDOPTERA. Rhopalocera. (2) A Pierid, 5,000 ft., 22-v-06. COLEOPTERA. (3) 1 beetle, 7,000 ft., 4-v-07.

Woodfordia floribunda, Salisb. There is a great quantity of honey in the tube of the flower at which ants were seen, 4,000 ft., 17-v-06. The tube is sometimes bitten through apparently by a *Bombus*.

Punica Granatum, Linn. The flowers are markedly proterandrous, the style being at first short. During flowering it doubles its length. *Bombus hæmorrhoidalis* is a most regular visitor; it stands generally on the stamens and turns to all sides of the flower successively. Visitors. HYMENOPTERA. Apidae. (1) *Bombus hæmorrhoidalis*, Smith, seeking honey, 3,000 ft., 22-v-06; 3,200 ft., 9-v-06; 4,000 ft., 12-v-06. (2) *Bombus* sp., 8,000 ft., 12-v-06. (3) *Apis florea*, Fabr., sp., 3,000 ft., 9-v-07. COLEOPTERA. (4) Beetles sheltering in the flowers, 3,000 ft., 17-v-06.

Heracleum candicans, Wall. Visitors. DIPTERA. Muscidae. (1) *Calliphora* sp., sh. Anthomyiidae. (2) 1 sp., sh. COLEOPTERA. (3) One beetle. All at 7,000 ft., 2-v-07.

Viburnum cotinifolium, D. Don. Visitors. LEPIDOPTERA. Rhopalocera. (1) *Vanessa urticae*, Linn., sh., 7,500 ft., 4-v-07.

Viburnum pulchellum, Buch.-Ham. All the flowers of the flat panicle are open at the same time. The filaments are 3—3.5 mm. long; the style is absent; the corolla-tube is 1 mm. long. The flower is evidently intended to be fertilised by insects running over it.

Viburnum fœtens, Decne. The flowers are very conspicuous on the leafless trees, of a delicate rose pink, turned downwards or horizontally, scented and with a moderate quantity of honey. The tube is 14—16 mm. long. Visitors. HYMENOPTERA. Apidae. (1) *Bombus tunicatus*, Smith, ♀, sh., at 9,200 ft. and 9,400 ft., 29-iv-07.

Lonicera angustifolia, Wall. For the mechanism, see above. It is very well visited. Visitors. HYMENOPTERA. Apidae. (1) *Bombus tunicatus*, Smith, sh., 8,000—8,500 ft., 2—4-v-07. (2) *Podalirius quadri-fasciatus*, Villars, sh., 8,500 ft., 2-v-07. (3) *Apis indica*, Fabr., sh., 8,000—8,500 ft., 27-iv—3-v-07. LEPIDOPTERA. Rhopalocera. (4) One species, sh., 7,000 ft., 7-v-06. Heterocera. (5) Spingid, sh., in several individuals and persistent, 8,500 ft., 2-v-07.

Valeriana Wallichii, D.C. Gynodioceous. Visitors. HYMENOPTERA. Apidae. (1) *Apis indica*, Fabr., sh., 8,000—9,000 ft., 27-iv—1-v-07. DIPTERA. Bombyliidae. (2) *Bombylius major*, Linn., sh., 9,000 ft., 30-iv-07. Syrphidae. (3) *Éristalis tenax*, Linn., 8,000 ft., 4-v-07. (4) *Syrphus balteatus*, De Geer, 8,000—8,300 ft., 26-iv-07 and 2-v-07. (5) *Syrphus* sp., 8,000 ft., 3-v-07. (6) *Platychirus manicatus*, Meig., sh., 8,000 ft., 28-iv-07. Muscidae. (7) *Calliphora* sp., 8,300 ft., 3-v-07. Anthomyiidae. (8) One species, sp., 8,500 ft., 26-iv-07. THYSANOPTERA. (9) *Thrips*, 8,000 ft., 27-iv-07.

Morina persica, *Lim.* The mechanism is described in this *Journal*, 1906, pp. 522-523. The visitors which fertilise the flowers are Sphingids.

Oldenlandia gracilis, *Hook. f.* The grey-yellow 4-merous flowers are not conspicuous. They are absolutely upright. I could find no honey in the tube. The anthers are at the mouth of the tube; the stigmas expand about the middle of the tube soon after the opening of the flower. Pollen apparently falls onto the stigma. During flowering the style grows from being 3 to 7 mm. in length; the stigmas are 1.5 mm. long.

Randia tetrasperma, *Benth. et Hook. f.* The greenish-white flowers contain a fair quantity of honey in a tube which is 10 mm. deep and 5 mm. wide at the mouth. The corolla lobes are sharply bent back so that they do not serve as an alighting stage. The four stamens project at the edge of the cup and the stigma stands well above it. Pollen is shed in the bud some little time before it expands into a flower, and adheres to the swollen outside of the stigmas. It is then exposed in the male stage of the proterandrous flower. Later, the stigmatic lobes separate a very little. Visitors were not seen, though a look-out was kept for them both in 1906 and in 1907.

Wendlandia exserta, *D.C.* Visitors. HYMENOPTERA. *Apidæ*. (1) *Apis indica*, *Fabr.* COLEOPTERA. (2) A small brown beetle very abundant. Both at 2,500 ft., 11-v-07.

Vernonia cinerea, *Less.* The tube is 4 mm. long. Visitors. HYMENOPTERA. *Apidæ*. (1) *Megachile*?. LEPIDOPTERA. *Rhopalocera*. (2) *Lycæna* sp. Both at 3,500 ft., 16-v-06.

Aster molliusculus, *Wall.* Visitor. LEPIDOPTERA. *Heterocera*. (1) Sphingid, one sp., sh., 7,000 ft., 17-v-06.

Erigeron multicaulis, *Wall.* Visitors. LEPIDOPTERA. *Heterocera* (1) *Pieris soracta*, *F. Moore.* (2) *Lycæna* sp. Both at 7,000 ft., 10-v-06.

Gnaphalium leontopodium, *Lim.* DIPTERA. *Anthomyiida*. (1) One species to ♀ flowers, 8,000 ft., 28-iv-07.

Gerbera lanuginosa, *Benth.* The tube is 9 mm. long. Visitors. HYMENOPTERA. *Apidæ*. (1) *Xylocopa* sp., sh., very persistently, 6,000 ft., 11-v-07. (2) *Halictus* sp., cp., 19-v-06, 9-v-07, 3,000 ft., LEPIDOPTERA. *Rhopalocera*. (3) *Pieris soracta*, *F. Moore*, sh., 5,000 ft., 20-v-06. (4) *Ypthima* sp., sh., 5,000 ft., 22-v-06.

Galinsoga parviflora, *Cav.* Every flower sets fruit at 7,000—8,000 ft.

Senecio nudicaulis, *Buch.-Ham.* The tube is 3 mm. long. Visitors. DIPTERA. Muscidae. (1) One species, sh., 6,400 ft., 19-v-06.

Vicoa auriculata, *Cass.* The tube is 2.5 mm. long. Visitors. LEPIDOPTERA. Rhopalocera. (1) *Lycæna* sp., sh., 3,000 ft., 9-v-07.

Cnicus argyracanthus, *C. B. Clarke.* The tube is 17 mm. long. Visitors. HYMENOPTERA. Apidae. (1) *Xylocopa* sp., sh., 3,500 ft., 16-v-06: (2) *Bombus hæmorrhoidalis*, sh., 1,600—3,500 ft., 13—21-v-06. (3) *Cœlia* sp., ? sh., 5,000 ft., 22-v-06. Eumenidae. (4) 1 sp., seeking honey., 5,000 ft., 22-v-06.

Ainsliæ pteropoda, *D.C.* Visitors. DIPTERA. Syrphidae. (1) *Rhingia angusticincta*, Brunetti, sh., 8,000 ft., 27-v-07.

Taraxacum officinale, *Wigg.* Visitors. HYMENOPTERA. Apidae. (1) *Bombus tunicatus*, Smith, sh., 8,200 ft., 3-v-07. (2) *Apis indica*, Fabr., sh., 8,000—8,500 ft., 27-iv—3-v-07. (3) *Elis prismatica*, Smith, ♂, 8,700 ft., 3-v-07. (4) *Halictus duophobus*, Bingh. ♀, cp., and sh., 8,000 ft., 1-v-07. (5) *Halictus viridulus*, Bingh. ♀, sh., 8,000 ft., 27-iv-07. (6) *Ceratina bhavani*, Bingh. ♀, cp., and sh., 8,000—8,300 ft., 2—3-v-07. Formicidae. (7) Black ant, frequent 8,000 ft., 27-iv-07 and 1-v-07. LEPIDOPTERA. Rhopalocera. (8) *Papilio machaon*, Linn., 9,000 ft., 30-iv-07. (9) *Pieris brassicæ*, Schrank, sh., 8,000—8,300 ft., 29-iv—1-v-07. (10) *Vanessa urtiæ*, Linn., 8,300 ft., 29-iv-07. (11) *Vanessa xanthomelæna*, Denis and Schieff., sh., frequent, 8,300—9,000 ft., 29-iv—3-v-07. (12) *Argynnis* sp., 6,000 ft., 23-v-06; 8,000 and 9,000, 30-iv-07. (13) *Colias* sp., sh., 6,000 ft., 23-v-06 and 8,500 ft., 1-v-07. (14) *Gonepteryx rhamni*, Linn., 8,000 ft., 28-iv-07. Heterocera. (15) Spingid, one sp., sh., diligently, 8,000 ft., 27-iv-07. (16) Noctuid moth, sh., 8,000 ft., 28-iv-07. DIPTERA. Syrphidae. (17) *Eristalis tenax*, Linn., sh., 8,000—8,300 ft., 1—3-v-07. (18) *Syrphus pyrastris* Linn., 8,300 ft., 2-v-07. (19) *Platychirus albimanus*, Fabr., 8,000 ft., 27-iv-07. (20) *Sphærophoria brevis*, Brunetti, sh., 8,300 ft., 1-v-07. (21) *Sphærophoria* sp., 8,000 ft., 27-iv-07. (22) *Oriothina dentata*, Brunetti, sh., 8,300 ft., 29-iv-07. Anthomyiidae. (23) One sp., fp. 8,300 ft. 0-v-07.

Launæa nudicaulis, *Hook. f.* Visitors. HYMENOPTERA. Apidae. (1) *Bombus hæmorrhoidalis*, Smith, sh., 2,000 ft., 12-v-06; 4,000 ft., 15-v-06. (2) *Apis indica* Fabr., cp., 7,000 ft., 14-v-06. (3) *Halictus* sp., 1,800 ft., 14-v-06. Formicidae. (4) One species, 5,000—6,000 ft., 17-v-06. DIPTERA. Anthomyiidae. (5) One species, 3,500 ft., 10-v-07.

[N.S.]

Sonchus oleraceus, *Linn.* Visitors. LEPIDOPTERA. *Rhopalocera*. (1) *Pieris soracta*, F. Moore, sh., 7,000 ft., 17-v-06. DIPTERA. *Anthomyiidae*. (2) One species, 3,500 ft., 10-v-07.

Sonchus arvensis, *Linn.* Visitor. HYMENOPTERA. *Apidae*. (1) *Halictus* sp., 3,800 ft., 10-v-07.

Lactuca heyneana, *D.C.* Visitor. HYMENOPTERA. *Apidae*. (1) *Bombus hæmorrhoidalis*, Smith, at 4,000 ft., 21-v-06.

Tragopogon gracile, *D.C.* The tube is 5 mm. long and the stigmas ultimately recurve into more than a complete circle which should produce self-pollination. The flowers are little visited. Visitor. HYMENOPTERA. *Apidae*. (1) *Halictus duophobus*, Bingham, ♀, cp., several times, 8,500, 1-v-07.

Pieris ovalifolia, *D. Don.* The mechanism was described in *Nature* of July 26, 1906, vol. lxxiv., p. 296. A shower of pollen falls on the visiting insect, and the most suitable of its visitors is *Bombus hæmorrhoidalis*. The visitors observed on the flowers were:—HYMENOPTERA. *Apidae*. (1) *Bombus hæmorrhoidalis*, Smith, sh. (2) One or more species of ? *Halictus*, sh. through holes bitten in the corolla. *Vespidae*. (3) One species biting holes in the corolla. LEPIDOPTERA. *Rhopalocera*. (4) *Pieris soracta*, F. Moore, sh. (5) *Pieris brassicæ*, Schrank, sh. All 6,000 ft., 20-v-06.

Rhododendron arboreum, *Sm.* Visitors. HYMENOPTERA. *Apidae*. (1) *Apis indica*, Fabr., 8,000 ft. DIPTERA. *Syrphidae*. (2) *Syrphus* sp., 8,000 ft. *Muscidae*. (3) *Lucilia* sp., 8,500 ft. All 23-iv-07. On 10-iii-1902 at Palampur, somewhat further west (4,000 ft.), I saw a number of wasps in the flowers of this plant all more or less narcotised.

Diospyros montana, *Rorb.* Visitors. HYMENOPTERA. *Apidae*. (1) *Cœlioxyys* or a similar bee. *Vespidae*. (2) Eumenid, one sp. Both sh., 3,500 ft., 11-v-07.

Primula denticulata, *Smith.* The mechanism has been described above. Visitors. HYMENOPTERA. *Apidae*. (1) *Podalirius quadrifasciatus*, Villers, sh., going from plant to plant. LEPIDOPTERA. *Rhopalocera*. (2) *Argynnis* sp., sh. Both 8,700 ft., 3-v-07.

Androsace rotundifolia, *Hardw.* The spread of the corolla is 8–10 mm; the tube is 2–2.5 mm. long with very little honey; it is ventricose, 2 mm. in diameter at the middle, and 1 mm. at the mouth. The flower at its opening is white; in age it becomes a deep rose-pink. Visitors are very rare. The anthers are situated

just above the middle of the flower, on the same level as the stigma and in age self-pollination apparently occurs.

Jasminum officinale, Linn. Visitor. LEPIDOPTERA. R h o p a l o c e r a. (1) *Pieris brassicæ*, Schrank, sh. H e t e r o c e r a. (2) Sphingid, one sp., sh. Both at 6,300 ft., 20-v-06.

Carissa spinarum, A. D.C. Flowers white, abundantly honied and fragrant; tube 8 mm. long. In a very young bud the closed stigmas lie below the anthers; at the opening of the flower they are close to them, and receive the shed pollen onto the ring brush of hairs which they possess. Visiting insects brush off this pollen, and crawling insects are excluded from access to the honey by the hairs lining the corolla-tube. Visitors. HYMENOPTERA. A p i d a e. (1) *Bombus hæmorrhoidalis*, Smith, sh., 3,500 ft., 10-v-07; 4,000 ft., 15-v-06. LEPIDOPTERA. R h o p a l o c e r a. (2 and 3) *Papilio* 2 spp., sh., 4,000 ft., 15-v-06. (4) One other species, 5,500 ft., 18-v-06.

Calotropis procera, R. Br. Visitor. HYMENOPTERA, A p i d a e. (1) *Xylocopa æstuanis*, Linn., 1,700 ft., 13-v-06.

Buddleia paniculata, Wall. The tube is 9—11 mm. long, with very little honey. The anthers are situated about half way down the tube, and 1 mm. above the stigma. Visitors very few. HYMENOPTERA. A p i d a e. (1) *Bombus* sp., sh., 1-v-07. (2) *Apis indica*, Fabr., sh., 28-iv-07. LEPIDOPTERA. R h o p a l o c e r a. (3) *Vanessa urticæ*, Linn., 4-v-07. DIPTERA. S y r p h i d a e. (4) *Eristalis* sp., fp., 4-v-07. All at 8,000 ft.

Gentiana pedicellata, Wall. Flower an intense sky-blue. Tube 5 mm. deep with a fair amount of honey, which can be obtained through the five channels made by the inwardly projecting adnate filaments, and the ovary. The flower is at first protandrous, the anthers touching one another in a little group over the stigmas; later the filaments move out to the walls of the corolla tube, and place the anthers at the rim of the mouth of the corolla, while the stigmas expand where the anthers were. The stigmas are carried up to this position by the growth of the gynophore. It is almost certain that there is self-fertilisation in the closing and withering of the flower.

Gentiana argentea, Royle. Flower light sky-blue, rarely white; mechanism the same as in *G. pedicellata*. It grows at higher levels than the latter and at them is freely visited. When *Thymus* begins to flower, *Apis* begins to desert the *Gentiana* for it. Visitors. HYMENOPTERA. A p i d a e. (1) *Bombus tuni-catus*, Smith, ♂, sh., 8,500—9,300 ft., 29-iv-07. (2) *Apis indica*, Fabr., sh., often excessively constant 8,000—9,400 ft., 28-iv—3-v-07. (3) *Andrena burkillii*, Bingham, sh., 8,000 ft., 30-iv-07. (4) *Halictus duophobus*, Bingham, ♀, sh., 8,800., 1-v-07. (5) *Halictus*

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paris, Bingham, ♀, sh., 8,000 ft., 28-iv-07. (6) *Halictus festus*, Bingham, ♀, 8,300 ft., 29-iv-07. (7) *Elis prismatica*, Smith, ♂, sh., 8,000—8,700 ft., 30-iv—3-v-07; 8,000 ft., 1-v-07. (8) An ant once, 8,300 ft., 29-iv-07. LEPIDOPTERA. *Rhopalocera*. (9) *Pieris brassicæ*, Schrank, sh., 8,500 ft., 1-v-07. (10) *Vanessa uticæ*, Linn. sh., 8,500, 1-v-07. (11) *Vanessa xanthomelæna* Denis and Schieff., 8,700 ft., 3-v-07. (12) *Lampides* sp., sh., 8,000 ft., 1-v-07. (13) *Lycænid*, sh., 8,000 ft., 28-iv-07. HETEROPTERA. (14) Sphingid, one sp., not very diligently sh., 8,000, 29-iv-07. DIPTERA. *Bombyliidae*. (15) *Bombylius major*, Linn., sh., 9,300—9,400 ft., 29-iv-07. *Syrphidae*. (16) *Syrphus pyrastris*, Linn., 8,300 ft., 2-v-07. (17) *Platycheirus albimanus*, Fabr., sp., 8,000 ft., 29-iv-07. (18) *Sphærophoria* sp., sp., 8,000 ft., 29-iv-07. *Anthomyiidae*. (19) One sp., 8,000 ft., 3-v-07. COLEOPTERA. (20) *Meligethes*, 8,000 ft., 3-v-07.

Ehretia acuminata, R. Br. Visitors. HYMENOPTERA. *Apidae*. (1) *Apis dorsata*, Fabr., in great numbers. DIPTERA. *Anthomyiidae*. (2) One sp. COLEOPTERA. (3) One small species in fair quantity. All at 3,000 ft., 9-v-07.

Mertensia racemosa, Benth. Visitors. HYMENOPTERA. *Apidae*. (1) *Apis indica*, Fabr., 8,200, 3-v-07. DIPTERA. *Syrphidae*. (2) *Platycheirus albimanus*, Fabr., 8,400 ft., 28-iv-07.

Trichodesma indicum, R. Br. The flowers open at 7 A.M. They face earthwards. The corolla is 20 mm. in diameter, pale blue, with claret-brown patches round the throat, alternating with the corolla-lobes. The tube is 8 mm. deep, circular in section near the mouth, but pentagonal towards its insertion by reason of the way in which the filaments are attached. The anthers make a funnel-shaped inverted cone with the stigma and shed pollen held in it. They shed their pollen first at the downwardly directed tip, later from the opposite ends: and it all slides down into the funnel. There are five ways to the honey, and *Anthophora zonata* (an insect which apparently especially visits this flower) hangs under the cone as it turns round to explore each in turn. The pollen is liberated on to the lower surface of its thorax in this act, if the flower be young and the stigma immature: when the flower is older, the now ripe stigmas project 4 mm. from the empty cone and are rubbed by the insect's thorax and pollinated if pollen is there. The ways to the honey are well guarded by hairs. HYMENOPTERA. *Apidae*. (1) *Anthophora zonata*, Linn., diligently and constantly sh., 3,000 ft., 9-v-07, and 4,000 ft., 15-v-06.

Evolvulus alsinoides, Wall. Visitors. HYMENOPTERA. *Apidae*. (1) *Bombus hæmorrhoidalis*, Smith, 4,000 ft., 15-v-06. (2) *Apis ? dorsata*, Fabr., 1,700 ft., 13-v-06; *Chrysididae*. (3) *Chrysis ?* sp., 1,700 ft., 13-v-06. DIPTERA. *Anthomyiidae*. (4) One sp., 2,500 ft., 9-v-07.

Solanum xanthocarpum, *Schrad. et Wendl.*—Visitor. HYMENOPTERA. *Apidæ*. (1) *Xylocopa* sp., cp., 3,550 ft., 10-v-07.

Celsia coromandeliana, *Vahl.* Visitor. HYMENOPTERA. *Apidæ*. (1) *Bombus hæmorrhoidalis*, Smith, sh., 1,600 ft., 14-v-06.

Herpestis Monnieria, *H. B. et K.* Solitary and erect, lilac, very slightly zygomorphic flowers with but little honey. The stigma comes to occupy the position of the aborted fifth stamen, and ultimately the style grows to be a little longer than the longer filaments.

Veronica biloba, *Linn.* The flowers close early and in closing self-pollinate.

Adhatoda Vasica, *Nees.* See this *Journal* 1906, p. 521. The visitors observed on the flowers have been:—HYMENOPTERA. *Apidæ*. (1) *Xylocopa æstuans*, sh., 1,700 ft., 4-v-06. (2) *Xylocopa* a different species sp., sh., 2,500 ft., 9-v-07. (3) *Bombus* sp., 1,800 ft., 12-v-06.

Dicliptera bupleuroides, *Nees.* See this *Journal* 1906, p. 521. Visitors recorded:—HYMENOPTERA. *Apidæ*. (1) *Anthrophora zonata*, Linn., sh., 4,500 ft., 20-v-06. (2) *Apis indica*, 7,000 ft., 24-v-06. LEPIDOPTERA. *Rhopalocera*. (3) *Lycæna* sp., 7,000 ft., 24-v-06. A wasp was seen biting the corolla, 4,500 ft., 20-v-06.

Micromeria biflora, *Benth.* Gynodioecious. The tube is 5—6 mm. long, and at the mouth 1·5 mm. in diameter. There are a few hairs at the mouth and three deep violet spots. The ♀ flower is slightly proterandrous; the stigma at first does not reach to the anthers of the lower stamens, but later by the growth of the style it becomes exserted. Visitors. HYMENOPTERA. *Apidæ*. (1) *Apis indica*, Fabr., sh., 4,000—4,500 ft., 15—16-v-06, 2-v-07; 8,000 ft., 8-v-07. (2) *Halictus* sp., 2,000 ft., 21-v-06. LEPIDOPTERA. *Rhopalocera*. (3) *Papilio machaon*, Linn., sh., 7,000 ft., 18-v-06. (4) *Pieris soracta*, F. Moore, 7,000 ft., 18-v-06. (5) *Argynnis* sp., 6,400—7,000 ft., 18—29-v-06. (6) *Lycæna* sp., sh., 4,000 ft., 15-v-06; 6,400 ft., 19-v-06.

Thymus Serpyllum, *Linn.* The flowers are gynodioecious. Visitors. HYMENOPTERA. *Apidæ*. (1) *Apis indica*, Fabr., sh., 6,000 ft., 9-v-06; 8,000—8,300 ft., 26-iv—v-07. (2) *Ceratina kali*, Bingham, sh., 8,000 ft., 28-iv-07. LEPIDOPTERA. *Rhopalocera*. (3) *Pieris soracta*, F. Moore, 7,000 ft., 18-v-06. (4) *Vanessa urticæ*, Linn., sh., 8,000 ft., 1-v-07. (5) *Chrysophanus phlæas*, Linn., 8,000 ft., 2-v-07. (6) *Lycæna* sp., sh., 8,000 ft., 4-v-07. DIPTERA. *Bombyliidæ*. (7) *Bombylius major*, Linn., sh., 8,000 ft., 4-v-07.

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Salvia lanata, *Roxb.* See this *Journal*, 1906, p. 523. Visitors. HYMENOPTERA. A p i d a e . (1) *Bombus tunicatus*, Smith, sh., 7,000 ft., 18-v-06. (2) *Bombus hæmorrhoidalis*, Smith, 7,000 ft., 18-v-06. LEPIDOPTERA. H e t e r o c e r a . (3) SpHINGID, one sp., 8,000 ft., 4-v-07.

Nepeta ruderalis, *Buch.-Ham.* Visitors. HYMENOPTERA. A p i d a e (1) *Andrena* sp., 3,500 ft., 16-v-06.

Scutellaria linearis, *Benth.* See this *Journal*, 1906, p. 524. Visitors. HYMENOPTERA. A p i d a e . (1) *Bombus hæmorrhoidalis*, Smith, stealing the honey by biting the corolla tube, 6,000—7,000 ft., 21—23-v-06.

Roylea elegans, *Wall.* Visitors. HYMENOPTERA. A p i d a e . (1) *Bombus hæmorrhoidalis*, Smith, 4,000 ft., 8—9-v-07. (2) *Anthophora zonata*, Linn., 4,500 ft., 16-v-06. (3) *Apis indica*, Fabr., sh., 3,800 ft., 9-v-07.

Teurcium royleanum, *Wall.* See this *Journal*, 1906, p. 524. Visitor. HYMENOPTERA. A p i d a e . (1) *Anthophora zonata*, Linn., 4,500 ft., 16-v-06.

Ajuga bracteosa, *Wall.* The tube is 4 mm. long. The stigma touches the anthers of the lower longer stamens. Visitor. LEPIDOPTERA. H e t e r o c e r a . (1) SpHINGID going systematically to all the flowers, 8,000 ft., 3-v-07.

Duranta Plumieri, *Jacq.* In a garden at Bilaspur. Visitor. HYMENOPTERA. A p i d a e . (1) *Bombus hæmorrhoidalis*, Smith, sh., 1,600 ft., 12-v-06.

Lantana Camara, *Linn.* LEPIDOPTERA. R h o p a l o c e r a . (1) One sp., 3,000 ft., 12-v-06. DIPTERA. A n t h o m y i i d a e . (2) One sp., 3500 ft., 10-v-07.

Caryopteris wallichiana, *Schau.* Visitor. HYMENOPTERA. A p i d a e . (1) *Xylocopa* sp., sh., 2,500 ft., 21-v-06.

Elæagnus umbellata, *Thunb.* Small beetles and *Thrips* were seen in the richly honied pendent flowers, at 7,000 ft., 7-v-06.

Loranthus ligustrinus, *Wall.* The flowers are richly honied. The tube is 3 mm. long; it is red in colour, narrowed above, and has an entanglement of hairs blocking the way to the honey.

Viscum japonicum, *Thunb.* The minute green flowers are only .5 mm. in diameter and not massed; nevertheless I saw without much search four insects sucking the tiny drops of sweet juice off the stigma. Visitors. HYMENOPTERA. One Apiid, one ant and two minute winged Hymenoptera at honey, 5,000 ft., 22-v-06.

Euphorbia royleana, Boiss. Visitor. HYMENOPTERA. Formicidae. (1) A large black ant sh., 4,000 ft., 9-v-06.

Sapium sebiferum, Roxb. Visitors. HYMENOPTERA. *Apis* and wasps in great numbers to the glands on the pedicels of the flowers, 2,000 ft., 21-v-06.

Salix elegans, Wall. ♂. Visitors. DIPTERA. Bibionidae. (1) *Dilophus* sp., sh., 30-iv-07 and (2) one other fly, 30-iv-07. Empididae. One sp., 1-iv-07. All at 8,000 ft.

Salix oxycarpa, Anderss. ♂. Visitors. HYMENOPTERA. (1) *Apis indica*, Fabr., sh. (2) *Andrena floridula*, Smith, in some numbers. DIPTERA. Syrphidae. (3) *Syrphus* sp. Tachinidae. (4) *Echinomyia* sp. Scatophagidae. (5) *Scatophaga* sp. All at 8,700 ft., 3-v-07.

Gagea lutea, Schult. f. Visitors. HYMENOPTERA. Apidae. (1) *Andrena* sp., cp., 9,000 ft., 30-iv-07.

THE INSECTS.

HYMENOPTERA. Two species of *Xylocopa* are recorded above as visiting the flowers of the Simla Hills: one is the familiar *X. aestuans* of the plains which was seen no higher than near Bilaspur at 1,700 ft.: the other is a species like *X. nigrescens*. This second *Xylocopa* ascended to the hill top (6,000 ft.) at Kasauli, whereas further back from the plains than Kasauli, though it was seen frequently at varying heights, it was never above 4,500 ft.; it visited two honeyless flowers—*Rosa moschata* and *Solanum xanthocarpum* and six different honied flowers,—*Lathyrus odorata*, *Enothera rosea*, *Gerbera lanuginosa*, *Cnicus argyranthus*, *Adhatoda vasica* and *Caryopteris wallichiana*.

Bombus hæmorrhoidalis was seen to descend to Bilaspur (1,600 ft.) where it visited *Celsia coromandeliana*, and to ascend to 7,000 ft. Between these limits, but particularly about 4,000—6,000 ft., it is common, and a great-flower visitor especially to *Punica Granatum* which is wild on the hill sides, and to *Rosa moschata*, which can provide it with pollen only; for honey it is often very constant on Labiates such as *Roylea elegans* and *Scutellaria linearis*; but the latter it robs by biting the corolla. I have already mentioned the habit of the insect of apparently always biting the left side of the corolla. Above the zone of *Bombus hæmorrhoidalis* up to my highest limit *Bombus tunicatus* occurs plentifully; it goes diligently to pendulous and horizontal flowers such as *Lonicera angustifolia* and *Viburnum foetens*.

With it occurs *Podalyrius quadrifasciatus*.

With the *Xylocopas* occurs *Anthophora zonata*. It was seen to reach 4,500 ft., and to be a constant visitor to the blue inverted flowers of *Trichodesma indicum*.

Apis indica is everywhere from the plains up to my highest

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and is diligent on a great variety of plants most of which are not or hardly visited by the species of *Xylocopa* and *Bombus*.

Apis dorsata and *Apis florea* occurred no higher than 3,000 ft.

Species of *Andrena* and *Halictus* and similar small bees are common on the hills at the higher elevations. I do not know enough about them to justify any lengthy remarks here. Six of the Compositæ received visits from them and five of the Rosaceæ; they were not uncommon on the little blue *Gentiana argentea*; in all they visited twenty-four species.

Elis prismatica was seen on *Taraxacum officinale* and *Gentiana argentea*.

At low elevations *Eumenids* were seen and several bees of various genera which, when they could not be caught, are not satisfactorily identified even generically, and are only mentioned above with notes of interrogation.

Ants were seen on the flowers of ten different species and at all elevations; but perhaps they are more abundantly present in the valleys than on the hill tops.

LEPIDOPTERA.—Butterflies are very abundant at the higher elevations. Species of *Pieris* visited the flowers of thirteen different plants, species of *Vanessa* seven, species of *Argynnis* four, *Lycænid*s eleven, and species of *Papilio* three. *Sphinx*ids were also present plentifully and must do a considerable amount of flower visiting at night; by day I observed them on seven species.

Half of the butterflies are species abundant in Britain.

DIPTERA. Of the order Bombyliidæ, *Bombylius major* was found between 8,300 ft. and 9,400 ft., visiting freely the flowers of *Viola*, *Thlaspi*, *Valeriana*, *Gentiana* and *Thymus*. It, without doubt, is an important insect in flower-fertilisation. *Rhingia angusticincta* is the longest tongued of the *Syrphidæ* seen; it occurred from 8,000 to 9,000 ft. on flowers of *Arabis*, *Viola* and *Ainsliæa*. *Eristalis* did not ascend on the whole quite so high as *Rhingia*, ranging from 6,000 ft. to 8,300 ft. Species of *Syrphus* were common with the *Rhingia*, and also of *Melanostoma* and *Platychirus*. One *Melanostoma* was found as low down as 4,000 ft. It is worthy of remark that the *Syrphids* visited very many white flowers and few intensely coloured flowers; but that may be a consequence of the large numbers of pale flowers offering honey to them.

One small *Empid* was seen.

Short-tongued flies are not very abundant. There are a few *Muscids* and *Tachinids*, and some *Anthomyids*, but not the enormous preponderance that I have been accustomed to in my work in the Grampians.¹

COLEOPTERA were sparingly present in the flowers: they were taken on nine plants.

Thrips was taken on two.

The butterflies and the flies are, just as the flora is, markedly European; but the proportions of the insects above is most unlike what it is in spring, or indeed at any season, in Britain.

¹ Vide Annals of Scottish Natural History, 1903, p. 29.

25. The Jew's Harp in Assam.

By A. WILLIFER YOUNG.

It was the gift of a Jew's harp, made of bamboo, which first suggested enquiry as to the distribution and use of this ancient and primitive little musical instrument, particularly in Assam whence my specimen had come.

My search for similar instruments in the Indian Museum was in vain. Sir Saurendra Mohan Tagore does not mention the Jew's harp in his various treatises on the subject of Hindu music, whilst Capt. C. R. Day in his book on "The Music and Musical Instruments of South India and the Deccan" simply states that "The Jew's harp," or "murchang," is mentioned in most of the Sanskrit works upon musical instruments, and its use is common all over India.

It is open to question, however, whether this is not too sweeping a generalisation. Enquiries in Lower Bengal, Behar and Chota Nagpur make it evident that the instrument is not in use in these districts, nor have I ever seen one, or heard of one, when travelling in the villages around Calcutta. A friend who has travelled over a large part of Lower Burma tells me that he has not seen or heard of the instrument in any town or village south of Mandalay.

The late Dr. Carrington Bolton, in a paper printed in the *American Science Monthly*, states that the birthplace of this instrument is in Asia and that it is common throughout the East, in Tibet, Burma, Siam and Japan as well as in the islands of the seas from Borneo to Fiji, Samoa and the Philippines.

Six varieties of the Jew's harp were collected a few years ago in Siam and Perak by Dr. Nelson Aunandale, and have been fully described in a recent number of the *Fasciculi Malayenses* by Mr. Henry Balfour, Curator of the Pitt Rivers Museum, Oxford. The illustrations show that the instruments are very similar to those used in Assam.

In China a variety of the Jew's harp is known as "keou kinn," or "mouth harp," and the fact that it has been found among the Ainos is a proof of the age and universality of its use.

The metal instruments known by the same name in England have also a long history. They were manufactured at Nuremberg as far back as 1524 and brought into the country by the Jews.

The origin of the name in the West is not absolutely determined. The *Encyclopædia Britannica* gives it as composed of "jeu trompe"; and in the Highlands, especially in St. Kilda, where for long it was the only instrument known, it is still called "tromp" or "Jew's tromp."

In France it is called "Guim barde" and in Germany "Maul trommel," "mund harmonica" or "Brummeisen," *i.e.*, "buzzing iron."

The common idea is that it was called in English "Jew's harp," because it was introduced by the Jews into England in the Middle Ages. Perhaps a slighting reference to David's harp is implied.

References to its value as an article of barter in the West Indies, in the 16th century, are found in *Hakluyt's Voyages*.

In a letter taken in 1594 by Capt. George Popham (*Hakluyt's Voyages*, III, p. 665) from one Alonso, a Spaniard, who had written to his brother concerning the new El Dorado, the following reference occurs: "The interpreter asked whence hee (the chief Arataco) had those Hennes; he sayde they were brought from a mountaine—where were many Indians, yea, so many as grasse on the ground—and had so many Hennes as was wonderful, and if wee would have any we should send them Jewes harpes, for they would give for every one two Hennes. Wee tooke an Indian and gave him five hundred Harpes; the Hennes were so many that hee brought us as were not to be numbered."

In 1595 Sir Robert Duddleley (*Hakluyt's Voyages*, III, p. 576), making a report of his voyage to Orinoco and the Bermudas, etc., wrote: "Upon this my boat went and at his appointed place hee (*i.e.*, Armago, Captaine of the towne of Orocoa) met them with some 100 men in Canoas and tolde them that by force they should have nothing but blowes, yet if they would bring him hatchets, knives, and Jewes-harps, hee bid them assure me he had a Mine of gold and could refine it and would trade with me."

Proceeding now to the description of such specimens as I have been able to obtain from Assam and the extreme north of Burma, it should be remarked that generally it is as a serenading instrument that the Jew's harp is held in high estimation among many of the aboriginal tribes.

Breathing softly on their bamboo harps the young men address love calls to the marriageable girls; and as undesirable alliances not infrequently result, the missionaries in some districts have prohibited the use of the Jew's harp in their compounds. This, however, is by no means universal. It is curious that mention of the Jew's harp being played by the lads to their sweethearts occurs in some doggerel verses written a century ago, and describing the delights of the annual "feast" or "fair" at the little village of Wicken, in Cambridgeshire.

And now there comes our village feast,
On thirteenth of May of days the best,
When out town folks bring in their wares,
And every peasant richly fares.

When sweetheartys sweeter far become
And lads their Jew's harps gaily thumb;
Dust is kicked up on the barn floor,
Such dust no tasker raised before.

Six different specimens of bamboo Jew's harps have been obtained and will be described in order of their primitiveness.

1. The Lakhers and Chins, who live in the hills in the extreme north-west of Burma, use a rudely-made Jew's harp. The specimen shown was made by a Chin visiting Fort Lungleh in South Lushai. It is cut out of a single piece of bamboo and the vibrating tongue is of the same width throughout its length. Strings are attached with which to hold and play it. As may be imagined the Chin harp is rather difficult for a novice to handle, but when played by an expert hillswan the sounds produced exactly resemble those of the well-known Jew's harp at home.

In playing, the little finger of one hand is placed through the loop of the string attached to the instrument, the end of the harp being firmly held between the tips of the thumb and first finger, allowing the string of the loop to pass through the closed hand. The harp is placed between the lips, being very lightly touched by them; the string is held by the little cross piece of bamboo at the end and jerked with the free hand rapidly, at the same time breathing in and out alternately.

The Rev. J. H. Lorrain, in the course of a tour to the south of Lushai, when staying in Chin and Lakher villages, was struck by the "weird" sounds produced by the harp when he first heard it played late one evening. He writes: "The operator was playing the instrument and chanting a love ditty to his sweetheart at the same time . . . and kept on so long that we began to marvel that any girl could be wooed and won by such an awful din. We have heard a Jew's harp played several times since, but we have grown positively to dislike the sound!"

In the Chittagong Hill Tracts the people do not make, but import and play the Jew's harp. They do not attach any particular significance to its use.

The Lushais neither make or use any form of Jew's harp, which is rather strange, as the instrument is made and used freely by surrounding tribes.

2. The tribes in the Naga Hills make a harp very similar to that of the Chins, which they call "tebang kogki," or mouth music. The specimen obtained measures $6\frac{1}{2}$ inches, is very primitive in type, and shows no attempt at ornamentation. It is played as follows: The Naga winds the string once around the first two fingers near the end, and then gives the tongue of the instrument a succession of little jerks as he blows gently against the tongue. The principle is the same as that of the western-made instrument, but the sound is feeble. Young men use it for serenades, but its use by Christian Nagas is not objected to.

3. The Mikirs in the Nowgong and Sibsagar districts make and use a double Jew's harp. It measures about six inches, and is locally termed "krong chui." The two harps are not tied tightly together, but are held in position by the thumb and fingers of the left hand. In other parts of India three harps are used together giving different notes. The specimen

illustrated shows traces of ornamentation at each end. A simple but effective pattern is formed by accurately crossed lines which are coloured with a dark stain.

The Mikir instrument is played by females, but boys also indulge sometimes, especially the unmarried lads, who play it in the evening, some as a relaxation in the intervals of work, others at bed-time.

4. The Garos, whose home is in the hills which bear their name, make a harp very much like that in use among the Mikirs. It is a double instrument, each one being about five inches in length.

The specimen shown was made by a Garo boy and is the kind commonly used. Both old and young men play it. When asked if the Christians played it, the lad answered, "No, not that it is considered bad, but they have not the wish to use it." Probably further investigation would reveal a deeper reason why it is not used by Christian Garos.

5. The Kachins, who are also called in Burma Chingpaw, and in Assam Singpho, and who live to the extreme east of Assam and north-west of Burma, are adepts at playing this instrument. The specimen shown, which was obtained from Myitkyina, is slightly more elaborate than those above described. It measures six inches and is made, as all are, of a strip of bamboo, but with the addition of a double splice. Apparently it is the only variety made, and is a very popular instrument among the wild Kachins.

All love passages are conducted with this as the chief musical instrument, and it is universally used by the young men in serenading girls.

The missionaries have found it necessary to prohibit the use of it among the school children on the Mission compound. Whenever a young fellow is caught somewhere near the girls' dormitory discoursing sweet music on his harp, he is called to order, "as we know what it means."

6. The most elaborately made and best-sounding harps have been obtained from the Sadiya district of Assam. They are in every way an advance on the primitive instruments above described. One measures nine inches and the other ten inches. There is an attempt at ornamentation and the music obtainable from them is much louder and approximates very nearly in tone to that of a metal instrument. They can be easily played by a European, which is not the case with the others. The Assamese also make iron instruments, but as yet I have not been able to obtain a specimen. The use of the Jew's harp is prohibited by some of the A.B.M.U. missionaries because of its intimate association with heathen songs and festivals. The probability is that the reason above stated for prohibition in other places is the real one in this case also.

It would be interesting to extend the enquiry as to the distribution of the Jew's harp in India further than has been possible in this preliminary paper.

[N.S.]

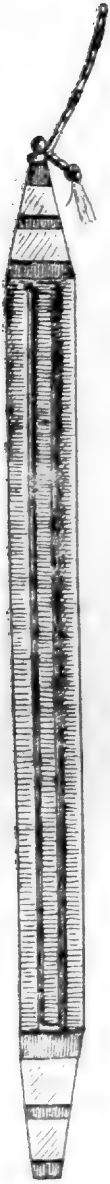
I have been told that the instrument is well known in Tibet and Nepal, but I have not been able to secure specimens.

Hooker in his *Himalayan Journals* writes : After dark we sat over the fire, generally in company with a little Lepcha girl Dolly was fond of hearing me whistle airs and procured me a Tibetan Jew's harp with which, and coarse tobacco, which I smoked out of a Tibetan brass pipe, I wiled away the dark evenings. In a footnote it is stated that "this instrument (which is common in Tibet) is identical with the European, except that the tongue is produced behind the bow in a strong steel spike, by which the instrument is held firmer to the mouth."

In the account of his journey through Mongolia and Tibet, Mr. W. W. Rockhill writes of the Jew's harp (dulcet sounds) : "This most ancient, primitive and popular instrument is brought to this part of the country (it is only used in and around Bat'ang), from the Ts'ak's lung and to the country to the south of here, and is not of Tibetan origin, nor, I think, made. It consists of three bamboo harps each of different tone, all of them played together held in the left hand, the one above the other, that with the highest note at the top. The harp with the deepest note is said to give the *p'o ka* (*p'o skad*) or "male note," the middle one gives the *ding ka* or "middle note," and the sharper note is known as *mo ka* or "female note." Three or four persons frequently play together in unison, and nearly every girl or woman carries a *k'api* suspended with chevron-shaped carvings and bands of coloured quills. The Chinese of Kan-su call the Jew's harp *k'ou ch'i*.

The Tibetan name is an exact counterpart of the Kan-su one, for *k'a* means "mouth," and *pi* stands for *pi-wang*, the three-stringed banjo (*san hsien*).

The Pekinese Jew's harp is of iron and very like the one used among us."



1. Chin harp.



2. Assamese harp.



3. Mikir harp.

26. On some Reciprocal Relations of Curves and Surfaces.

By MAHENDRANATH DE, M.A., B.Sc., *Bengal National College, Calcutta.*

1. The following theorem is given by Dr. Asutosh Mukhopādhyāya in 'A Memoir on Plane Analytic Geometry' in the *Journal of the Asiatic Society of Bengal* for 1887.

"If from any point P two tangents be drawn to the conic $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and P is constrained to move on any curve $F(x, y) = 0$, the locus of the middle point of the chord of contact is

$$F\left(\frac{a^2b^2x}{b^2x^2 + a^2y^2}, \frac{a^2b^2y}{b^2x^2 + a^2y^2}\right) = 0."$$

He adds that this result is an immediate consequence of a new method which he proposes to call the Method of Elliptic Inversion.

That method does not seem to have been published since, and the object of this paper is to give a very simple method of establishing this and similar results and their space-analogues and to point out a remarkable relation between the two loci.

2. If x', y' be the co-ordinates of any point P in the plane of the curve $\frac{x^2}{a^2} \pm \frac{y^2}{b^2} = 1$; X, Y the co-ordinates of the middle point of the chord of contact $\frac{xx'}{a^2} \pm \frac{yy'}{b^2} = 1$, it is easily seen that

$$X = \frac{x'}{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2}}; \quad Y = \frac{y'}{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2}}$$

[∵ it is well known that the diameter passing through x', y contains the point X, Y .]

$$\therefore \frac{X^2}{a^2} \pm \frac{Y^2}{b^2} = \frac{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2}}{\left(\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2}\right)^2} = \frac{1}{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2}}$$

$$\therefore x' = \frac{X}{\frac{X^2}{a^2} \pm \frac{Y^2}{b^2}}; \quad y' = \frac{Y}{\frac{X^2}{a^2} \pm \frac{Y^2}{b^2}}$$

So that, if the locus of x', y' is the curve $f(x, y) = 0$, the locus of

$$X, Y \text{ is } f\left(\frac{x}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2}}, \frac{y}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2}}\right) = 0, \text{ which agrees with Dr. Mukho-}$$

pādhyāya's result and which at the same time gives a similar result for the hyperbola.

3. It is important to observe that the relation between the two points x', y' and X, Y is a reciprocal one, so that each is the middle point of the polar chord of the other, as is evident from the expressions for the co-ordinates of the one in terms of those of the other—the relation being, in fact, exactly similar to that of

$$\text{two inverse points. } f(x, y) = 0 \text{ and } f\left(\frac{x}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2}}, \frac{y}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2}}\right) = 0, \text{ are,}$$

therefore, two inverse loci, each being the locus of the middle points of polar chords of points lying on the other locus.

4. Similar results are also true for the parabola $y^2 = 4ax$. If x, y be the co-ordinates of any point P and X, Y , those of the middle point of the polar chord of P with respect to the parabola, it has been proved by Dr. Mukhopādhyāya

$$\text{that } X = \frac{y^2 - 2ax}{2a}; Y = y$$

$$\therefore y^2 = 2ax + 2aX$$

or

$$Y^2 = 2ax + 2aX$$

$$\therefore x = \frac{Y^2 - 2aX}{2a}; y = Y,$$

so that the points x, y and X, Y may, in a certain sense, be regarded as inverse points.

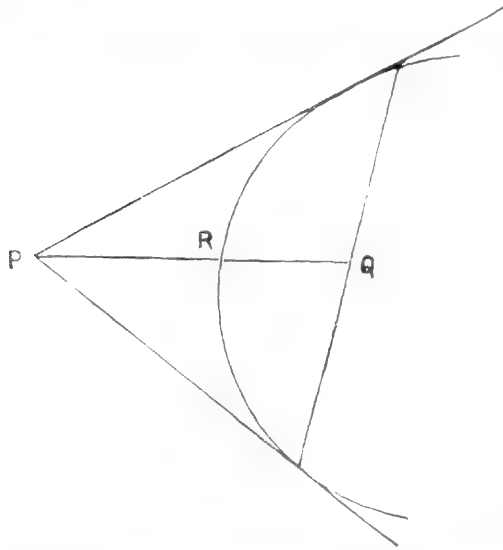
In the case of the parabola, the above results can be established directly with very great ease.

Thus if $(x, y) : (X, Y)$ be the co-ordinates of the points P, Q in the opposite figure, since PQ is parallel to the axis (Prop. XXI, p. 38, Dr. Mukhopādhyāya's Geometry of Conics).

$$\therefore Y = y.$$

Again, if R be the middle point of PQ , R is a point on the parabola and its co-ordinates are $\frac{x+X}{2}, y$,

$$\therefore y^2 = 4a \cdot \left(\frac{x+X}{2}\right) = 2ax + 2aX \text{ whence } X = \frac{y^2 - 2ax}{2a}.$$



5. Generally, if x', y' be the co-ordinates of any point P in the plane of the curve $f(x, y) = 0$ and X, Y those of the point where the line joining P to the origin meets the first polar of the curve with respect to P , and if the equation of the curve be rendered homogeneous by the introduction of the linear unit z , it is easy to prove that

$$x' = -x \cdot \frac{z \frac{df}{dz}}{x \frac{df}{dx} + y \frac{df}{dy}}; \quad y' = -y \cdot \frac{z \frac{df}{dz}}{x \frac{df}{dx} + y \frac{df}{dy}}.$$

It is easily seen that the relation between the two points x', y' and x, y is not, in general, reciprocal.

6. In the particular case, however, when $f(x, y) = 0$ represents the general equation of the second degree

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0 \quad \text{we have}$$

$$x' = \frac{-x(gx + fy + c)}{ax^2 + 2hxy + by^2 + gx + fy}; \quad y' = \frac{-y(gx + fy + c)}{ax^2 + 2hxy + by^2 + gx + fy} \quad \dots \quad (\text{A})$$

$$\text{or} \quad \left. \begin{aligned} x' (ax^2 + 2hxy + by^2 + gx + fy) &= -x(gx + fy + c) \\ y' (ax^2 + 2hxy + by^2 + gx + fy) &= -y(gx + fy + c) \end{aligned} \right\} \dots \dots (1)$$

$$\text{whence} \quad \frac{x'}{x'} = \frac{y}{y'} = \frac{ax^2 + 2hxy + by^2 + gx + fy}{gx + fy + c} = m \text{ (say)} \dots \dots (2)$$

$$\therefore x = mx' ; y = my'.$$

$$\therefore \text{From (1) } x' [m^2(ax'^2 + 2hx'y' + by'^2) + m(gx' + fy')] = -mx'(mgx' + mfy' + c)$$

$$m^2x'(ax'^2 + 2hx'y' + by'^2 + gx' + fy') = -mx'(gx' + fy' + c)$$

$$\therefore m = \frac{-(gx' + fy' + c)}{ax'^2 + 2hx'y' + by'^2 + gx' + fy'} \dots\dots\dots (3)$$

$$\therefore \left. \begin{aligned} x &= \frac{-x'(gx' + fy' + c)}{ax'^2 + 2hx'y' + by'^2 + gx' + fy'} \\ y &= \frac{-y'(gx' + fy' + c)}{ax'^2 + 2hx'y' + by'^2 + gx' + fy'} \end{aligned} \right\} \dots\dots\dots (B).$$

It is evident from (A) and (B) that the relation between the points is, in this case, a reciprocal one. For central curves of the second order, the point where the line joining *P* to the origin meets the polar chord of *P* is the middle point of that chord, the centre being the origin.

The theorem stated in Art. 1, therefore, follows immediately.

7. Equating the two values of *m* given by the equations (2) and (3) we get,

$$\frac{ax^2 + 2hxy + by^2 + gx + fy}{gx + fy + c} = \frac{gx' + fy' + c}{ax'^2 + 2hx'y' + by'^2 + gx' + fy'}$$

$$\text{or } (ax^2 + 2hxy + by^2 + gx + fy)(ax'^2 + 2hx'y' + by'^2 + gx' + fy') = (gx + fy + c)(gx' + fy' + c),$$

so that if *S*, *S'* be the values of *f*(*x*, *y*) when we substitute in it the co-ordinates of a pair of inverse points and *P*, *P'* those of the polar of the origin, the relation connecting two inverse points is

$$(S - P)(S' - P') = PP' \dots\dots\dots (4).$$

I have not, hitherto, been able to find any simple geometrical interpretation of this result.

8. Space-analogues of the results of Arts. 6 and 7 can be easily obtained.

Thus if *f*(*x*, *y*, *z*) = 0 represents the quadric

$$ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 3hxy + 2ux + 2vy + 2wz + d = 0$$

and (*x'*, *y'*, *z'*, and *x*, *y*, *z*) the co-ordinates of any point *P* and the point where the line joining *P* to the origin meets the polar plane of *P* with respect to the quadric, it is easily proved that

$$\frac{x'}{x} = \frac{y'}{y} = \frac{z'}{z} = - \frac{ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 2hxy + ux + vy + wz}{ux + vy + wz + d}$$

from which it can be proved as in Art. 6, that

$$\frac{x}{x'} = \frac{y}{y'} = \frac{z}{z'} = - \frac{ax'^2 + by'^2 + cz'^2 + \dots + ux' + vy' + wz'}{ux' + vy' + wz' + d}$$

whence it is evident that the relation between x', y', z' and x, y, z is reciprocal.

We have further the identity

$$(S - P)(S' - P') = PP' \text{ exactly analogous to that of Art. 7.}$$

9. When $f(x, y, z) = 0$ represents the surface

$$\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = 1 \quad \text{we have}$$

$$x' = \frac{x}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}} \quad \text{and} \quad x = \frac{x'}{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2} \pm \frac{z'^2}{c^2}}$$

$$y = \frac{y}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}} \quad y = \frac{y'}{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2} \pm \frac{z'^2}{c^2}}$$

$$z' = \frac{z}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}} \quad z = \frac{z'}{\frac{x'^2}{a^2} \pm \frac{y'^2}{b^2} \pm \frac{z'^2}{c^2}}$$

So that if the point x', y', z' be constrained to move on the surface $F(x, y, z) = 0$, the inverse point moves on the surface

$$F\left(\frac{x}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}}, \frac{y}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}}, \frac{z}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}}\right) = 0 \dots\dots\dots (5).$$

It is evident from the above expressions for x', y', z' in terms of x, y, z and *vice versa* that the point x, y, z is the centre of the polar plane of the point x', y', z' with respect to the surface

$$\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = 1. \quad (\text{See Art. 234, Frost's Solid Geometry}) \text{ and}$$

vice versa.

As an interesting particular case of (5) let $F(x, y, z) = 0$

represent the conicoid $\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = m$.

Then

$$x = \frac{x'}{\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2}} = \frac{x'}{m},$$

similarly

$$y = \frac{y'}{m}; \quad z = \frac{z'}{m}.$$

\therefore the locus of x, y, z is $m^3 \left(\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} \right) = m$

or $\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = \frac{1}{m}.$

So that, each of the two conicoids

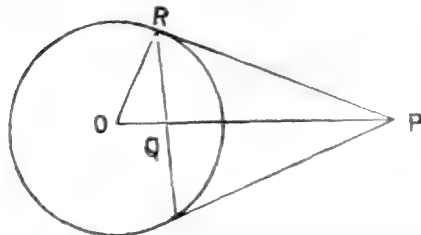
$$\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = m$$

$$\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = \frac{1}{m}$$

is the locus of the centres of polar planes with respect to the surface $\frac{x^2}{a^2} \pm \frac{y^2}{b^2} \pm \frac{z^2}{c^2} = 1$ of points lying on the other.

10. From what has gone before, it is clear that the idea of inverse points may be generalised and the inverse of a point may be defined to be the point where the line joining it to the origin meets its polar line (or plane) with respect to a curve (or surface) of the second degree, inverse curves (or surfaces) being the loci of inverse points.

In fact the ordinary definition of inverse curves is included in this as a particular case.



Thus, if O be the centre of a circle and P a point in its plane and Q the point where OP meets the polar of P , we have

$$OP \cdot OQ = R^2$$

(where R = the radius).

\therefore If O be taken as origin P and Q are inverse points.

If x, y and x', y' be the co-ordinates of the points P and Q , equation (4) of Art. 7 becomes in this case

$$(x^2 + y^2) (x'^2 + y'^2) = -R^2 \times -R^2 = R^4.$$

In other words,

$$OP^2.OQ^2 = R^4$$

i.e.

$$OP.OQ = R^2.$$

The equations (A) and (B) of Art. 6 reduce in this case to

$$\left. \begin{aligned} x' &= \frac{R^2 x}{x^2 + y^2} \\ y' &= \frac{R^2 y}{x^2 + y^2} \end{aligned} \right\} \text{and} \begin{aligned} x &= \frac{R^2 x'}{x'^2 + y'^2} \\ y &= \frac{R^2 y'}{x'^2 + y'^2}. \end{aligned}$$

Analogous results, of course, hold for the sphere and can be deduced from those of Art. 8.



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APRIL 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 1st April, 1908, at 9-15 P.M.

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L., D.Sc., President, in the chair.

The following members were present:—

Dr. N. Annandale, Mr. I. H. Burkill, Mr. J. A. Chapman, Babu Promoda Prakas Chatterjee, Miss R. N. Cohen, M.D., Mr. H. G. Graves, Mr. D. Hooper, Dr. W. C. Hossack, Captain R. E. Lloyd, I.M.S., Dr. Girindranath Mukhopadhyaya, Lieut.-Colonel D. C. Phillott, Rai Ram Brahma Sanyal, Bahadur, Dr. E. D. Ross, Pandit Yogeśa Chandra Sastri-Samkhyaratna-Vedatirtha, Dr. Satis Chandra Vidyabhusana, Mr. E. Vredenburg, and Rev. A. W. Young.

Visitors:—Mr. T. Bentham and Dr. W. M. Haffkine.

The minutes of the last meeting were read and confirmed.

One hundred and two presentations were announced.

The President announced that the Council had appointed Lieut.-Colonel G. F. A. Harris, M.D., I.M.S., as one of the Vice-Presidents of the Society.

The General Secretary reported:—

1. That Mr. W. W. Hornell, Sir Edward FitzGerald Law, K.C.M.G., and Sir Thomas Raleigh, K.C.S.I., had expressed a wish to withdraw from the Society.

2. That the election of the Hon. Mr. W. W. Drew, as a member of the Society, was cancelled at his own request.

3. That Sir Dietrich Brandis, K.C.I.E., a Life Member of the Society, was dead.

The General Secretary read the names of the following gentlemen who had been appointed to serve on the various Committees for the present year:—

Finance Committee.

Dr. N. Annandale.
Mr. I. H. Burkill.
Mr. W. K. Dods.
Mr. H. G. Graves.
Mr. T. H. Holland.

Library Committee.

Dr. N. Annandale.
 Lieut.-Colonel W. J. Buchanan.
 Mr. J. A. Cunningham.
 Mr. J. N. Das-Gupta.
 Mr. H. G. Graves.
 Mahamahopadhyaya Haraprasad Shastri.
 Mr. Harinath De.
 Mr. H. H. Hayden.
 Mr. D. Hooper.
 Mr. T. H. D. La Touche.
 Major L. Rogers.
 Dr. E. D. Ross.
 Mr. G. Thibaut.
 Mr. E. Thornton.

Philological Committee.

Dr. Abdulla al-Mamun Suhrawardy.
 Mahamahopadhyaya Chandra Kanta Tarkalankara.
 Hon. Mr. E. A. Gait.
 Dr. Girindra Nath Mukhopadhyaya.
 Mahamahopadhyaya Haraprasad Shastri.
 Mr. Harinath De.
 Babu Monmohan Chakravarti.
 Babu Muralidhar Banerji.
 Babu Nagendra Nath Vasu.
 Lieut.-Colonel D. C. Phillott.
 Dr. E. D. Ross.
 Mahamahopadhyaya Satis Chandra Vidyabhusana.
 Acharya Satyavrata Samasrami.
 Mr. G. Thibaut.
 Mr. E. Venis.
 Pandit Yogesa Chandra Sastri-Samkhyaratna-Veda-
 tirtha.

The following five gentlemen were balloted for as Ordinary Members:—

Lieut. Walter Meade, 33rd Queen's Own Light Cavalry, Secunderabad, proposed by Lieut.-Colonel D. C. Phillott, seconded by Dr. N. Annandale; *Prof. E. P. Harrison*, Ph.D., Indian Educational Service, proposed by Mr. J. A. Cunningham, seconded by Mr. C. W. Peake; *Captain F. C. Hirst*, I.A., Survey of India, proposed by Mr. T. H. D. La Touche, seconded by Mr. H. G. Graves; *Mr. H. P. Duval*, I.C.S., proposed by Mr. T. H. D. La Touche, seconded by Mr. H. G. Graves; *Prof. W. C. Wordsworth*, Presidency College, proposed by Dr. Satis Chandra Vidyabhusana, seconded by Lieut.-Colonel D. C. Phillott.

Captain R. E. Lloyd, I.M.S., exhibited the skull of a gigantic ray of the genus *Ceratoptera* from Orissa coast.

The specimen exhibited was cast ashore at Puri, on the Orissa coast, and forms the type of a new species. No species of the genus appears to have been recorded hitherto from Indian seas. Photographs of allied species (one of them new to science) preserved in the Madras Museum were also exhibited.

Dr. N. Annandale exhibited some Freshwater Sponges recently collected by him in the Bombay Presidency and Burma.

The two collections exhibited were made in November, 1907, in the Western Ghats, and in March, 1908, at Rangoon and the Amherst district of Tenasserim. The Bombay collection includes several species originally described by Carter from that Presidency, as well as others new to science, not hitherto known from India or only recorded from Bengal. The most notable are *Spongilla bombayensis*, hitherto only known from Carter's very imperfect description; *Spongilla lacustris*, agreeing in every respect with European examples; *Ephydatia indica*, only known from Lower Bengal; and two new species, one of which is allied to Weber's *Spongilla sumatrana* and the other to an African species, Weltner's *Spongilla loricata*. The Burmese collection consists, with one exception, of species common in Calcutta, such as *Spongilla carteri*, *S. proliferens*, *Trochospongilla latouchiana* and *T. phillotiana*. The exception is a new species of *Tubella* (a genus not hitherto recorded from India) allied to *T. vesparium* Martens, which is only known from Borneo and is the only representative of the genus hitherto recorded from the Oriental Region.

The following papers were read:—

1. *Eastern Hoods for Hawks*.—By LIEUT.-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*
2. *Note on the Drum in Falconry*.—By LIEUT.-COLONEL D. C. PHILLOTT, *Secretary, Board of Examiners.*
3. *The Jew's Harp in Assam*.—By A. W. YOUNG.
4. *Notes on the Geography of Old Bengal*.—By MONMOHAN CHAKRAVARTI.

This paper will be published in a subsequent number of the *Journal*.

5. *On some Reciprocal Relations of Curves and Surfaces*.—By MAHENDRANATH DE.

6. *The Age of Kalidas*.—By PROF. SARADA RANJAN RAY, M.A. *Communicated by the President.*

This paper will be published in a subsequent number of the *Journal*.

7. *An Account of the Construction of (1) the Taj, (2) the Moti Masjid, (3) the Agra Fort, and (4) Fatehpur Sikri*.—By HARINATH DE.

The Adjourned Meeting of the Medical Section was held at the Society's Rooms on Wednesday, April 8th, 1908, at 9-15 p.m.

LIEUT.-COLONEL G. F. A. HARRIS, I.M.S., in the chair.

The following members were present:—

Lieut.-Colonel W. J. Buchanan, I.M.S.; Dr. Gopal Chandra Chatterjee; Miss R. N. Cohen, M.D.; Captain F. P. Connor, I.M.S.; Dr. H. M. Crake; Lieut.-Colonel F. J. Drury, I.M.S.; Dr. W. C. Hossack; Dr. E. A. Houseman; Captain D. McCay, I.M.S.; Dr. Girindra Nath Mukhopadhyaya; Captain J. G. Murray, I.M.S.; Dr. T. F. Pearse; Major J. C. Vaughan, I.M.S.; Major L. Rogers, I.M.S., Honorary Secretary.

Visitors:—Dr. C. A. Bentley and Lieut.-Colonel W. B. Thomson, R.A.M.C.

The minutes of the last meeting were read and confirmed.

Specimens and lantern slides of a case of Pulmonary Atheroma were shown by Major L. Rogers.

A paper by Captain T. H. Delaney on "Epidemic Dropsy" was read, and the discussion on that subject concluded.

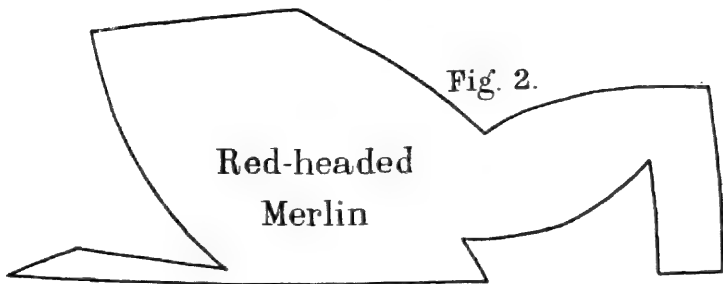
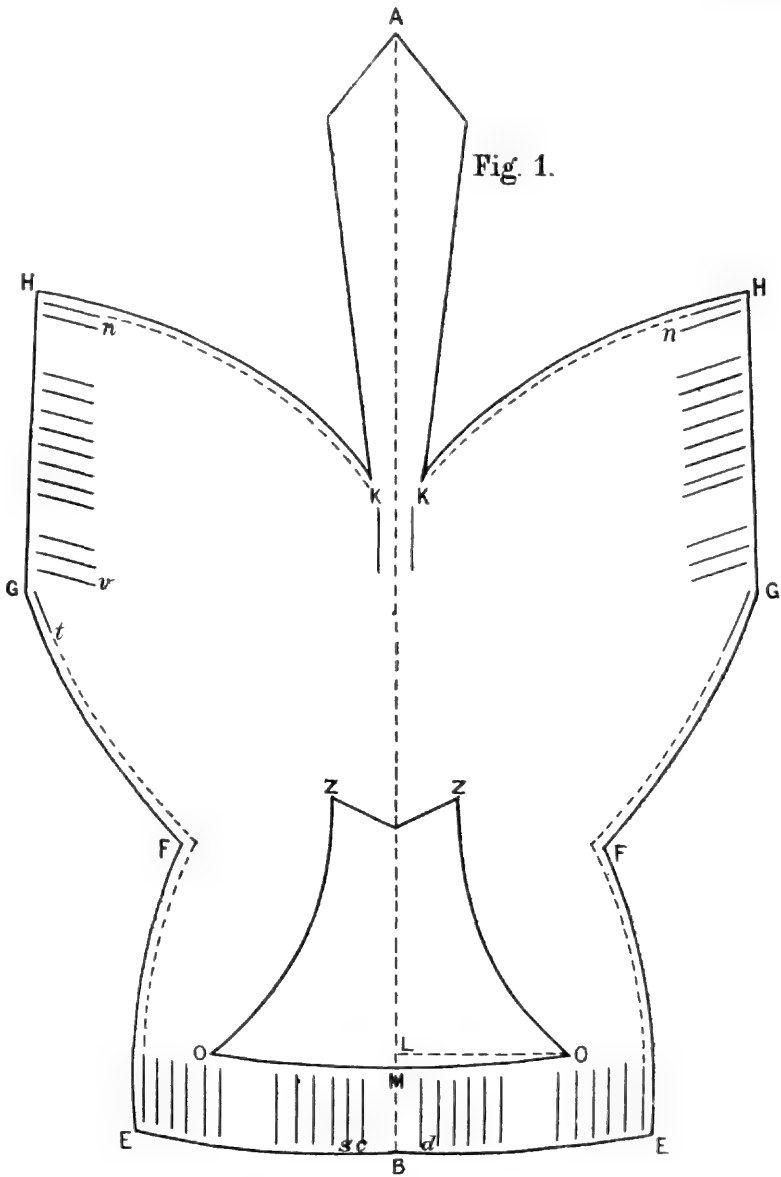




Fig. 1.

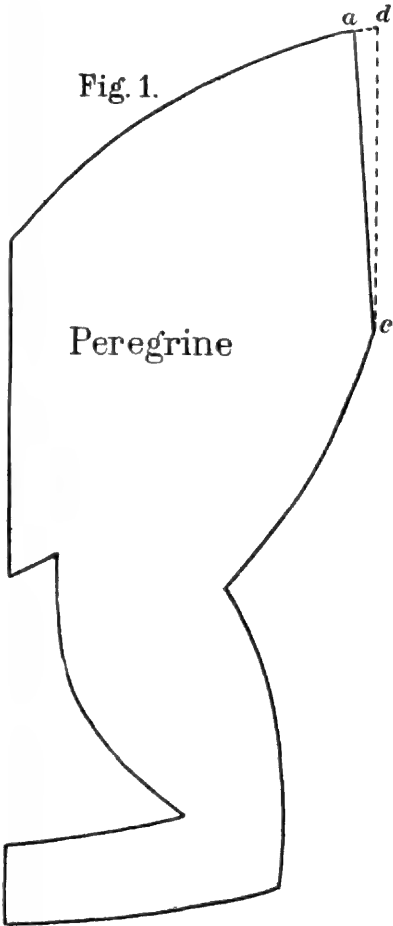


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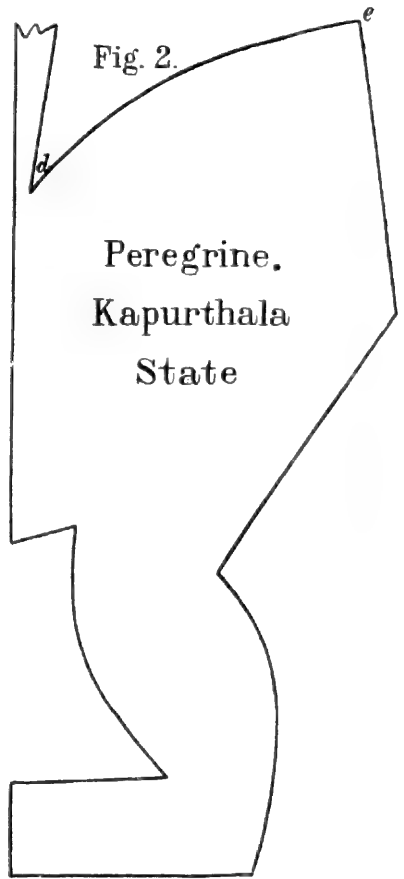
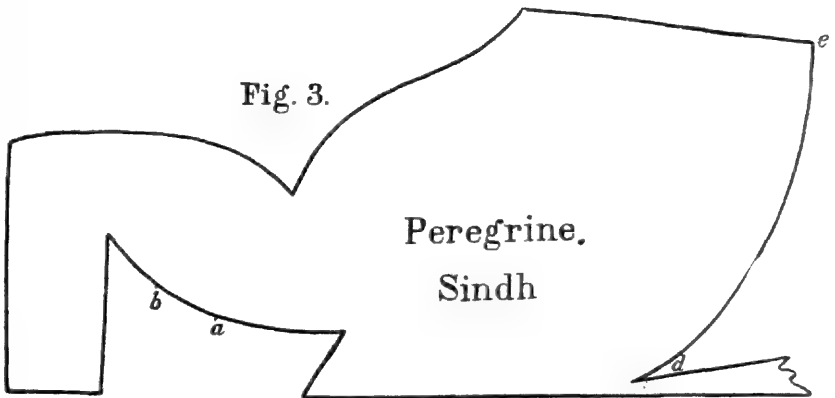


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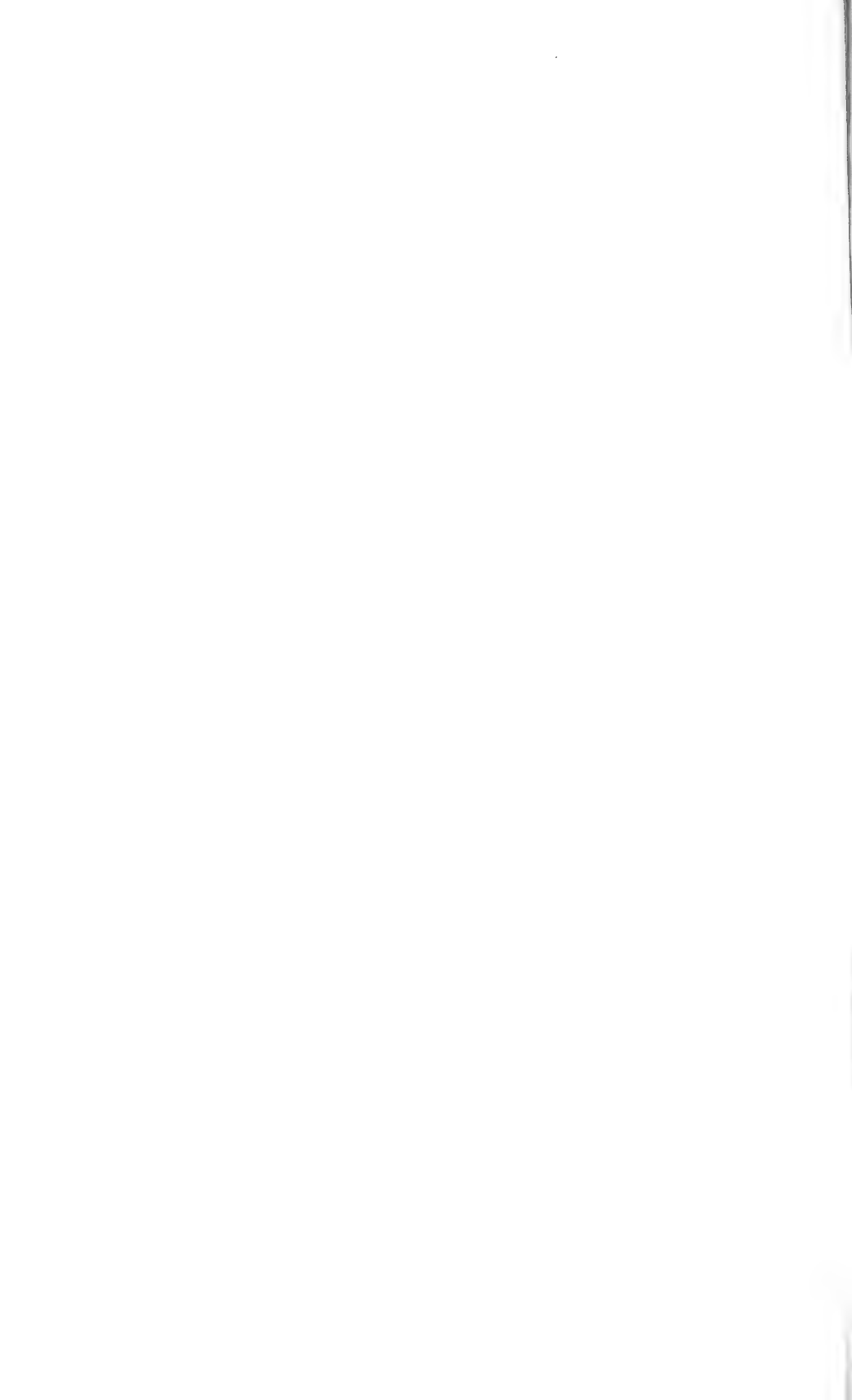


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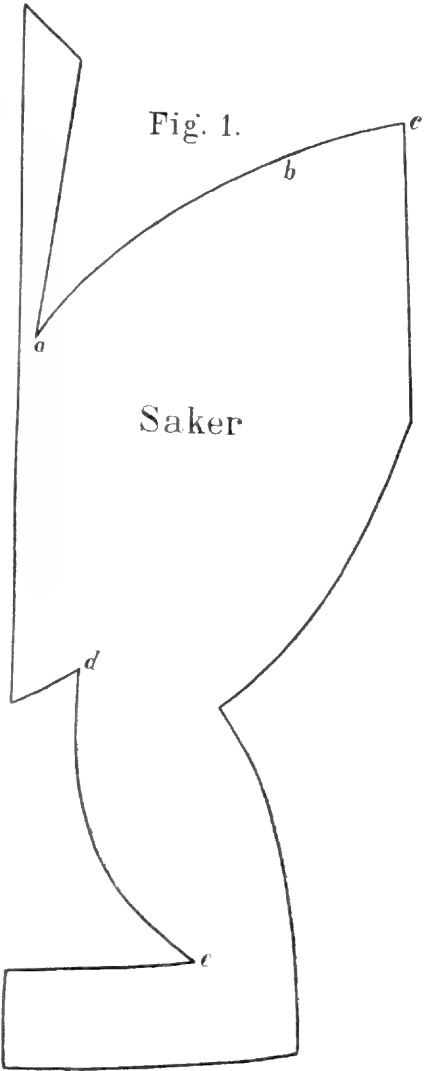


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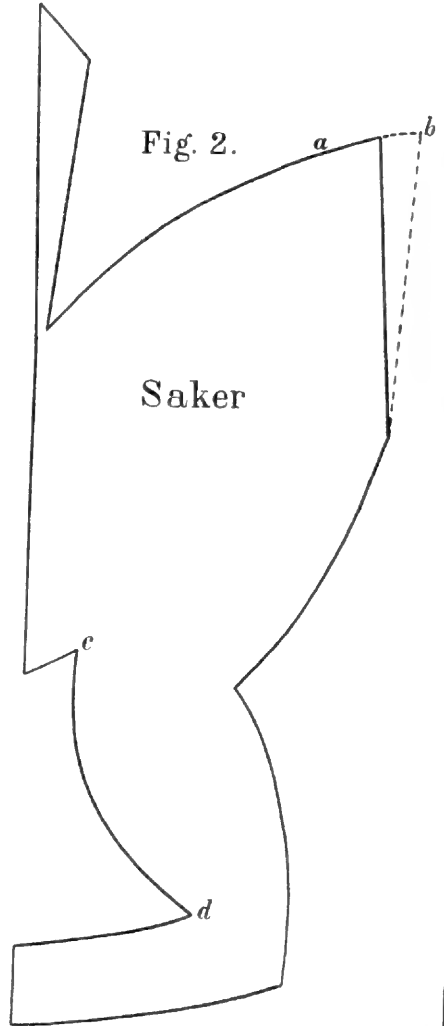
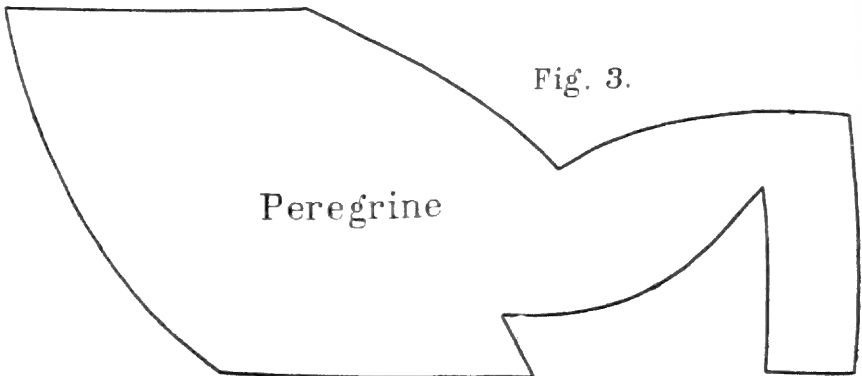
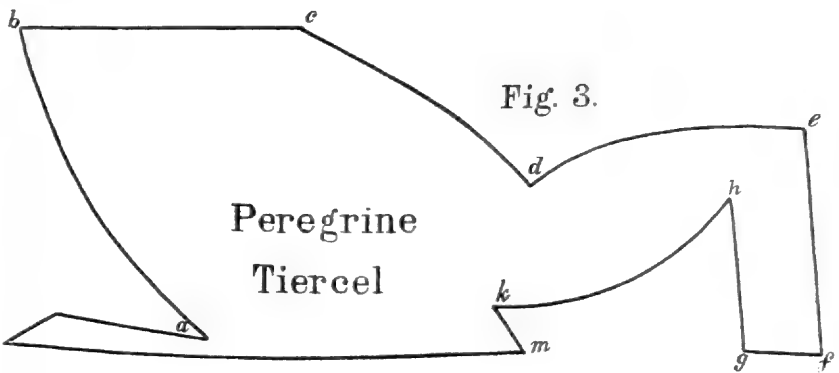
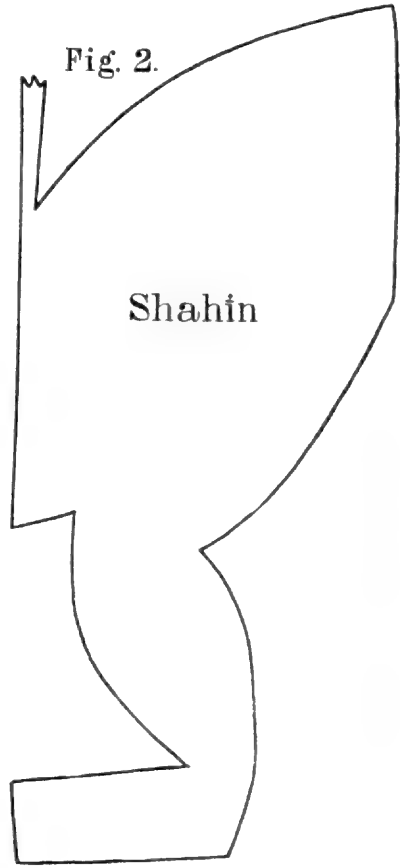
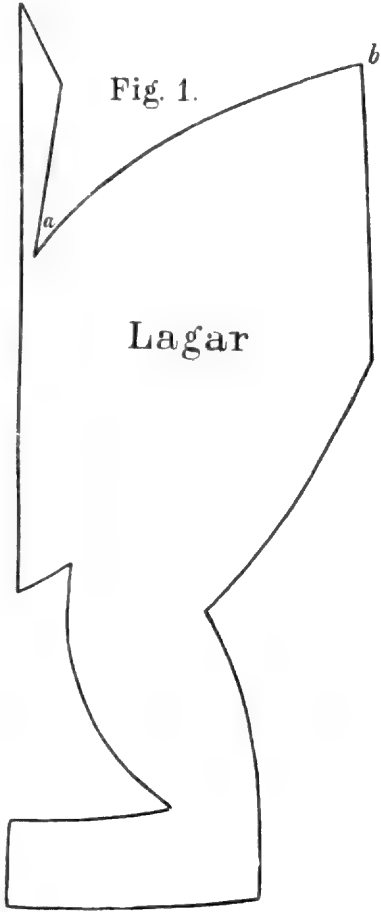


Fig. 3.









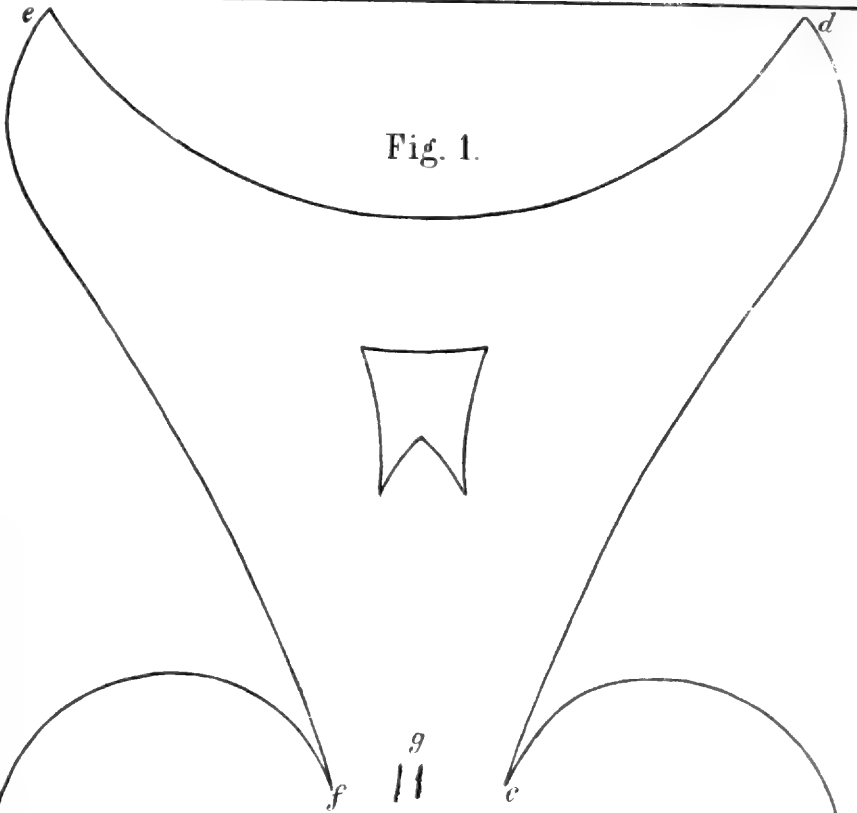


Fig. 1.

Peregrine or Saker.
Persian gulf

a b

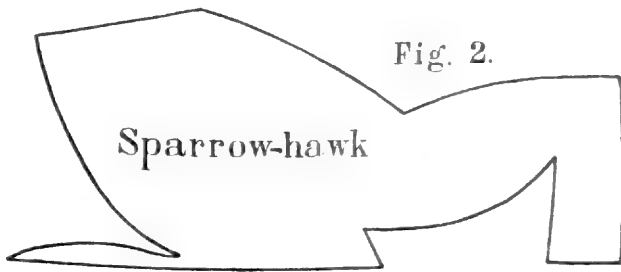


Fig. 2.

Sparrow-hawk

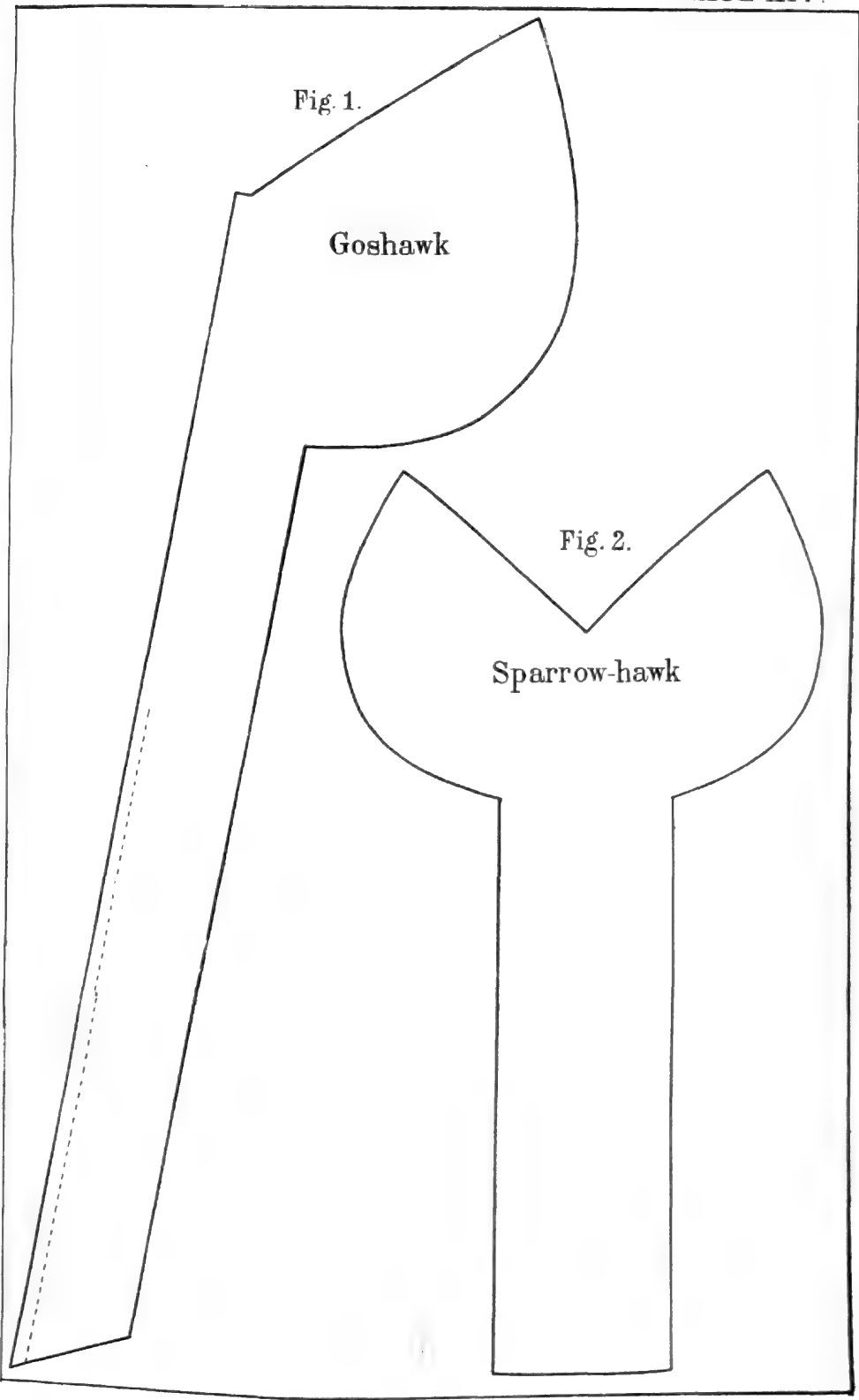


Fig. 1.

Goshawk

Fig. 2.

Sparrow-hawk





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27. Lakshmee Puja.

By PANDIT YOGESA CHANDRA SHASTRI-SAMKHYARATNA-
VEDATIRTHA.

The word Lakshmee is derived from the root Lakshi, to see.

Etymological meaning,
synonyms and attributes
of Lakshmee.

पाणिनिः, उणा २।१६० :
अमरकोशः ॥

Its etymological meaning is—one who looks upon, *i.e.*, helps an industrious and persevering man. Its synonyms are—Haripriya (wife of Vishnu), Lokamata (mother of the Universe), Sree (wealth and beauty), Padmalaya (one whose abode is the lotus), etc. She, being believed to be the wife of Vishnu and the predominating deity of wealth and beauty, is worshipped by every Hindu householder of India. When Lakshmee is propitious, her devotee gets all sorts of prosperity.

Once upon a time Indra, the king of heaven, being cursed by

Origin of her worship.

ब्रह्मवैवर्ते, प्रकृतिखण्डे
२५।२६ अध्यायौ, तत्रैव
गणेशखण्डे च । गारुडैवापि
१२४ अध्यायः ।

Durbasha, a Rishi, was forsaken by Lakshmee, and, therefore, he lost all his prosperity. The other gods and goddesses shared the same fate with Indra. Afterwards they went to Baikuntha, the abode of Vishnu, and worshipped Lakshmee, by which act they recovered their former prosperous condition. Hence the introduction of her worship in heaven. Manu, the son of Brahma and progenitor of mankind, having heard from Indra of the blessings he had obtained from the worship of Lakshmee, introduced her worship on earth.

Lakshmee is worshipped by Hindus in two forms. The first

The forms of Lakshmee—
drawings and paintings.

Vide लक्ष्मीचरित्रम् ।

is by preparing a female figure consisting of two hands and feet. The colour of the figure is yellow. Seated on a lotus she holds a lotus in each of her hands. She wears a red cloth and various kinds of ornaments.¹ The second form of her worship is a basket full of paddy, upon which a half-opened cocoanut is placed, and on the right side of this cocoanut there is placed a shell filled with water

¹ This form being a Pauranika one, is worshipped by the Hindu householders of all parts of India when they have a mind to do so, without distinction of caste or sub-caste. But it is sometimes substituted by an earthen jar filled up with water, and having a small mango-branch and a cocoanut on it, in the Presidencies of Madras and Bombay and also in the several places of upper Assam. It is strange enough to note that a ceremony similar to that of Lakshmeepuja is solemnized by the Persis in the month of Kartic (October).

and containing a hibiscus flower. On the left of the cocoanut is placed a small cylindrical vessel made of the outer covering of a plantain tree. Besides these, there are placed on the basket some small shells, cowries, and small chariot-shaped wooden boxes. The whole thing is covered with a red cloth. This basket is kept upon a wooden seat having a lotus drawn upon it.¹ Besides several kinds of creepers, footprints of Lakshmee, owls, etc., are painted on the floor of the house where Lakshmee is worshipped.

The materials required for the worship of Lakshmee are—a seat made of *kusla* grass, a candlestick,

The materials required for her worship.

a shell, a bell, an incense-pot, various kinds of flowers, rice, yellow-myrobalam, sesamum-seed, *bet*-leaf, lotus.

sandal, *ghee*, various sorts of roasted paddy, milk, sugar, sugarcane, cowries, various kind of fruits and eatables, betel-leaves, and betel-nuts, etc.

Lakshmee is to be generally worshipped by the housewife of a household; but in the event of her inability to offer worship personally, the ceremony is to be performed by the priest of the house. This takes place on Thursday of the first half of the lunar months of Pousha (January), Chaitra (March), and Bhadra (August) of every year when harvests are gathered: and especially on the full-moon day of the month of Aswin (September) and the new-moon day of Kartic (October). Besides these, she should not be worshipped in any other month or on any other day. Her worship should be solemnized in the evening, not in the afternoon nor at night.

The person by whom Lakshmee is to be worshipped and the time of her worship.

Vide कन्दपुराणम् and *कालचन्द्रिका*।

Those who offend their parents, preceptor and friends; who speak falsehood and ignore the existence of God and who do not believe in the transmigration of the soul; who are ingrates and traitors; who give false evidence; who are cowards and misers; who are quarrelsome and have got terma-gant wives; who are sellers of the Vedas, and sell their daughters, *i.e.*, who take money from the bridegrooms of their daughters; who are dirty and whose laughter and mode of eating bring hatred upon them; who are malicious and who obstruct the marriage of others through jealousy; who revoke the religious and Brahmanical endowments or impose tax upon them; who are proud and self-sufficient; who sleep when the sun rises or sets; who through miserly habits do not maintain their parents, wives or helpless sisters; and who look

The persons whom Lakshmee deserts and with whom she lives.

Vide मरुतपुराणम्।
मार्कण्डेयपुराणम्।

who are quarrelsome and have got terma-gant wives; who are sellers of the Vedas, and sell their daughters, *i.e.*, who take money from the bridegrooms of their daughters; who are dirty and whose laughter and mode of eating bring hatred upon them; who are malicious and who obstruct the marriage of others through jealousy; who revoke the religious and Brahmanical endowments or impose tax upon them; who are proud and self-sufficient; who sleep when the sun rises or sets; who through miserly habits do not maintain their parents, wives or helpless sisters; and who look

¹ This form is worshipped especially by the Hindu householders of Bengal in substitution of the first form. In Orissa, Central India and Rajputana either of the forms is worshipped.

upon another's wife with amorous eyes. Lakshmee lives with persons who do not possess any of the evil qualities enumerated above.

The worship of Lakshmee generally concludes with the recitation of stories illustrating the good or evil consequences that follow from a regard or disregard of her. The following, which is an abridgement of one of such stories, may perhaps be of interest:—

Once upon a time Lakshmee sent her son Kuvera to her daughter Bhushna to advise her not to forget to hear the story of Lakshmee. Kuvera, having come to Bhushna, asked her to listen to the story of Lakshmee, but she replied that she could not do so as she, through a mistake, had chewed betel that morning.

Tradition :
A story of Lakshmee.

Another day Kuvera went and again asked Bhushna to hear the story of Lakshmee. On that day Bhushna said that she had cooked rice for her children and by some mistake had eaten with them that morning. On a third occasion, Kuvera went again to Bhushna for the same purpose. Bhushna, seeing him and hearing the same request, became so angry that she threw her bracelet at the forehead of Kuvera, thus causing a sore thereon. Before this Kuvera had never been injured by anybody. So, thinking that if his sore were detected by his mother she would surely curse Bhushna and put her to great trouble thereby, he, instead of going to his mother, wandered about here and there during the whole day and went home in the evening. Lakshmee called him and made him sit upon her lap. While examining his body with motherly care, she discovered the sore and asked Kuvera how he got it. Kuvera, apprehending the peril of his sister, said, "Mother, while I was running in the streets, I fell down and got the sore." Hearing this, Lakshmee was very angry with the earth and called her presently and said, "Earth, as you have injured my hitherto uninjured son, I will withdraw your fertility." Earth being afraid said, "Mother, what power have I to injure your uninjured son? I did not do it." Lakshmee suspected that Bhushna had in reality caused the sore and asked Kuvra if Bhushna had done it; but Kuvera denied it, saying that the sore was caused by a fall from a tree. Lakshmee called the tree and asked if it had injured her hitherto uninjured son. The tree was very frightened and pleaded not guilty. Lakshmee then understood that the sore had surely been caused by her daughter, Bhushna, and not by anybody else, inasmuch as she knew well that no one would dare to injure her son.

Thereupon Lakshmee cursed her daughter, Bhushna, in the following words: "Bhushna, whereas you have injured my hitherto uninjured son, Kuvera, you shall lose all your beauty and shall be an eyesore to your husband, the king." After being so cursed Bhushna's beauty disappeared, her ornaments were transformed into iron, and the horses and elephants began to die on being seen by her. Her husband, too, was so displeased with her that he

ordered his servants, Kotoal and Jalhad, to slay her and bring her blood to him, so that he might bathe himself with it.

Jalhad took her into a forest and said: "Queen-mother, I have been brought up by you, so it would be an act of ingratitude on my part if I were to kill you. Moreover, kings are fickle-minded and act according to the advice of their ministers, without deciding by their own judgment as to whether the advice is good or bad. I know not whether our king will not some day ask me to bring back his queen. So you may go to your father's house. I shall take the blood of dogs and cats to satisfy the king." The Jalhad having said this went away.

The approach of night brought terror to Bhushna, who, being much afraid, took shelter under a banian tree. After some hours there came a huge python to devour Bhushna, but it was turned into ashes by her breath. There lived a pair of Begma and Bagmi birds on that tree. Their young ones asked the mother-bird, "Mother, when will my eyes be opened?" Its mother said, "When the lady, who is now under this tree, will anoint your eyes with the blood of her little finger, then your eye-lids will be opened. But this lady is in great distress; you should also do some good to her." Bhushna heard this and climbed up the tree and anointed with her blood the young one's eye-lids, which thereupon became opened instantly. After this, the bird carried Bhushna on its back to Lakshmee-Kantar (the wilderness of Lakshmee). When they reached the place, the bird bid adieu to her and went away.

There was a large lake in this wilderness with the water of which Narayana, the father of Bhushna and husband of Lakshmee, used to bathe. So the maid-servants of Narayana came there to fetch water. Bhushna asked them, "Who will bathe with the water you are taking?" They replied, "Narayana."

Bhushna then cleverly put her ring into a jar without the knowledge of the maid-servants. When Narayana was bathing, he found a precious ring in the water and asked the maid-servants whose ring that was. They could not give any satisfactory reply, but only said that when they were bringing water, they found an ugly woman on the bank of the lake; she might have put this unseen by them. After hearing this Narayana went to the lake and found that his daughter Bhushna was weeping there. He understood everything and instructed her to cry loudly, uttering the names of her father and mother. He came back and finished his bath. While going to his breakfast he heard the crying, and asked Lakshmee who was crying. Lakshmee knew that her daughter was crying, but suppressing the fact she said, "Somebody in distress is crying." But Narayana said: "Perhaps the mourner might be a near relation of ours, as your and my names are being uttered. Perhaps my beloved daughter Bhushna is in distress." Hearing this Lakshmee said: "When a man becomes old, he becomes mad, and such is the case with you; otherwise you could not think that my daughter is in distress, as she is the queen of a king. Old fool, mind your own business, take your food and take no more notice of the cry." Narayana said that he could not eat un-

[N.S.]

less he ascertained who was crying. He went to the spot and brought Bhushna home, and asked Lakshmee to cast a kindly look on her daughter. Lakshmee was obliged to be favourable to Bhushna, which removed all her calamities.

A few days after Bhushna was called back by her husband, the king, and again lived with him a happy life. From that time she never forgot to listen to the story of Lakshmee.¹

¹ These kinds of stories are listened in Bengal only. But in all other parts of India similar stories are listened at the end of the Lakshmeepuja in their respective languages.



28. **Two Tibetan charms obtained by Lieutenant-Colonel Stuart H. Godfrey in Ladakh, one for chasing away evil spirits and the other for compelling fortune.**

By MAHĀMAHOPĀDHYĀYA SATIS CHANDRA VIDYABHUSANA, M.A., PH.D.

A few weeks ago Lieut.-Colonel S. H. Godfrey, Political Agent, Dir, Swat and Chitral, sent to the Indian Museum two Tibetan charms obtained by him in Ladakh: they were put into my hands by Mr. I. H. Burkill for examination. One of the inscriptions appears to be a charm against demons called "Sruñ-de"; the other, called "Luñ-ta," is used both as a flag and for personal wear.

The first inscription contains the picture of a devil who is being coerced. She is shackled at the feet and arms by chains, and has an iron plate over the bosom. The inscription is in Tibetan character, but the language used is a corrupt form of Sanskrit with an occasional admixture of Tibetan expressions. An English translation of the inscription is given below:—

TRANSLATION OF INSCRIPTION I. (Fig. 1.)

- [On the top]—Let there be refuge in the Saviour Mother.
 [At the ears]—Noise of thunder.
 [On the bosom]—O Governess of the three worlds, come hither to grant us boons; thou art coerced, fulfil our desires. Fettered!
 [Between the legs]—Thunder! Thunder!
 [Below the feet]—Protect! Protect! Hail!
 [On the right side]—In all times let black spirits and red devils hide.
 [On the left side]—In the region of the living save us from injury by demons. Fettered!

According to Colonel Godfrey the charm is used to deliver a man from the enmity of another and from evil spirits including madness. He reports that the writing in the centre, locally unintelligible, is believed to have come from China.

The second inscription contains the picture of a Luñ-ta, that is, an aerial horse of fortune. It is also called a gem-carrying horse, for it carries a jewel called *nor-bu* on its back. Its figure is often hoisted upon a tall post by the side of a dwelling-house. It corresponds exactly to the Long-Horse or Horse-Dragon of China, which is there a symbol of grandeur. In India and Burmah there is nothing which is an exact counterpart of the Luñ-ta.

The inscription is in Tibetan character and the language used is Tibetan, with the exception of a few Sanskrit words at the

beginning. An English translation of the inscription is given below :—

TRANSLATION OF INSCRIPTION II. (Fig. 2.)

Om-ā-hūm. Hail! Vajra-guru Padma-siddhi.

O Tārā, save us, I invoke thee. Om-ā-hūm.

Ho-He. Tiger, lion, Garuḍa and dragon! be propitious here.

Be ye all assembled!

Let age, body, might, fortune, life, merit and wealth prosper during the year.

Om! Offering to the Supratiṣṭha-Vajra.

Victory to the gods!

Colonel Godfrey says that the charm is believed to free a man from illness: "Illness will leave a man like a horse galloping, if the charm be bound on to him; like *yarki-tusol*, the waxing moon, a man will improve, who wears this; and an unfortunate man hoists it as a flag on a hill to bring fortune to him."



Fig. 1



Fig. 2.

29. The Date of the Salimi Coins.

By H. BEVERIDGE.

Dr. Taylor in the Numismatic Supplement to the Journ. Asiat. Soc. Beng. for 1904, p. 68, thinks that the Salimi coins cannot have been issued during the reign of Akbar, as Jehangir never was governor of Gujarat, and as his rebellion did not extend to Ahmadabad. The first of these propositions is probably technically correct, for it does not appear that Prince Salim was ever formally made governor of Gujarat. But it also seems certain that in the last year of his father's reign he had large interests in the province of Gujarat, and it may very well have issued coins there in his own name. We are told in the *Mirāt Ahmadi*, p. 193 of the Bombay lithograph, that Salim, in the year 1011 (1602-03), received a grant of a lakh of rupees out of the collections of the port of Cambay; and the *Maaṣir-i-Umarā*, in the notice of Farid Bokhāri, Vol. II, p. 636, says that during Akbar's last illness he requested Salim to confine himself to his house, outside of the citadel, as his servants had gone off to Gujarat (a name which often means Ahmadabad) *which had been recently given to him in fief (ṭiyūl)*.

The ostensible motive for this request was to protect Salim from being assaulted by the partizans of *Khusrau*, but the appointment looks as if Akbar had wished to banish Salim to a distant province, in the interests of Sultan *Khusrau*. His descendant Aurangzeb acted in a similar manner when he sent away, when he was dying, his son A'zam Shāh to Malwa lest he should interfere with *Kām Bakhsh*. It is true that Azizkoka was nominally governor of Gujarat at the time of Akbar's death, but for years he had been in personal attendance on the emperor, and perhaps the authority of his son Mirzā Shamsi, *alias* Jehangir Qulī *Khan*, was confined to Jūnagarh and the northern part of Gujarat. At all events he seems to have been a special partizan of Prince Salim, for the title of Jehangir Qulī, which Jehangir gave on the third year of his reign, appears to imply this.

It seems to me exceedingly improbable that Jehangir would, after his accession, use the name Salim on his coins; and it is still more unlikely that he would use the regnal year of his father (50) on his coins. I therefore incline to the view of the British Museum Catalogue that the Salimi coins were issued during Akbar's lifetime. They were issued either because the Prince was *de facto* governor of Gujarat, or because he was a rebel. I note with reference to p. 71 of Dr. Taylor's article that Jehangir ascended the throne on the 20th and not the 8th Jumāda II. Akbar did not die till the 10th of that month.



30. Note on the Peregrine Falcon (*Falco peregrinus*).

By LIEUT.-COLONEL D. C. PHILLOTT, *Secretary,*
Board of Examiners.

In India the female is called *bahri*, and the male *bahri bachcha*; but by the Persians and Arabs both the *shāhin* and the peregrine are called *shāhin*. In Baghdad the female peregrine is called *shāhīna*, more rarely *bahriyah*.

The heaviest weights recorded by me are those of one young female caught at Kamāl Kheyli, near Kohat, on the 21st October, 1897, which weighed 2 lbs. 7 oz.; and of another young female, which weighed on the 12th May of the same year, after being set down to moult, 2 lbs. 7½ oz. A very fine-looking haggard, caught at Dera Ghazi Khan on the 25th March, 1899, weighed only 2 lbs. 4½ oz.

The number of scutellæ on the middle toe of a female—scutellæ that quite cross the toe—is ordinarily 17 or 18. Very rarely is it 22. The number of these scales, however, is no indication of the length of the toe, as the scales in different individuals vary very much in size.

The peregrines enter India with the duck, and in the Panjab are usually caught on the banks of the rivers by means of a *bārak* of either a lagar or a *shāhin tiercel*. A bird-catcher told me that he once caught a peregrine tiercel with a red-headed merlin as a *bārak*. Hawk-catchers state that the peregrines entering India are single, not paired. I have been told, too, that an old bird sometimes conducts her young brood; and hawk-catchers have assured me that they have occasionally caught young birds with bits of down still adhering to the feather tips.

The earliest date of capture recorded by me is the 22nd September, 1898, when I heard that a young female had been caught a few days previously. On the 27th of the same month a second female was caught at Nowshera. The earliest date on which I actually observed a wild peregrine was 4th October, 1891, at Dera Ismail Khan.

In 1896, a dry year, only one young peregrine was caught in Peshawar, two in Chhach-Hazara, four in Jallandhar and twenty-one at Gurgaon.

In the plain of Gandi Umr Khan near Dera Ismail Khan, *chagh*-catchers say that they catch on an average five peregrine 'tiercels' a year, but never 'falcons.' In 1895, however, one 'falcon' was caught there.

Peregrines migrate out of India later than *chaghs*. Some Chhach falconers maintain that the haggards leave first, and that the young birds follow, making their exit with the quail. On the 10th April, 1897, the peregrines were passing back through the Bannu District, on the return migration.

Some haggards, at any rate, pair before leaving India. On the 4th April, 1896, a pair were seen to hawk and kill a small bird in Jhelum. On the 18th, Lieut-Colonel S. Biddulph caught a young falcon. On the 28th April, 1897, a young falcon was reported to me in Chhach as having been seen that day. Most of the peregrines, it was said, had passed over. There were then, still, a good many duck and quail about, and also an old heron or two. A young 'falcon,' caught a day or two before, had yellow feet, and had renewed a few of the small feathers on the back, breast and thighs.

Hawks caught on the return migration are styled by falconers *nau-rozi*.¹

In a wild state, peregrines prey chiefly on duck, pigeons, quail, small birds, and Indian crows. Like many other hawks they will, in the dusk, kill bats; but bat's flesh is not palatable to them. They will also eat locusts.² In the locust year of 1891 very few young peregrines had been caught by the 19th November. None were caught at Lakhi in the Bannu District; two only were caught in Chhach Hazara, two in Jallandhar, while there were only two for sale at the Amritsar Diwali Fair. An extraordinarily large number of saker falcons was caught that year.³

Whether hawks do or do not act as "Nature's Police" is a moot point. They do, however, when they have a choice, select the bird of weakest flight. This does not mean that they select the bird that is nearest to them, nor even the bird that is best placed for a stoop. If several houbara get up one after another, a hawk will waver, and perhaps change its objective more than once. It will forsake, greatly to the disgust of the falconer, a fine cock houbara that is quite close, and perhaps go after an unseen bird two or three hundred yards off. When such is the case, it will always be found that the bird last selected is small or weakly. The reverse never happens. This peculiarity is more marked in haggards than in young hawks. Wild birds, hunters or hunted, are marvellous judges of pace. A hawk always knows a bagged bird even if the bagman is released first and the hawk unhooded afterwards. A peregrine quickly learns the vice of flying at only bagged birds and of 'refusing' wild quarry.

Some young peregrines seem to injure the breast-bone when stooping, perhaps by grazing it along the ground. I had a trained bird that did so twice, on each occasion out of sight; and I twice caught young birds that had been so injured, and had a scab all along the breast-bone. The second bird was caught in a curious manner. On the 9th April it killed a crow in the Infantry lines at Dera Ghazi Khan and was deprived of its quarry by a sepoy. In half an hour or so it killed another crow in the lines,

¹ Adjective from *Nau-roz*, the Persian New Year's Day, corresponding to the 21st March.

² The writer had a haggard that used to eat earthworms.

³ *Vide* Journal of the Asiatic Society of Bengal, Vol. III, No. 3, of 1907, p. 186.

[N.S.]

when a Pathan sepoy, stalking it round the corner of a building, cast a blanket over it. The bird was, with the exception of the scab on its breast, healthy and well, but rather thin.

Peregrines return year after year to the same spot. In 1886 a peregrine could be seen late every evening high over Jallandhar City chasing the pigeons. Pigeon-fanciers said it had been their bane for years, and a big reward was offered for its capture. Several years later it was still in its old haunt.

Another bird used to roost in a palm-tree at the edge of the Indus, near Dera Ghazi Khan. One year the bridge of boats started from this very tree, and a boat, its mast level with the tree-top, was actually tied to the trunk of this palm near the top. The falcon, however, was quite unconcerned and did not desert her roosting place. Another peregrine was discovered by Lieut.-Col. Biddulph roosting under the eaves of a bungalow in Dera Ismail Khan Cantonment not more than eight feet from the ground. Peregrines are unfortunately slow moulters. I twice caught fine healthy haggards at Christmas that were not clean moulted, their first flight-feather being only three parts grown. Peregrines rarely commence moulting before the rains, whereas *charghs* commence in April. I had a haggard *chargh* that on a 20th September had, of its old coat, only a few small feathers of the breast remaining. Mitchell, in his "Art and Practice of Falconry," quoting John Barr, states that the latter moulted a peregrine in an exceedingly short space of time by feeding her on the heads, necks and pinions of fat ducks, and by keeping her under a small tented shelter upon which the sun beat down with force: and that the feathers nourished by the fat were broader and stronger and grew faster than in any other instance. For the same reason Indians mix butter with a moulting hawk's food, and in a short time hawks will learn to eat a big pat of butter, plain. I have more than once tried mixing the yolk of egg with a moulting hawk's food, but am of opinion that the egg makes the feather dry and brittle.

The best working weight for any peregrine falcon is 2 lbs., and at this weight she should be kept when flying. If any first class and fully trained peregrine, belonging to any falconer, be weighed, it will be found, that whether the bird be large or medium-sized, her weight will approximate this weight closely, *i.e.*, within less than an ounce. I had a young peregrine that, weighing 2 lbs. 3 oz., would kill houbara, and 2 lbs. 2 oz., heron; but at this weight she would never even try a second flight. I reduced her weight after some time to 2 lbs. and found she would kill several houbara in a morning. She, also, at this weight took to chasing pigeons when being exercised at the lure, though at the higher weights she had ignored them. I then brought her up again to the weights first mentioned, with the same results. When intermewed she still worked best at 2 lbs.¹

¹ An experienced falconer knows the condition of his hawk by simply passing his fingers over breast and muscles under the wings, for his fingers

Either the 'haggard' or the young passage-falcon can be trained to both large and small quarry, but the former is harder to keep in condition and seldom loses her wildness completely, *i.e.*, she is inclined to become wild when on the wing. There is no hawk of any kind, young or old, that cannot be thoroughly tamed or flown at quarry of some sort, but the question is, is she worth the trouble. Some hawks, on the other hand, seem to train themselves.

Peregrines should be trained and entered to wild quarry as soon as possible, while the 'first hunger' is still on them. If a hawk has been simply exercised at the lure for a long time and not flown at wild quarry, she may be quite spoilt,¹ and it may be no easy matter to get her to kill even teal. She will have lost her decision and will stoop too late. When the first hunger is on them, peregrines may easily be entered to large quarry, in fact I believe that any young falcon and most haggards can be made to heron at this stage if properly entered; but they will not all make good heron-hawks, not because the flesh of the heron is unpalatable to them, but because they soon learn that the heron is a dangerous quarry, and that on the ground they cannot make sure of avoiding its spear-like beak and needle-claws. In the air a hawk can safely knock a heron about by stooping at the point of the shoulder, a fact well depicted in one of Lodge's pictures. A peregrine can with ease be fully trained to fly out of the hood (but not to 'wait on') in three weeks. On a 4th November two peregrines were brought to me with sealed eyes.² The first killed a wild houbara on the 19th of the same month, having in that time been thoroughly trained to the lure, given two trains of fowls, a flying train of night-heron, and one of houbara.³ The second, trained in the same way, killed on the 21st. Both hawks killed heron⁴ and houbara well. On the other hand unduly hurrying the early training to the lure is fatal, for if a hawk is put on the wing before she is fit and keen, she will fly and stoop in a slack manner: this will become a confirmed habit and it will then be impossible to give her the requisite amount of exercise at a *dead* lure. It is, of course, understood that, if peregrines are trained to the ordinary dead lure, they must be given nothing on it but fresh palatable birds. Mitchell, probably writing from hearsay, states that in some oriental countries peregrines are commonly flown at hares; but this is, I think, a mistake. A peregrine's flight-feathers are too stiff and brittle for such a flight. The Lagar, an Indian falcon that somewhat resembles the peregrine in

are educated. A *beginner*, however, will learn a good deal by weighing his hawks frequently. To catch, train, and enter hawks to quarry is no difficult matter: to keep them in the best flying condition *is*.

¹ These remarks do not apply to sakers intended for houbara.

² Even sitting on a perch with 'sealed' eyes has a certain taming effect, and so too the 'carriage' on the journey. Hawks that have been caught some days have, at least, learnt to feed on the fist.

³ She weighed then, as stated above, 2 lbs.

⁴ It is very rare that two falcons are flown at a heron in India.

size and appearance, is commonly flown at hare. I have known even experienced falconers to mistake a lagar on the wing for a peregrine.

All hawks should be trained as fat as possible. If trained and entered thin, especially if they have been kept thin any time, they will, when brought up into condition, take to 'soaring' in the jungle, or will misbehave in other ways. If a freshly-caught hawk reaches you thin, no great harm may be done if she is not allowed to remain thin. Gradually but quickly she should be raised in condition, being made to know the lure and jump to it the while; but she should on no account be put on the wing till she is in high condition and keen. Young passage-hawks can easily be taught to 'wait on' if kept in low condition, but this, I think, lowers their pitch; and certainly hawks that have been kept in low condition can rarely be flown in high condition. There is, however, no difficulty or danger in teaching an 'inter-mewed' hawk to 'wait on.'

If a peregrine has not been flown at large quarry for some time, it is as well she should be extra keen for the first flight. Perhaps you have an excellent young peregrine that has killed, say only one or two houbara, and for some reason you have not been able to fly her for a fortnight. If she is now not extra keen, she will, at her first flight, follow the houbara perhaps for miles, hesitating to close and turn it. There is every chance of her getting lost. In the Introduction, page viii, to "*A Sporting Turn*" by Colonel T. Thornton, it is stated that, ". . . occasionally flew his hawks at bustards, the apparent slowness of that bird, when seen at a distance, tempting him to the trial, but the hawks had no chance. (*Birds of Wiltshire*, page 345)." Now it could not have been that the peregrines were outpaced, but they naturally hesitated to close with such a powerful quarry as a big bustard. Some hawks require to be skilfully entered by trains to even houbara, which on the ground puff themselves out and look formidable, and do not hesitate to charge an uncertain hawk. Even steady and tried old duck-hawks, if not flown at wild quarry for some time, will, on the first day, be successful in only easy ground: they will continually miss opportunities.

Freeman, in his "*Practical Falconry*," writes:—"I do not know how it is, but I have almost always found that good fresh beefsteak—which must be exceedingly nourishing—gives hawks which were fed on it yesterday an appetite to-day. *Hot* birds, i.e., birds just killed—though excellent, do not seem to me to give such an appetite as beef does." Even the wretched butcher's meat of India, *boti* as Panjab falconers call it, gives a better appetite than hot birds, but it is quite unsuitable for any hawks but *lagars* and *charghs*, and only occasionally for these. It makes the mutes green, a distressing sight to a falconer. Hawks cannot be kept in good condition except by being fed on fresh birds, pigeons and doves for choice. If the beginner feeds on one kind of bird only he will be able to judge the exact amount of food necessary.

Whether the hawk is fed twice a day according to the

Eastern, or once a day according to the Western custom, is merely a personal matter, for the amount of food given in the twenty-four hours should be the same.

The morning is the best time for hawking, so if the falconer can manage to fly his hawks in the morning, well and good; let them be fed once a day, and in the morning. When, however, beating all day for houbara in the desert where it is not always possible to have houbara marked down, or if the falconer wishes to fly his hawks twice a day at houbara marked down for him, he should feed twice a day. When the nights are long and the days short, the evening meal is larger and the morning meal smaller. As already stated, the best food for hawks is pigeon or dove flesh. As a make-shift, crows¹ may be given. The difference between feeding a hawk on crows and pigeons is the difference between feeding a pony on gram and oats. Indian falconers style all the flesh of one wing and one side of the breast of a bird, a *baghl*. A trained hawk, *chargh* or peregrine, should, on an average, get as a morning meal the two *baghl* of a crow, and as an evening meal the two *baghl* and the two thighs. The heart, lungs, and gall-bladder can be given. A third or more of each meal can be given fresh and warm on the lure, and two-thirds wetted, *i.e.*, while the hawk is pulling on the fist, well-water or water with the chill off, should be continually dabbed on the meat with the left hand. Indian falconers, through laziness, cut up the meat and add water to it, giving it to the hawks as wet as possible. Hawks, however, should get as much pulling-exercise ('tiring') as possible. A casting of wetted feathers and a sprinkling of clean river gravel, the grains about the size of a pin's head, should be given after the evening meal; and occasionally when the weather is very cold, two or three seeds of the large cardamoms may be concealed in the 'casting.' The ordinary daily feed of a hawk in flying condition is therefore about as much flesh as there is on one-and-a-half to one-and-three-quarters of a crow. It will be found that the weight of the morning meal is a little more than $3\frac{1}{2}$ tolas (about $1\frac{1}{2}$ oz.) and of the evening about 6 tolas. [Mitchell mentions that the daily allowance for a peregrine falcon is about a third of a pound of beef.] Natives are fond of giving goat's heart, with the skin and fibre removed. If goat's heart is given, about a third more than the above quantity should be given; but, as already stated, even to a *chargh* or *lagar*, butcher's meat should rarely be given, and to a peregrine never.

If a hawk has been accustomed to be fed twice a day, it should not be allowed to go too long in the morning without food, or it will feel faint. If not fed as usual before noon, it will certainly lose a little condition. The hawk that is to be flown last may get a very light meal, with water, in the morning, before starting to beat for houbara, one or two hawks being kept unfed for the early flights.

¹ In Scotland the peregrine is said to prey largely on carrion-crows and magpies.

[N.S.]

In India, lost hawks have considerable difficulty in feeding themselves, as there is seldom enough breeze to deaden the sound of the bell. English falconers tell me that, on Salisbury plain, the reverse is the case.



31. Notes on the Geography of Old Bengal.

By MONMOHAN CHAKRAVARTI, M.A., B.L., M.R.A.S.

The Geography of Old Bengal has been discussed in several papers, notably by Mr. Pargiter for the Hindu period, and by Messrs. Blochmann and Beames for the Mussalman period.¹ Still the field is not exhausted, and an immense amount of spade-work yet remains to be done. The present paper has been written with the object of drawing attention to the subject, which must be interesting to all residents of Bengal.

I. PUṆDRAS, PUṆDRA-VARDDHANA.

This paper is confined to the Bengali-speaking tract, otherwise one might have begun with the Aṅgas, who are generally grouped with the Bengal tribes in the epics, and who formed the easternmost tribe known to the Aryans in the time of *Atharva-saṁhitā*.²

The Puṅdras, if not so old as Aṅgas, must still be placed in a remote period. In the *Aitareya-brāhmaṇa*, while narrating the legend of

Puṅdras: (a) Vedic period.

Śunahṣepa, it is said that he was offered the right of pre-mogeniture by Viśvāmitra. Of the latter's hundred sons, the fifty elder ones were not pleased at this, on which they were cursed by their father to have the lowest castes for their descendants. "Therefore are many of the most degraded classes of men, the rabble for the most part, such as the *Andhras*, *Puṅdras*, *Sabaras*, *Pulindas* and *Mūṭibas*, descendants of Viśvāmitra."³ The same legend is repeated in the *Śāṅkhyāyana-śrauta-sūtra*, with the names modified to *Andhrāḥ Puṅdrāḥ Sabarā Mucipā iti*.⁴ The *Aitareya* is one of the oldest Brāhmaṇas and is much older than the Upaniṣads, the earliest of which extended over a period of 1000 or 800 to 500 B.C. according to Professor Deussen.⁵ Consequently.

¹ F. E. Pargiter, *Ancient Countries in Eastern India*, J.A.S.B., 1897, Part I, pp. 85-112; H. Blochmann, *Geographical and Historical Notes on the Burdwan and Presidency Divisions, Bengal, Appendix to the Statistical Account of Bengal*, vol. I; and *Contributions to the Geography and History of Bengal*, Part I, J.A.S.B., 1873, Part I, pp. 209-310; Part II, 1874, p. 280. *et seq.*; Part III, 1875, p. 275 *et seq.*; John Beames, *Notes on Akbar's Subahs*, J.R.A.S., 1896, pp. 83-136.

² *Gandhāribhyo Mūjavadbhyo = 'ṅgebhyo Magadhebhyoḥ | Praiṣṭyan janān = iva śevadhīm takmānāṁ paridadmasi ||*

Transl.:—In the Gandhāris, the Mūjavantas, the Aṅgas, and the Magadhas, we deliver over the *takman* (fever) like a servant, like a treasure. *Atharva-saṁhitā*, *Kāṇḍa V, Anuvāka 5*, verse 14.

³ *Ait. Brāhmaṇa*, Bk. VII. 18; Haug's translation, pp. 469-470.

⁴ Ch. XV, 26 (Bib. Ind. Ed., p. 695).

⁵ Deussen, *Philosophy of the Upaniṣads*, Eng. transl., p. 51.

before 1000 B.C., the Puṇḍras had been known to the Aryans, and located in East India evidently beyond the Aṅgas.

The statement that the Puṇḍras were descendants of the sage Viśvāmitra would seem to imply that they had Aryan blood, though degraded;

(b) **Epic period.** and this opinion survived in the epic period. In the *Mahābhārata* and *Harivaṃśa*,¹ the Puṇḍras with Aṅgas, Vaṅgas, Suhmas and Kaliṅgas are said to be descended from the blind sage Dirghatamas (born of the queen of the demon Bali). As to their degradation the MBh. says that these Kṣattriyas were outcasted from indignation of the Brāhmanas; while according to the *Manu-saṃhitā* they sank gradually to the condition of Śudras in consequence of the omission of sacred rites and for not consulting Brāhmanas.² The Puṇḍras were evidently too powerful to be left out of the Aryan pale, but had rites and customs so different from those in Kuru-Pāñcālas, the home of Vedic Brāhmanism, that a theory of degradation was set up. The difference originated no doubt from the fact that the twice-born castes among the Puṇḍras represented an older immigration, who had been influenced in one direction by the surrounding tribes of *dasyus*, while the religious faith in the Madhyadesa had been changing in quite a different direction.

In the epic period, the tribe was generally named Puṇḍra; but variations were used as Puṇḍraka, Pauṇḍra, Pauṇḍraka, and in one instance even Pauṇḍrika.³ The forms Puṇḍra and Pauṇḍra are found so late as Varāhamihira's *Bṛhat-saṃhitā* of the sixth century A.D., *Daśa-kumāra-carita* probably of that century, and

¹ *Mahābhārata*, Ādi-parvva, Ch. CIV, 52-55; *Harivaṃśa*, *Harivaṃśa-parvva*, Ch. XXXI. 33-42. I quote from the Baṅgabāsi Editions, reprints of the Bombay Texts with the commentaries of Nilakaṅṭha, unless otherwise specified.

² *Manu-saṃhitā* X, 44; MBh., Anuśāsana-parvva, XXXV, 18.

³ The various references may be thus classified:—

Puṇḍra—*Mahābhāṣya*, under Pāṇini IV. 2. 52; *Aṅgānām Viśaye-ṅgāh* | *Vaṅgāh Suhmāh Puṇḍrāh*, || Kielhorn's Ed. II, 282. *Rāmāyana*, Kiśkindhyākāṇḍa, Ch. XL. 23, XLI, 12. *Mahābhārata*, Ādi-P^o, CIV. 53, 55, CXIII, 29; Sabhā-P^o, XIV, 20, XXX, 22, LII, 16; Bhīṣma-P^o, IX, 51; Karṇa-P^o, VIII, 19, XXII, 2, 14. *Harivaṃśa*, Hariv. P^o, XXXI, 34, Bhaviṣya-parvva, XLVI, 56. *Bṛhat-saṃhitā*, V, 70, IX. 15, X, 14, XI, 58, XVI, 3. *Daśa-kumāra-carita*, ucchāsa III, (^odeśa), p. 125, 126, (N. Sagar Press Ed.). *Viṣṇu-purāṇa*, II, 3, 15; *Mārkaṇḍeya-Purāṇa*, (transl. Bib. Ed.), pp. 325, 327, 329, 331, 334, 358. *Garuda-purāṇa*, LV, 13.

Pauṇḍra.—MBh., Ādi-P^o, CLXXXVII, 16; Vana-P^o, LI, 22; Drona-P^o, IV, 8, X, 15; Anuśāsana-P^o, XXXV, 17. HV., Viṣṇu-P^o, XXXIV, 14, LIX, 4, 53, 68; Bhaviṣya-P^o, XCI, 1, XCII, 1, 7, XCIII, 1, 6, XCVII, 25, CI, 1, 2, 18. Bharata's *Nāṭya-śāstram*, XIII, 32. *Br. saṃ.*, V, 74, 80, XIV, 7. *Garuda-pur.*, LXVIII, 17-8; *Mārka-pur.*, p. 329. *Vāyu-pur.*, (Anandāśrama, Puṇā Ed.) XCIX, 385.

Puṇḍraka.—MBh., Sabhā-P^o, IV, 24, LII, 18. HV., *Harivaṃśa*-P^o, XXXI, 42. *Mārka-pur.* (transl.), p. 329.

Pauṇḍraka—*Manu-saṃ.*, X. 45. MBh., Ādi-P^o. CLXXXVI, 12; Sabhā-P^o, XIV, 20, XXXIV, 11. HV., XCII, 4, XCIII, 20, XCIV, 8 *et seq.* *Viṣṇu-pur.*, V. 34. 4-27; *Bhāgavata-pur.*, X. 66. 1-23.

Pauṇḍrika—MBh., Sabhā-P^o, LII. 16. Cf. *Mārka-pur.*, transl., p. 329.

[N.S.]

the *Purāṇas* generally of uncertain dates but containing much old material.

In the references of the epic period, the Puṇḍras were located in Eastern India. A passage in the *Sabhā-parvva*, Chapter XXX, describing Bhīma's conquests in that part supplies a little more precise details. Bhīma fought with Karna (the king of Aṅga), and after defeating him conquered the hill tribes (20). Then he killed in battle at Modāgiri (its) king (21). Next, subduing the powerful Puṇḍra king Vāsudeva and the king of Kausiki-kaccha, he fell on the Vaṅga king (22-3). After conquering Samudrasena and the king Candrasena, the rulers of Tāmralipta and Karvva (24), he subdued the Sumha king, the residents of the sea-coast and all the Mlecchas (25). In another passage of the same parvva (XIV, 20), the aforesaid Vāsudeva is described as the king of Vaṅgas, Puṇḍras and Kirātas. The Puṇḍra land is thus narrowed down to the tract having Aṅga and the Kausiki marshes on the west, the Kirātas (hill tribes) on the north, the Vaṅgas on the south-east, and the Suhmas with Tāmraliptas on the south-west.

As was usual in old days, this tract was probably bounded by natural barriers like mountains or large rivers. On the east the boundary was

Their location.

the Karatoyā, named in the *Mahābhārata* list of rivers and specially noted for sanctity.¹ The *Amarakoṣa* gives it the synonym *sadā-nirā*,² i.e., always with water, or unfordable, a name justified by its present extensive deep beds, though much silted up at places. In the *Mahābhārata* list of rivers, however, the *Sadānirā* is named (IX. 24) separate from the Karatoyā, and therefore might have been the name of another river, the *Sadānirā* of Bidegha Mathava in the *Śatapatha-brāhmaṇa*. Is the name Karatoyā derived from *khara-toyā*, or swift-watered, having been fed by the rapid hill-streams? On the west the boundary of Puṇḍras would have been some large stream, lying east of the Kausiki. What river can this be but the modern Mahānandā? It is not unlikely that the Ganges itself flowed further east into the southern part of the modern Mahānandā, with the junction-point higher up. In the south it was bounded probably by the S.-E. branch of the Ganges (modern Padmā); the bifurcation being pretty old and shown in Ptolemy's map.³ The northern boundary was ill-defined, with jungles, hills, and aboriginal tribes like Kirātas. The grey (*śyāmā*) diamonds exported from Pauṇḍra⁴ were probably brought from these northern hills.

¹ Bhīṣma-P°, IX, 35; Vana-P°, LXXXV, 3:—
Karatoyām samāsāilya tri-vātr-oposito narah |
Aśvamedham = avāpnōti prajāpati-kṛto vidhik || 3 ||

² *Amarakoṣa*, Kāṇḍa I, Vargga X, verse 33.

³ A. E. Nordenskiöld, *Fac-simile Atlas*, Plate XXV (reprint of 1490 A. D., Ed. Romæ).

⁴ *Brhat-saṁhitā*, LXXX, 7; *Garuḍa-purāṇa*, LXVIII, 17-18. Cf. *Travels of Nicolo Conti* (circa 1440), transl., J. W. Jones, (Hakluyt Society), p. 10. He speaks of carbuncles.

It has been suggested that Puṇḍras were separate from Pauṇdras, the Puṇḍras lying on the south side of the Ganges, and the Pauṇdras on the north side, between Aṅga and Vaṅga. But of the two passages from which this conclusion is drawn, the one in Bhīṣma-parvva containing Pauṇdra does not appear in the Bombay text. In the Sabhā-parvva alone, *Puṇḍrāḥ* and *Pauṇḍrikāḥ* appear in the same sentence (LII, 16). But they might be mere poetical repetitions (or even interpolations), as similar repetitions appear in the same sentence with respect to *Kaukkurāḥ* and *Kukkurāḥ*. The formation *Pauṇḍrikāḥ* is also peculiar. Is it a mis-reading of *Sauṇḍikāḥ*, a name used with *Puṇḍrāḥ* in Anuśāsana-parvva, XXXV, 17? Anyhow, it would not be safe to draw any distinction on this single line, apparently corrupt, until corroborated.

The *Mahābhārata* and the *Harivaṃśa*, and following them the *Purānas*, name only one king of Pauṇdra, *viz.*, Bāsudeva. In the legends he is described as a powerful sovereign, ruling Puṇḍras, Vaṅgas and Kirātas, *i.e.*, the greater part of Bengal, and surnamed *Pauṇḍraka* (MBh., HV., Viṣṇu-pur, Bhāgavata) and also *Pauṇdra* (HV.). A son of his, Sudeva, is named in HV. (Viṣṇu-parvva, LIX, 4), and his capital called *Pauṇḍrasya nagaram* (Bhaviṣya-Parvva, XCII, 1). He fought with the Yādavas and was killed by Kṛṣṇa with discus (battle described in 12 chapters in HV., Bhav.-parvva, CXCI-CII: *Viṣṇu-pur.*, V, 34. 4-27; *Bhāgavata-pur.*, X, 66-23).

In the mediæval period the tribal name Puṇḍra was replaced by the country name Puṇḍra-varddhana. **(c) Mediæval period.** The latter appears in the list of Jaina Sthaviras, where the third *śākhā* of Godāsa Gaṇa is named Puṇḍra-varddhaniyā¹; and in the *Aśok-āvadāna*, which speak of Aśoka having put to death in Puṇḍra-varddhana many naked sectarians for doing despite to Buddhist worship.² The dates of their compositions are not known. But the name is mentioned in the *Records* and the *Life* of Yuan-chwang, under the heading *Pun-na-fa-tan-na*³ (Punṇya-varddhana). Yuan-chwang visited the land about 640 A.D. The name can next be traced in several Sanskrit works and several inscriptions, the earliest being the Khālimpur plate of Dharmapāladeva⁴ (beginning of the tenth century?). The variant, *Pauṇdra-varddhana*, appeared later in works of the eleventh century⁵ and in inscriptions of the twelfth century, the earliest being the Manahāli plate of Madanapāladeva⁶ (middle of the twelfth century).

¹ *Kalpa-sūtra*, Jacobi, S.B.E., XII. p. 288.

² *Divy-āvadāna*, p. 427, l.c., Watters.

³ *Records of the Western World*, Beal, II, 194-5; Watters, II, 184-5; *Life*, Beal, p. 131.

⁴ J.A.S.B., 1894, p. 53ff; Ep. Ind., IV, 247.

⁵ *Kathā-sarit-sāgara*, Lambaka III, taraṅga 3, vv. 254, 290, tar. 5, 17, 19, 21; Lamb. V, tar. 1, 71. Cf. *Rāja-taraṅginī*, IV, 421.

⁶ J.A.S.B., 1900, p. 71.

In his *Records* Yuan-chwang supplies us with a description of the land and the people. The country was 4,000 li in circuit, and had a flourishing population. Tanks, hospices and flowery groves alternated here and there. The land was low and moist, and crops were abundant. The climate was genial. The people respected learning. The Digambara Nigranthas were very numerous; and the Deva temples were a hundred in number. Twenty Buddhistic monasteries existed with some 2,000 brethren of both the vehicles. Of these the most magnificent was a *saṅghārāma*, 20 li to the west of the capital, with the name variously given as *Po-shih-p'o*, *Po-kih-p'o* or *Po-kih-sha* (? Vaṣiva, Julien).

In coming to this country from the west, the pilgrim had to cross the Ganges; and in going from this country eastward, he had to cross a large river. The province was thus evidently bounded on the west by the Ganges with the Mahānandā, and on the east by the Karatoyā. The large number of Jains comes as a surprise, but is pretty fairly indicated by the references in the *Kalpa-sūtra* and *Aśok-āradāna*. The Deva temples were mostly Śaiva or Śākta. The *Harivaṁśa* and the *Purāṇas* located the territory of Bāṇa the Śaiva king towards this side; and Kāmarūpa, the great stronghold of Devi-worship, adjoined it.¹

In the epigraphical records Puṇḍra (or Pauṇḍra°)-varddhana is called a *bhūkti* or province. It was

In inscriptions. divided into *viṣayas* or districts, *maṇḍalas* or sub-districts, and *grāmas* or villages. In the plates of Pāla and Sena kings the following names of its divisions appear:—

1. Mahantāprakāśa-*viṣaya* with Vyāghratati-*maṇḍala*;²
2. Sthālikkaṭa-*viṣaya* with Āmraśaṅḍikā-*maṇḍala*;³
3. Koṭivarṣa-*viṣaya* with maṇḍalas Halāvarta and Gokalikā.⁴

Koṭivarṣa is to be identified with the Parganā of Devi-kot, a town on the left bank of the Punarbhavā river, 18 miles S.-S.-W. of Dinājpur town, and named in the *Tubaḳāt-i-Nāṣirī* as Dīw-kot. The others cannot be located. According to an inscription, Pauṇḍra-varddhana-bhūkti included even Vaṅga with the *bhāga* Vikramapur.⁵ The Tarpana-dighi plate of Lakṣmaṇasenadeva

¹ The Lexicographers support this view. Hemacandra, 997, has—
Lomapāda-karṇayoh pūr-Devikoṭa umā-vanam |
Koṭivarṣam Bāṇa-puram syac-Choṇita-puram ca tat ||

Puruṣottamadeva's *Tri-kāṇḍa-śeṣaḥ* similarly says (II, 197):—
Devikoṭa Bāṇa-puram koṭivarṣam = umā-vanam |
Syac-Choṇita-puram c = ātha yojanam mārga-dhenukam ||

² Khālīmpur plate, Ep. Ind. IV. 249, l. 30; Anllia plate of Lakṣmaṇasenadeva, J.A.S.B. 1900, p. 64, l. 34-5 (Maṇḍala alone).

³ Khālīmpur plate.

⁴ Gokalikā in the Dinājpur plate of Mahipāla, J.A.S.B. 1892, p. 84, l. 30; Halāvarta in the Manahāli plate of Madanapāladeva, J.A.S.B., 1900, p. 71, l. 32; *viṣaya* alone in the Āmgācchi plate, Ind. Ant., XIV 265 l. 24.

⁵ J.A.S.B., 1896, p. 13, l. 42.

has *Varedyān* in the place of *Viṣaya*, which seems to be a misreading.¹

The grant-portions clearly show that Puṇḍra-varddhana formed a part of the Pāla kingdom, from the time of Dharmapāla-deva (fourth quarter of the ninth century) to Madanapāladeva (middle of the twelfth century). Even before the rise of this dynasty it had been included in the Gauḍa empire, if the *Rājatarāṅginī* is to be believed. On the decline of the Pālas, it became subject to the Senas, as the various plates of Lakṣmaṇasena, and his son Viśvarūpasena, show in their grant-portions.

Towards the end of Lakṣmaṇasena's rule Bengal was invaded (d) **Mussalman period.** by the Islamic forces under the *Khalj* chiefs, who gradually conquered this province. In Pauṇḍra-varddhana lay most of the Bengal places named in the *Tabakāt-i Nāsirī*,—e.g., Burdhan-koṭ and Diw-koṭ, where Muḥammad-i Bakht-yār halted on his way to and retreat from Tibbat; Nāran-goe, the fief of 'Ali-i Mardan, the murderer of Muḥammad-i Bakht-yār; Maksadah and Santus, where lay the tomb of his successor Muḥammad-i Sheran; Gaṅgūri or Kānkūri, the first fief of Huṣain ud-din 'Iwaz, later called Sultān Ghiyas-ud-din. Debikot (No. 23 of Dinājpur District), Mosidah (No. 57 of Dinājpur District), Santos (No. 68 of Dinājpur District), and Khaṅgor (No. 16 of Bogrā District) still survive as parganās.² Burdhan-koṭ is identified with Rājbari, 19 miles north of Bogrā town; and Bāṅgāon of the printed text (Bekānwah of Raverty) with a place of the same name near Devikot; while Nāran-goe must be near Devikot.³

After the Mussalman conquest, the name Pauṇḍra-varddhana disappeared. In only two later Sanskrit works the name Puṇḍra can be traced. The lexicography *Tri-kāṇḍa-śeṣa* divides the Puṇḍras among Varendri, Gauḍa and Nivṛṭti⁴; while the Brahmanḍa section of the *Bhaviṣyat-purāṇa*⁵ extends the term Puṇḍra-deśa over Bengal, Bihār and Chota-Nāgpur and divides it into nine divisions. In the rent-roll of Todarmal, the tract proper was distributed among the following sarkārs,—Bārbakābād Panjrā, Ghorāghāt, N.E. Lakhnauti and S.W. Bazuhā.⁶

Very little is known about its old capital. The *Records* says that the capital was more than 30 li in circuit, and that the pilgrim travelled from it east above 900 li to reach the country of Kāmarūpa; the *Life* adds that going from it 900 li or so south-east he came to the country of Karṇasuvarṇa. Cunningham identified it with Mahāsthān-gar, whose ruins lie seven miles north of Bogrā town on the

¹ J.A.S.B., 1875, p. 12. Is *Varedyān* meant for *Varendrān*? The text requires re-editing.

² The numbers are taken from the Statistical Accounts of Bengal.

³ Blochmann, J.A.S.B., 1875, pp. 284-9.

⁴ II. 187; *Madhya-deśa* = o'tha *Puṇḍrāḥ śyur* = Varendri-Gauḍa-Nivṛṭti

⁵ Wilson, I.c. Ind. Ant., XX, pp. 419-421.

⁶ Jarrett, *Ain-i Akbari*, II. 131, 135-8; J.R.A.S., 1896, pp. 112, 115-7, 122-8.

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Karatoyā river, and identified the monastery *Po-shi-po* with Bhasu Bihār to its west.¹ The fort has several old remains, from which images and coins (some Gupta) have been recovered; and a large fair is held on the Karatoyā bank near it on the new moon day of the month Pausa (Decr.-Jany.). The place is shown in Rennell's Atlas Plate V (1779) in rather large type as one of importance. But it is not noticed in the older maps, and the direction S.-E. to Karṇa-suvarṇa (Gauḍa) does not hold good. With this direction, some place higher up on the Mahā-nandā would agree. Were it not that the distance from Karṇa-suvarṇa would be much smaller, Paṇḍuā (vernacular Pēro; Sans. Paṇḍra?) could have been identified with this. It had undoubtedly old Hindu tanks with architectural remains, several of which had been built into Adinā mosque, Eklākhī tomb, and other Mussalman buildings of Paṇḍuā.² The distance from Kāmarūpa and the distance from Kajaṅgal (600 li) also do not disagree with this identification.

The name of the capital is not given in the *Records*. In the Sāngli plate of the Rāṣtrakūṭa Govinda IV, dated 8th August 933 A.D., land was granted to a Brāhmana coming from Puṇḍra-varddhana-nagara³; while in the *Brh̄t-kāthā-mañjari* a town is named Puṇḍra-varddhana-pura.⁴

Lastly, according to the oldest existing dramatical treatise, the

Language. language which should be used by actors personating Aṅgas, Vaṅgas, Kalingas, Vatsas, Odras, Māgadhas, Pauṇḍras, Naipālikas, Prāḅjyotiṣas, Pulindas, Vaiḍehas and Tāmraliptakas is Ardhā Māgadhi,⁵ thus pointing out the prevalent form of language in Eastern India.

II. GAUDA, LAKṢMAṆĀVATĪ.

Gauḍa has not been traced in any works of the Vedic or epic period. But it must have existed

Gauḍa. from a pretty old time, as it is named in the oldest rhetorical works. In *Kāvya-ādarśa* or Mirror of Poetry by Daṇḍyācārya, of the various poetical māṅgas or styles, two are specially selected for discussion, *Vaidarbha-Gauḍiyan*, Vaidarbha and Gauḍiya⁶; and *Kāvya-ādarśa's* date is believed to be of the sixth

¹ *Arch. Sur. Rep., India, XV., pp. v., 102ff.*

² *Do., p. 80: Ravenshaw's Gauḍ, p. 44.*

³ *Ind. Ant., XII, 251.*

⁴ *Lamb. III, story 3, vv. 237, 285.*

⁵ *Bharata's Nāṭya-śāstram, XIII, 32-34.* Two verses of this important passage are quoted below:—

Aṅgā Vaṅgāḥ Kalingāś = ca Vatsāś = c = aiv = Odra-Māgadhāḥ |

Pauṇḍra-Naipālikāś = c = aiva Antar-giri-Bahir-girāḥ || 32 |

Prāḅjau-(ggyau) tiṣāḥ Pulindāś = ca Vaiḍehāś = Tāmraliptakāḥ |

Pragāḥ prāvṛtayaś = c = aiva yuñjanti dhy(?cār) dha-Māgadhim || 34 ||

⁶ *Kāvya-ādarśa, paricheḍa I, 40, 42, 44 (anuprāsa-dhīyā), 46, 54, 94.* For Gauḍiyā style, cf. *Harṣa-caritam*, introductory verse 7; *Vāmana's Kāvya-lankāra-sūtra*, Nos. 9 and 12; *Rudrata's Kāvya-lankāra*, Adh. II. 4-5 *Sarasvatī-kanṭh-ābharāṇa*, II, 28, 31.

century A.D. In the still older work, Bharata's *Nāṭya-sāstram*, or Treatise on Dramatic Performances, the hair-dressing of Gaudiyas is specially described.¹

Gauḍa was originally the name of a district. An inscription on the Kanheri hill, Bombay, declares that the Buddhist *Gomin* Avighnākara, who caused to be built hall-mansions thereon with a donation of one hundred *dramma*s, came from Gauḍa-*viṣaya*. *Gauḍa-*viṣayā*ḍ = āgata*.² In *Bṛhat-saṁhitā*, the tribe Gauḍaka is placed in the eastern division with Pauḍras and Tāmraliptakas.³ A more precise location does not appear in Sanskrit works. But if the Gauḍa king of Bāṇa's *Harṣa-caritaṁ* be identical with *She-sang-kiu* (Śaśāṅka), king of *Kie-lo-na-su-*ja*-la-na* (Karna-suvarṇa), as the king at whose instance was killed Rājya-varddhana after luring him by the false confidence of a friendly reception,⁴ then the *viṣaya* of Gauḍa could be identified with Karna-suvarṇa of Yuan-chwāng's *Records and Life*. According to the Chinese pilgrim, this country was about 4,450 li (1,400 or 1,500, Beal) in circuit, and well-cultivated. The land was low and moist, farming operations regular, with abundant flowers and fruits. The climate was temperate. The people are said to be very rich, and of good character, and patrons of learning. There were more than ten Buddhist monasteries with above 2,000 brethren of the Sammatiya school, besides three monasteries of Devadatta's school in which milk product were not taken as food. There were 50 Deva temples, and the followers of various religions were very numerous.⁵ With other writers I agree in thinking that the *Life* is correct in placing Karna-suvarṇa S.E. of Pauḍravardhana, and that the statement in the *Records* of its being N.-W. of Tāmralipti is probably a mistake for N.E. The position of its capital will be discussed *infra*.

The references also show that Gauḍa was not only the name of a *viṣaya*, but was the general name of a kingdom or empire that included

An empire also.

¹ *Nāṭya-sāstram*, (N.S.P. Edn.), Ch. XXI, 48—
Achya (? *Av*) *anti-yuvatinām tu śiraḥ s-āḷaka-kuntalam* |
Gauḍinām-āḷaka-prāyaṁ śeṣā prāy-aika-venikam ||48||

² Ind. Ant., XIII, 134 The inscription was of the reign of the Rāstrakūṭa Amogha-varṣa I, dated 16th September 851 A.D. (Saka 775 for 773).

³ *Bṛ. Saṁ.*, XIV, 7:—

Udayagiri-Bhadra-Gauḍaka-Pauḍr-Otkala-Kāśi-Mekal-Āmbasthāḥ |
Ekapāda-Tāmraliptaka-Kośalukā-Vardhamānāḥ = ca || 7 ||

⁴ *Harṣa-caritaṁ*, 6th *ucchāsa*, (N.S.P. Edn.), p. 186, *Gauḍa-ādhipena mithy-opacār-opacita-viśvāsam mukta-śāstram = ekākinam viśvadhām svabhavana eva bhūtāram vyāpāditaṁ = aśrausit*. *Records*, Beal, I., 210. "At this time the king of Karna-suvarṇa—a kingdom of Eastern India—whose name was Śaśāṅka, frequently addressed his ministers in these words: 'If a frontier country has a virtuous ruler, this is the unhappiness of the kingdom' On this they asked the king to a conference and murdered him." Cf. Watters, I, 343.

⁵ *Records of the Western World*, Beal, II, 201; Watters, II, 191.

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various provinces, changing from time to time according to circumstances. For example, the *Gauḍ-ādhipa* of Bāṇa, or the Śaśāṅka of Yuan-chwang, ruled a powerful empire. It included besides *Kie-lo-nu-su-fu-lu-na*, *Mo-kie-t'ō* (Magadha), and *Kin-shi-nu-k'ie-to* (Kusinagara),¹ and, therefore, the intervening tracts of Tirabhūkti (Tirhut) and Kāśī.² At one time his forces captured Kānyakubja.³ The Gaṅjām plate of Mādhavarāja II. issued from Kongeda (*kong-u-to* of *Records and Life*, modern Puri and Gaṅjām) acknowledged the overlordship of Śaśāṅkarāja⁴; and, therefore, the intervening countries of Suhmas, Tāmraliptas and Oḍras were presumably under his suzerainty. The adjoining Puṇḍravardhana was very likely included in his empire, and probably Vaṅga too. It is no wonder, therefore, that the emperor Harṣa, although he thundered to uproot the Gaṇḍas and deputed his minister Bhaṇḍi against them,⁵ could not carry out his threat at least for 14 years more.

The earliest epigraphical mention of Gauḍa is on the Aphisad

Frequently mentioned in inscriptions.

pillar of the Magadha King Ādityasena, where the *prasasti* was composed or engraved by the Gauḍa Suksma-siva.⁶ The time of Ādityasena is approximately settled by the Shāhpur image inscription dated in the Harṣa era 66 or A.D. 671.⁶ Suksma-siva might have been resident either of Gauḍa-*viśaya* or Gauḍa kingdom, probably of the former. The Gauḍa kingdom is probably referred to in the Kātmāṇḍu inscription, dated Harṣa (?) 153 (?758 A.D.), which says that the Nepāl King Jayadeva Paricakrakāma married Rajyāmāti, "the noble descendant of Bhāgadatta's royal line, and daughter of Śrīharṣadeva, lord of Gauḍa, Oḍra, Kaliṅga, Kosala and other lands."⁷ By "Bhāgadatta's royal line" is meant, I suppose, connexion with the kings of Prāṅgyotiṣa, probably through her mother.

Similarly in the Prākṛt poem *Gauḍa-cuho* of Vākpatirāja,⁸ Gauḍa evidently referred to the whole kingdom, and not simply the

¹ *Records*, Beal, II, 91, 118, 121; II, 42.

² A seal cut in the rock at the hill-fort of Rhoṭāsgar, District Shāhābad, Bengal, bears the inscription: *Srī-Mahāsāmanta-śaśāṅka-devasya*, probably of this Śaśāṅka, in his early reign. *Fleet, Gupta Inscriptions*, pp. 283-4.

³ *Harṣa-caritaṃ*, 8th *ucchāsa*, p. 249. *Kānyakubjad = Gauḍa-sambhramam gupṭito Gupta-nāmnā kula-putrena niṣkāsanam*.

⁴ *Ep. Ind.* VI, 144; dated 300 *Gauṭ-ābde*, 619-20 A.D.

⁵ *Harṣa-caritaṃ*, 6th *ucchāsa*, p. 194, *nir-Gauḍām*, besides abusing him as *Gauḍa-ādhamā*, 6th *ucch.*, p. 118, 193; addressing Bhaṇḍi; *bhavan = api kaṭakam = ālāya, pravartatām Gauḍ = ābhimukham*, 7th *ucch.*, p. 226.

⁶ *Fleet*, *Gupta Inscriptions*, p. 205, line 27; for Shāhpur image date. *Fleet*, *Gupta Inscriptions*, p. 210, line 2. Other examples of poets having Gauḍa lineage, *Gauḍ-ānvaya*, are Gadādhara who composed the *Vṛtesvara Candella* inscription of Paramārḍi-deva, *Ep. Ind.* I, 211, line 22; and Madava, the Rāja-guru of Arjunavarman of Dhār, who composed the Dhār *prasasti nātikā*, *Ep. Ind.*, VIII, 101, line 3.

⁷ B. Indrāji, *Ind. Ant.* IX, 181.

⁸ S. P. Pandit, *Bombay Sanskrit Series Ed.*, *Gauḍaraho*.

viṣaya. It narrates that the king Yaśovarmmā of Kānyakubja invaded East India; that the Magadha king fled before him (verse 354); that the vassals and nobles of Magadha king, feeling ashamed, returned to fight (v. 414); that the defeated and pursued Magadha king was killed (v. 917); that then proceeding to the coast of coconuts Yaśovarmmā conquered the Vaṅgas powerful with elephants (vv. 418-421). Evidently on this slaying of the Magadha king and his army, the poet calls the subject *Gauḍa-vaho* in verse 1074, and again says *Gauḍa-gala-ccheya-valagga-saṁthi-eāvali* or the necklace of Gauḍa necks in verse 1194. At that time Gauḍa, therefore, included Magadha. The date of Yaśovarmmā is dependent on the time of Lalitāditya, King of Kaśmir, who, according to *Rāja-taraṅginī*,¹ defeated him. Roughly it falls in the second quarter of the eighth century A.D.

In the following inscriptions Gauḍa is mentioned as a kingdom generally. In the Wāni and Rādhanpur plates of the Rāṣtrakūta Govinda III, it is narrated that his father Govinda II, surnamed Dhruva, drove "into the trackless desert Vatsarāja, "who boasted of having with ease appropriated the fortune of royalty of the Gauḍa."² Vatsarāja was king of Avanti (and Kanauj?) in Śaka 705 or A.D. 783-84, the year in which the Jaina *Harivaṁsa* of Jinasena was finished. Similarly the Benirām plate of Karka II mentions that Karka's arm was used by his master Govinda III, for protecting Mālava, as an "excellent door-bar of the country of the lord of Gūrjaras who had become evilly inflamed by conquering the lord of Gauḍa and the lord of Vanga."³ This grant is dated Śaka 734 or A.D. 812. The Nilgund stone inscription of the reign of Rāṣtrakūta King Amoghavarṣa I, speaks of his father "having fettered the people of Kerala, Mālava and Gauḍa."⁴

In the second half of the ninth century the Pāla kings rose into power, and gradually became known as rulers of Gauḍa. The earliest epigraphical mention of them as *Gauḍa-śvara* is to be found in the Budal pillar inscription of Gurava Miśra, in which this title is applied to Deva-pāla.⁵ But his

¹ *Rāj-tar., taraṅga* IV, 133ff., Stein, I, 132. Lalitāditya is also credited with the conquest of *Gauḍa-maṇḍala*, IV. 148, Stein I, 135:—

Ākṛṣṭa-Lakṣmī-paryāṅka-danti-sakhyād = iv-āyatāh)

Āśirvayam = stam nihēgā dantino Gauḍa-maṇḍalāt || 148 ||

"Numberless elephants joined him from the Gauḍa land, as if attracted by friendship for the elephant [carrying] the conch of Lakṣmī, who was attached [to the king]."

² Rādhanpur plate, Ep. Ind. VI, 243, lines 12-13; Wāni plate Ind. Ant. XI, 157, lines 11-13. Cf. E.I. VI, 195-6, for *Harivaṁsa*.

³ Ind. Ant. XII, 160, line 39, *Gauḍendra-Vaṅga-pati-nirjjaya*°.

⁴ Ep. Ind. VI, 102, line 6; the corresponding part in Sirūr inscription has *śautān* for *Gauḍān*.

⁵ Ep. Ind., II, 163, line 14. According to Tārānāth, the Tibetan chronicler, Varendra and Orissa were conquered by Devapāla son of Gopāl; A.S.R., XV, 111.

father Dharmapāla practically ruled Gauḍa. On the east he had Paundravarddhana-bhākti, in which he granted land by the Khālimpur plate¹; in the centre he had Magadha, as he issued from Pāṭaliputra the said grant¹; while in Bodhgayā an image has been found with an inscription recognising his overlordship.² His territory extended probably further westwards, as in the Khālimpur plate he is described to have subjugated Kānyakubja, but gave it over to its king.¹ Of his father, Gopāla, the two inscriptions found are on images of Nālanda and Bodhgayā, showing that Magadha belonged to him³; and from his assumption of the title *Mahārājā-dhirāja*, it is not unlikely that other lands were also included besides Magadha. Other references to Pālas as kings of Gauḍa are also to be found in (1) the Sārnāth image inscription of the time of *Gaudādhipa* Mahipāla dated Śaṃvat 1083 (1027 A.D.)⁴; and (2) Kamauli plate of Vaidyadeva, a Governor of *Gauḍ-eśāsya Kumāra-pāla-urpateḥ*.⁵

Other references to Gauḍa lie scattered in inscriptions and literature of ninth to twelfth centuries. Some of them may really refer to Pāla kings, but most are vague, e.g. :—

A. *Inscriptions* :—

(i & ii) Karhād and Deoli plates of Kṛṣṇa III.⁶ His ancestor Kṛṣṇarāja II “was the preceptor charging the Gauḍas with the vow of humility,” *Gaudānām vinaya-vrat-ārppana-gurus*.⁷

Kṛṣṇa II, end of the ninth century A.D.

(iii) The Bilhāri stone inscription.⁷ The Cedi king Keyūravara Yuvarāja I “fulfilled the ardent wishes of the minds of the women of Gauḍa,” *Gauḍi-gāḍha-mano-manoratha-karaḥ*.

Yuvarāja I, of the tenth century.

(iv) Bhuvaneśvara stone inscription of Brahmeśvara temple,⁸ Udyotaka-keśari “defeated the whole force of his enemy, the Siṃhala, Coḍa and Gauḍa, as it were in child play,” *prati-bhatam = akhilaṃ Siṃhalaṃ-Coḍa-Gauḍam*.

Udyotaka Keśari, probably of the tenth century A.D.

(v) Kahlā plate of the Kālācūri Sodhadeva,⁹ Gunām = bhodhideva by a warlike expedition “took

¹ Ep. Ind. IV, p. 249, lines 28-9, *Pāṭaliputra-samāvāsita*, lines 30-1, *Sri-Paundravardhanabhūkti-antahpāti*; lines 21-3 for Kānyakubja.

² Proc. A.S.B., 1880, p. 80.

³ Kielhorn's list of N. Indian Inscriptions, Nos. 631 and 632, p. 35. App. to Ep. Ind., Vol. V.

⁴ Ind. Ant. XIV, 140; Arch. Survey Rep. for India, 1905-6, pp. 221-2.

⁵ Ep. Ind., II, 351, line 17.

⁶ Deoli plates dated Śaka 862, Ep. Ind., V, 193, line 20; Karhād plates dated 9th March 959 A.D., Ep. Ind. IV, 233, line 22.

⁷ Ep. Ind. I, 256, line 10.

⁸ J.A.S.B., VII, 558f, verse 10.

⁹ Ep. Ind., VII, 89, line 9.

away the Gauḍa-Lakṣmī," *āhrtā Gauḍa-lakṣmīḥ*.

Gunāmbhodhideva, probably of the tenth century.

- (vi) Nāgpur stone inscription of the Mālava ruler Naravarmmadeva.¹ Of his elder brother Lakṣmadeva's expedition in East India it is said, "just as dread entered the town of the Lord of Gauḍa," *Yath-āvisat-Gauḍa-pateḥ puram daru[h.] Lakṣmadeva, circa 1080-1104 A.D.*
- (vii) Bhuvaneśvara stone inscription of Vāsudeva Temple.² The donor, Bhaṭṭa Bhavadeva's sixth ancestor, "got grant of land from the king of Gauḍa," *Sa śāsanam Gauḍa-nrpād-avāpa*.
Inscription about 1200 A.D., 6th ancestor, probably middle of the tenth.
- (viii) Govindapur stone inscription of Gaṅgādhara.³ He "married the charming Pāsadevi, a daughter of Jayapāni . . . a friend of the king of Gauḍa," *Gauḍa-rājā-suhṛdo*.
Inscription dated Śaka 1059 or 1137-8 A.D.
- (ix) Deopārā stone inscription of Vijayasena,⁴ who "impetuously assailed the king of Gauḍa," *Gauḍ-ēndram-adravat*.
Vijayasena, middle of the twelfth century.
- (x) Piṭhāpam pillar inscription of Prithvīśvara,⁵ whose ancestor Malla I. (12th generation up) "subdued the Gauḍas together with the Pāṇḍya king," *Gauḍān=sa-Paṇḍy-ādhipān*.
Inscription, Śaka 1108 or 1186-7 A.D., Malla I, probably of the ninth.

B. Sanskrit Literature :—

- (i) *Yūśas-tīlakam* of Somadeva Sūri, describes the Gauḍas of the Tairabhukta army, *Gauḍair-ōkūlīta-sakala-sainīkam . . . Tairabhuktaṁ valum*, (*Āśvōsa* III, N.S.P. Ed., p. 466.)
A Jaina *campu* of probably the ninth century.
- (ii) *Brhāt-kathā-māñjarī* of Kṣemendra, in describing the well-known castle-building story, *ghaṭ-ākhy-āyikā* locates it among the Gauḍas, *Gauḍeṣu Devasarmm-ākhyo bahūva Brāhmanah purā* (Lambaka XVI, story 38, verse 550, N.S.P. Ed. p. 586).
Kṣemendra, the Kāśmīrian, of the second half of the eleventh century.
- (iii) *Kāthā-sarīt-sāgaru* of Somadeva Bhaṭṭa narrates the arrival of *Gauḍoḥ Śakti-kumāro* to meet Vikra-

¹ Ep. Ind., II, 186, line 27.

² Ep. Ind., VI, 205, line 4.

³ Ep. Ind., II, 337, line 26.

⁴ Ep. Ind., I, 309, line 19.

⁵ Ep. Ind., IV, 40, line 24.

māditya (Lambaka XVIII, Taraṅga 3, verse 3).

Somadeva, second half of the eleventh.

- (iv) *Vikramāṅka-kāvya* of Bilhana. The Chālukya Vikramāditya of Kalyāṇa is said, rather magniloquently, to have carried his arms as far north as Gauḍa and Kāmarūpa (III. 71).

Poem's date—later than 1081 A.D., end of eleventh century.

- (v) The drama of *Anarṅha-Rāghavam* of Murāri, *purastāc-Champā nāma Gauḍānām . . . rājadhānī*. (VII, 124, p. 310, N.S.P. Ed.)

Murāri, not later than eleventh century.

- (vi) The Bengal poet Śaraṇa's verse, l.c., *Sūkti-karṇ-āmṛta* of Śrī-dhara-dāsa, *Bhru-ksepāḍ-Gauḍa-lakṣmīn jayati . . . vīkarate murdhniyo Māgadhasya*.¹

Śaraṇa, third quarter of the twelfth century.

From about the middle of the twelfth century, the Sena kings, originally of Vaṅga and Suhma, gradually encroached on the territories of the Pālas, and eventually ousted them from Gauḍa. During the reign of Lakṣmaṇasena, the whole of Gauḍa appears to have passed into his hands. In the Madanapāḍa plate of his son Viśvarūpasena, Lakṣmaṇa is said to have carried his victorious arm southwards as far as Purī in Orissa, and westwards as far as Benares and Prayāg (verse 11). Naturally he came to be called the Gauḍa king, e.g., in the *Pavana-lūtan* of Dhoyī Kavirāja, verses 5, 96, 101.² Similarly in the Bākarganj and Madanapāḍa plates,³ Viśvarūpasena, his son, is called lord of Gauḍa.

The Mussalmans began at first with the sack of Bihār and Nūdiah. But shortly after they removed their base of operations to Gauḍa capital, Lakṣanawaṭī. Gradually they invaded and began to take possession of the adjoining tracts, until, in the time of Ḥusām-ud-dīn 'Iwaz, Sultān Ghīyās-ud-dīn, "the whole of that territory named Gauṛ passed under his control."⁴ This fact was evidently commemorated by a unique coin dated 616 H. with the mint "struck in Gauṛ."⁵ Gauḍa did not include Vaṅga or Tira-bhukti, for in addition it is recorded: "The parts around about the state of Lakṣanawaṭī, such as Jāj-nagar, the countries of Bang, Kāmṛd and Tīrhut, all sent tribute to him."⁶ Bihār was probably included in Gauḍa; for "The august Sultān, Shams-ud-dīn wa ud-dunyā, on several occasions, sent forces from the capital,

¹ J.A.S.B., 1906, p. 174, note 1. Gauḍa is in this verse named separate from Magadha.

² J.A.S.B., 1905, pp. 53, 67, 68.

³ J.A.S.B., VII, p. 43ff; J.A.S.B., 1895, p. 1ff.

⁴ *Tabakāt-i Nāṣiri*, pp. 587-88.

⁵ J.R.A.S., VI, 350, wood-cut; a gold coin, 70.6 grains.

⁶ *Tab. Nāṣ.*, Raverty, pp. 587-8.

Dihli, towards Lakhanawati, and acquired possession of Bihār, and installed his own Amirs therein¹; and this he did again in 622 H., after forcing Ghiyās-ud-din to acknowledge his suzerainty.

During the pre-Mughal rule, Gauḍa generally retained the most prominent position in Bengal, though the capital was changed from Lakhnauti to Paṇḍuā and Tāṇḍā. In Todarmal's rent-roll Gauḍa tract was comprised in two sarkārs, Lakhnauti and Audumbar, *alias* Tāṇḍā,² the boundaries evidently being on the east the streams Punarbhavā and Mahānandā, on the west the old Kosi and the hills of Sontāl parganas, on the south North Mursbidābād and North Birbhūm, and on the north an ill-defined limit of Puraniyā and Dinājpur districts, Debikot being included in the extreme north-east. In the Mughal rule, except for two short periods in which the capital was removed to Dacca, Gauḍa country still occupied a front place, either with Rāj-mahal or Murshidābād as capital.

The name *Pañca-Gauḍa* first appears in Kalhana's *Rājataranginī*, completed in about 1150 A.D.

Pañca-Gauḍas. The Kaśmīr king, Jayāpiḍa, having subdued the ruler of Pañca-Gauḍas, made his father-in-law their overlord.³ What were the five Gauḍas? A few verses above (IV, 421), his father-in-law, Jayanta, is described as chief of Pauṇdra-varddhana under the shelter of the Gauḍa king. So Pauṇdra-varddhana was one, besides Gauḍa proper. The three others would probably be Rāḍhā, Magadha, and Tirabhukti, the three tracts which Gauḍa adjoins, and with which it is often mentioned. Vaṅga is generally mentioned separate from Gauḍa, and was probably not included in the five-divisioned Gauḍa. In some modern verses the northern Brāhmins are called Pañca-Gauḍiyā, *i.e.*, Kānyakubja, Sārasvata, Gauḍa, Maithila, Utkala; Gauḍa thus meaning nearly the whole of North India, a meaning the basis of which I have not yet been able to trace. *Pañca-Gauḍa* is several times used in vernacular literature, *e.g.*, in Vidyapati's songs, Krttivāsa's *Rāmāyaṇa*, *Parāgali Bhārata* of Kavindra Paramesvara, and Mādhavācārya's *Caṇḍī*.⁴

The capital of Gauḍa has not been named or described in any pre-Mussalman works. If Gauḍa be identical with Karṇa-suvarṇa, as is

Capital.

¹ Tab. Nās., pp. 590-1, 594.

² *Ain-i Akbari*, Jarrett, II, 129-132; Beames, J.R.A.S., 1896, pp. 92-6, 110-115.

³ *Rāj-tar.* IV, 468:—

Vyadhād-dhin = āpī sāmāgrīm tatra śaktim prakāśayan |

Pañca-Gauḍa-ādhipān = jītvā śvaśuraṃ tad-adhiśvaraṃ || 468 ||

"He showed there his valour by defeating, even without preparation, the five-Gauḍa chiefs, and by making his father-in-law their sovereign."—Stein I, 163.

⁴ Dīnēśacandra Sen, *Bāṅga-bhāṣā o Sāhitya*, pp. 104, 112, 139, 391.

[N.S.]

likely, then the capital in the seventh century was above 20 li in circuit, and had by its side a magnificent monastery named *Lo-to-wei* (or *mo*)-*chih*, *Rakta-vitti* or *-mitti* (red clay). This has been identified with *Rāṅgāmāṭi*,¹ a village on the *Bhāgirathī* branch, six miles south-west of *Berhāmpur* town in *Murshidābād* district. The identification rests on the similarity of the name *Rāṅgāmāṭi* with *Rakta-mitti*, and of an alleged older name of it *Kāṣṇānāgar* with *Karṇa-suvarṇa*, on the location of the place in the direction indicated by *Yuan-chwang*, and on its remains, *viz.*, mounds, images and coins. Unfortunately, the name *Rāṅgāmāṭi* is not uncommon, being derived from the red laterite soil that extends from the foot of the *Rājmahal* hills through the *Barind* to *Madhupur* Jungles in *Mymensingh* District. The name *Kāṣṇānāgar* is not in use now; but though it might have been in use once before, to judge from the introductory genealogical verse to *Sir Rādhākāntadeva's* *Sabda-kalpa-druma*,² mere similarity is not sufficient. The village is not named in any Hindu or Mussalman works, and is not found in any map older than *Valentyn's*, published in 1726 A.D. The *Parganā* in which it is situated, *Futte-sing*, was said to have been allotted to an up-country *Brāhman* by *Mānsingh* for valour shown in the war; and the remains found in the fort might be as well ascribed to him or his descendants.

On the other hand, if from the mention of *Śaśāṅka*, contemporary of *Rājyavarddhana*, *Karṇa-suvarṇa* be identical with *Gauḍa*, then what is more likely to be the capital than *Lakṣmaṇāvati*? It appears as a capital in the earliest Mussalman history describing Bengal. "After *Muḥammad-i Bakht-yār* possessed himself of that territory, he left the city of *Nūdiāh* in desolation, and the place which is *Lakṣmaṇāvati* he made the seat of government."³ The passage indicates that the city had been existing from before; and the fort of *Gaur* is said to have been built by *Ballāl Sen*,⁴ thus suggesting that the town was still older. According to *Jaina* writers of the thirteenth and fourteenth centuries, *Dharma* was reigning at *Lakṣmaṇāvati* in *Gauḍa*, as a contemporary of *Bappabhadda Sūri* (744-839 A.D.), and of *Āma*, the king of *Kānyakubja* and son of *Yaśovarman*.⁵ If these traditions have any historical basis, as is not unlikely, then *Lakṣmaṇāvati* existed in the eighth century, and, therefore, with some probability in the seventh too at the time of *Yuan-chwang*. As regards *Rakta-mitti*, *Gaur* itself is situated on a subsoil of red laterite soil, flanked by *Barind* on the east and the *Rājmahal* hills on the west, its subsoil being now covered by

¹ *Beveridge, the site of Karṇa-suvarṇa*, J.A.S.B., 1893, pp. 315-323.

² Ditto ditto J.A.S.B., 1893, p. 327.

³ *Tab. Nās.*, p. 559.

⁴ *Ain-i Akbari*, Jarrett, II, 146.

⁵ *Bappa-bhaṭṭa-Sūri-Carita*, *Prabandha-kośa* of *Rājasekhara Sūri*, *Prabhā-vaka-carita* of *Prabhācandra Sūri*. I.c., *Gauḍa-vaho's* Introductory note II of *S. P. Pandit*, pp. cxxxv-clii. *Dināṅ Katipayāsir-Gauḍa-deś-āntar-vihāran Lakṣmaṇāvati-nāmnyāḥ puro bahir-ārāme samāvās-āsit (?)*, *tatra puri Dharmo nāma rājā*, etc.

the enormous silt deposit of the Ganges with its branches and tributaries.

The old Lakṣmaṇāvati, Lakhaṇawati of *Tabakāt-i Nāṣiri* and Lakhnauti of later Mussalman writers, apparently lay in old days on the west bank of the Ganges. The oldest of modern maps, Gastaldi's (A.D. 1561, Venetia,¹ plate) shows Gauṛ on the west of the Ganges. The pāyiks of Jājnagar in 642 H. appeared before Lakhaṇawati; but no crossing of any river is mentioned, although they came from south-west, and Lakhaṇawati was on the bank of a river (*āb-i-Lakhaṇawati*).² Rāmāvati, of Pāla time, which is identifiable with Rāmauti, a mahal and a circle of sarkār Lakhnauti in its north centre, is said to have been on the Bhāgīrathī.³ Apparently, therefore, the Ganges flowed northwards through the modern Kālindi and then southwards into the lower course of the Mahānandā, east of Gauḍa ruins. On this supposition the selection of Lakṣmaṇāvati for headquarters would be justified as holding the key to the entrance into Bengal.

Lakhnauti continued to be the capital of Bengal governors, although Bang and Rādhā were gradually added by conquest. When in the time of the Delhi emperor, Muḥammad Shāh Tughlaq, Bengal was divided into three sub-provinces, Lakhnauti became the capital of the northern division, as Sunārgāon of the eastern and Satgāon of the south-western.

At length, probably forced by a change in the river course, the capital was removed to Paṇḍuā in the time of Shams-ud-dīn Ilyās Shāh. Coins bearing the mint name of Firozābād, another name of Paṇḍuā, exist from 740 H.⁴ According to Shams-i Sirāj 'Afif "the new names which he" [Sultān Firuz Shāh] "gave to Ikdāla and Pandwah were made permanent and were entered in the Government records as 'Azād-pur, otherwise Ikdāla,' and 'Firozābād, otherwise Pandwah.'"⁵ But before Firuz Shāh's first invasion, the name had appeared in Ilyās Shāh's coins, and the place might have been so called after Shams-ud-dīn Firūz Shāh, grandson of Bughra Khān, and an independent Sultān of Bengal (702-722 H.). Another city is also named on the coins of Ilyās Shāh, Shahr-i Nau, whose position has not yet been ascertained. In Gastaldi's map it (Cernouen) is shown a little N.-E. of Gauṛ on the left bank, in fact near the site which Paṇḍuā would have occupied, had it been shown in the map. Was it then another name for Paṇḍuā, as meaning the 'new city'?

Firozābād continued to be the capital for a century and half, but from inscriptions Lakhnauti does not appear to have been

¹ *Travels of Ludovico di Varthema*, Hakluyt Society, 1863, facing p. cxx. The book being out of print, a tracing of the map is annexed. At the best it can be taken only as a rough work.

² *Tab. Nāṣ.*, pp. 665, 739-40, 763.

³ *J.A.S.B.*, 1900, p. 71, lines 27, 30.

⁴ *J.R.A.S.* II, 206. For a coin dated 742 H., with mint Firozābād, of a rival governor, 'Alā-ud-dīn 'Alī Shāh, see *J.R.A.S.* II, 202, and *Chronicles of the Pathan Kings*, p. 265, No. 221, pl. vi, fig. 8.

⁵ *Sir H. Elliot, Muhammadan History of India*, III, 298.

altogether abandoned. In the reign of 'Alā-ud-dīn Ḥusain Shāh, a fresh change in headquarters took place to Lakhnauti. Ḥusain Shāh ranked among the most powerful rulers in India at the time. I have come across thirty-five inscriptions of his, and notices of numerous coins. During the rule of Husaini dynasty, Gauḍa, a name which began to be more common than Lakhnauti, flourished greatly. Based on account of Portuguese travellers, who visited Gauḍa first about 1535 A.D., Manuel de Faria y Souza wrote:— "The principal city Gouro seated on the bank of the Ganges, "three leagues in length, containing one million and two hundred thousand families, and well-fortified; along the streets which are "wide and straight, rows of trees to shade the people, which "sometimes in such numbers that some are trod to death."¹

On account of a great shifting of the river course westwards, the seat of government was again changed to Tāṇḍā, south-west of Lakhnauti, then probably on the right bank of the Ganges where the river bifurcated.² The change was made in the time of Sulaimān Karāni (972-980 H.). Except for a few months, in 983 H., when Munim Khān, Akbar's first Bengal Viceroy, removed to Gauḍa disastrously for himself and many of his officers, Tāṇḍā continued to be the capital for nearly half a century. Gauḍa became depopulated, and about 1588 Ralph Fitch "passed the country of Gouren, where we found but few villages, but almost all wilderness, and saw many buffes, swine and deere, grass longer than a man, and very many tigers."³ *Sic transit gloria mundi.*

Even at Tāṇḍā, the river course began to change, shifting eastwards. About 1588, Ralph Fitch noticed "Tanda standeth from the river Ganges a league," and added, "the old way which the river Ganges was wont to run remained drie, which is the occasion that the citie doeth stand so far from the water."⁴ Partly in consequence of this change, and partly from troubles in East Bengal, Islām Khān removed the seat of government to Dacca, *alias* Jahāṅgirnagar, about 1015 H. The river now changed again westwards, until it touched Āgmahal uplands, and then Tāṇḍā came to be on its left bank,⁵ cut off from its sarkār. In the time of the prince Shāh Shujāh the capital was again removed to Āgmahal, which name had been changed to Rājmahal (with an *alias* Akbar-nagar) in Mānsingh's time. This change of capital did not last more than a quarter of a century. To check the turbulent state of the eastern border, especially the Assamese and Arrakanese inroads, Nawab Shaistā Khān again made Dacca the headquarters, where the government remained until the final

¹ *Portugues Asia*, Stevens, 1698, vol. I, Chapter IX, pp. 415-6.

² Sarkār Tāṇḍā of Todarmal's rent-roll lay west of the Ganges; *Ain-i Akbari*, II, 129-130; J.R.A.S., 1896, 92-96. For the position of Tāṇḍā town, see specially the *Akbar-nāma*, Elliot, vi. 45.

³ Hakluyt's *The Principall Navigations, Voyages, &c.*, reprint, Vol. V, 482.

⁴ Hakluyt's *The Principall Navigations, Voyages, &c.*, reprint, Vol. V, 481.

⁵ *Riyā-zus-Salāfin*, trans., Bib. Ind. Ed., p. 221.

transfer towards the beginning of eighteenth century to Maxudābād by Murshid Quli Khān, at whose instance the latter name was altered to Murshidābād.

III. SUHMA.

Suhma is mentioned in the *Mahābhāṣya* under Paṇiniya IV, 2. 52, with Aṅgas, Vaṅgas and Puṇḍras.¹

Suhma.

It appears several times in the *Mahābhārata* and *Harivaṃśa*.² Curiously enough it is not named in the long list of countries given in Bhīṣma-parvva, IX, 39-70, and is probably to be sought in some corrupt form such as *Svakṣa* in IX, 45, which is placed after Magadha and before Aṅga and Vaṅga.

Suhma is placed in East India along with Aṅgas, Puṇḍras,

Epic period, and afterwards.

Vaṅgas and Tāmraliptakas³; but its exact position is nowhere given. In the well-known description of Bhīma's conquests Suhma is preceded by Vaṅga and Tāmralipta and is followed by residents on the sea-coast. Similarly in Raghū's *digvijaya*, Suhma is mentioned after the sea-coast, and before Vaṅgas and the tract within the streams of the Ganges. "From him, the rooter-out of the unbent, the Suhmas saved their lives by following the easy course, like against a river torrent."⁴ Piecing together these informations, the tribe is to be placed near (but not on) the sea-coast, on a great river with marshes full of canes. Its position apparently lay on the Bhāgirathī branch, west of Vaṅga, and north of Tāmralipti, including the modern districts of Bardwan, Hugli, Nadiā and part of 24-parganās.

Most of the references name Tāmralipti separately from Suhma; and, therefore, they were two distinct countries. But *Raghuvamśa* omits Tāmralipti; while the *Daśa-kumāra-carita* locates Dāmalīpti town among the Suhmas. It would seem, therefore, that at a later time both formed one kingdom. Yuan-chwāng in his *Records* and *Life* omits Suhma; which might have been then included in the large kingdom of Karna-suvarṇa. Still later, the name Suhma disappeared in the Rādhā. Nilakanṭha in commenting on Bhīma's conquest in Eastern India (Sabhā-P^o) remarks *Suhmāḥ Rādhāḥ*.

The early Mussalman governors were not apparently in possession of Suhma. The most powerful of the Khalj chiefs, Huṣam-ud-dīn

¹ Kielhorn's Ed., II, 231.

² MBh., Ādi-P^o, CIV, 53, 55 (origin from the sage Dīrghatamas), CXIII, 29 (Pāṇḍu's Conquest); Sabhā-P^o, XXVII, 21 (Arjuna's conquests), XXX, 16, 25 (Bhīma's conquest); Karna-P. VIII, 19. HV., Harivaṃśa-P^o, XXXI, 34, 42; Bhaviṣya-P^o, XLVI, 49.

³ Besides the above, *Bṛhat-saṃhitā*, V. 37, XIV. 5, XVI. 1; Parāsara, quoted in Utpala's commentary on *Br. Saṃ* XIV, 5; various Purāṇas, such as *Mārkaṇḍeya*, *Vāyu*, etc.; *Daśa-kumāra-carita*, 6th *ucchāsa*, pp. 155, 177.

⁴ *Raghuvamśa*, IV, 35.

'Iwaz, had at the southern end Lakhn-or which was not far south, lying at a distance of ten days' journey from Debi-kot, Dinājpur district. Lakhn-or continued to be the southern-most town in the time of 'Izz-ud-dīn Tughril-i Tughān Khān (642 H.), and evidently, too, of Ikhtiyār-ud-dīn Yūzbuk-i Tughril Khān (circa 647 H.).¹ Before the end of seventh century Hijra, the tract must have been annexed, as we find at Tribeni Zāfar Khān's mosque dated 698 H., and Madrasah, dated 1st Muharram 713 H. (28th April 1313 A.D.).² About 731 H., in the time of the Delhi Emperor Tughlak, Bengal was subdivided, and this portion must have been included in the south-western division with the seat of government at Satgāon. Shortly after reunited, the tract followed the varied course of Bengal history. Sher Shāh Sūr divided Bengal into separate provinces with a separate governor for each, all controlled by Kāzi Fazilat³; but the names of these divisions and governors are not known. The separate governorship was abolished by his son. In Todarmal's rent-roll, this tract was comprised in sarkārs Satgāon, Sharifābād and Sulaimānābād.⁴

Nothing is known about the old capital of Suhmas. A scholiast on Pāṇini VI, 2, 89 gives the formation *Suhma-nagara*. In the *Parvana-*

dūtām of the 4th quarter of the twelfth century, Vijayapuri on the Bhāgirathi is said to be the capital of Suhma (verse 36).⁵ It is probably another name of Nūdiāh, mentioned as the seat of government of Lakṣmaṇasena, at the time it was sacked by Muḥammad-i Bakht-yār (A.D. 1199).⁶ Lying at the confluence of the Khariā and the Bhāgirathi, the town had exceptional advantages, being within convenient reach of Vaṅga, Gauḍa, and Puṇḍravarddhana. It was left desolated by the Khālj invaders. By the end of the thirteenth century, the head-quarters had been removed to Satgāon including Tribeni, for which see Rāḍhā.

IV. RĀḌHĀ.

The name can be traced to a pretty old time. In the *Āyā-rāṅga-sūta*, ranking among the oldest Jaina scriptures, the Mahāvira "travelled in the pathless countries of the Lāḍhas, in Vajjabhūmi and Subbbabhūmi; he used there miserable beds and miserable seats (2). Even in the faithful part of the rough country, the dogs bit him, ran at him (3). Few people kept off the attacking, biting dogs. Striking the monk they cried *chu-chū*, and made the dogs bite him (4). Such were the inhabitants. Many other mendicants, eating rough food in Vajjabhūmi, and carrying about a strong pole or a stalk (to keep off the dogs) lived there (5). Even thus armed they were

¹ *Tab. Nāṣ.*, Raverty.

² J.A.S.B., 1870, p. 287.

³ *Tārīkh-i Sher-Shāhī*, Elliot, IV, 391.

⁴ *Ain-i Akb.*, Jarrett, II, 139-141; J.R.A.S., 1896, pp. 96-105.

⁵ J.A.S.B., 1905, pp. 45, 58.

⁶ *Tab. Nāṣ.*, pp. 554, 557-8.

bitten by the dogs, torn by the dogs. It is difficult to travel in Lāḍha (6).¹ This Lāḍha has been reasonably identified with Rāḍhā and Subbhābhūmi with Suhma.² Vajjabhūmi, so graphically described, is the rough jungly part on the west. Furthermore, in the fourth upaṅga, *pannavanā*, the Āriyas or sacred lands included *Koḍivarisaṃ va Lāḍhā* (variant, *Lāṭā*),³ by which is probably to be understood Rāḍhā.

Again in *Dipavaṃsa* (Ch. IX) and *Mahāvamsa*, the Ceylonese Buddhistic chronicles of the 4th and 5th centuries, Ceylon is said to have been colonised by Vijaya, who came from

Siṃhapura in Lāla. This Lāla has been, on good grounds, identified with Rāḍhā.⁴ So these traditions, Jaina and Buddhistic, about Rāḍhā existed before the birth of Christ; and if the traditions have any historical basis, a country in East India with this name existed in the fifth century B.C. at least.

Curiously enough, the name is not traceable in the epics (unless hidden under some *alias*, e.g., Karvata or Lāṭa), or in any Sanskrit records before the tenth century A.D. The earliest

Mediæval period.

mention is in a Khajurāho inscription, where the wives of the kings of Kāñci, Andhra, Rāḍhā and Aṅga are said to have been imprisoned by the Chandella Dhaṅgadeva (middle of the tenth century).⁵ The next mention is in two Tamil rock inscriptions of Tirumalai and a Tamil inscription of Tānjore,⁶ which record that Rājendra-Coladeva, *alias* Parakeśarivarman, conquered *Takkana-lāḍam* of Raṅasūra and *Uttira-Lāḍam* (of Mahipāla?). This alleged conquest of south and north Rāḍhā took place before the twelfth year and after the tenth year of the king, *i.e.*, between 1021-1023 A.D. The name Raṅasūra introduces a king of a new dynasty, hitherto known only in the genealogical lists of Bengal match-makers.⁷

In the drama *Prabodha-candr-odaya* of Kṛṣṇa Miśra (beginning of twelfth century), the tract *Dakṣiṇa-Rāḍhā* is mentioned twice (Canto II, pp. 52 and 59, after vv. 2 and 8),³ and the *Rāḍhā-purī* is said to be in Gauḍa (p. 58, v. 7). In Halāyudha's *Brāh-*

¹ S.B.E., XXII, Bk. I, Lect. 8, Lesson 3, pp. 84-5.

² S.B.E., XXII, Bk. I, Lect. 8, Lesson 3, p. 84, Jacobi's note 1.

³ Weber, Sacred Literature of the Jains, Ind. Ant., XX, p. 375. Is *Koḍivarisaṃ* same as *Kotivarsa*, a *viṣaya* of Puṇḍra-varddhana?

⁴ Burnouf, E. Muller, Ind. Ant. XI, 198, note 2, XII, 65; E. Kuhn, Ind. Ant. XII, pp. 54-5; Jacobi, p. 84, note 1 (above). The mother of Vijaya is said to have been a princess of Vaṅga.

⁵ Ep. Ind., I, 138.

⁶ South-Indian Inscriptions, Vol I, p. 96; II, 106-7.

⁷ According to the *Kula-Pañjikās* of the match-makers, the following kings with the title Sūra reigned:—Ādisūra, Bhūsūra, Kṣitisūra, Avanisūra, Dharanisūra, Dharasūra, Raṅasūra.—*Gauḍe Brāhmana*.

Rāḍhā is also mentioned in the Bhuvaneśvara inscription of Vāsudeva temple, *Rāḍhā-śriyaḥ* (I 3, Ep. Ind., VI, 205), and the Eastern Gaṅga plates of Orissa, *Rāḍhā-Yavana* (J. A. S. B., 1896, pp. 144, 250).

⁸ *Dakṣiṇa-Rāḍhā-pradeśa*? (N.S.P. Ed.).

maṇa-Sarvasva, *Rādhīya-Vārendras* are several times referred to.¹

These references show that *Rādhā* had, by the eleventh and twelfth centuries, been applied to an extensive country, which was divided into two tracts, south and north. The country apparently then included Suhma parts of Gauda proper, and Tāmrālipti, the Ganges and its Bhāgirathi branch forming the eastern boundary.

This description is confirmed by the accounts given in the *Mussalman period*. *Tabakāt-i Nāširi*. "The territory of Lakhanawaṭi has two wings on either side of the river Gang. The western side they call Rāl [Rārh], and the city of Lakhan-or lies on that side; and the eastern side they call Barind [Barindah], and the city of Diw-koṭ is on that side."² "Tughril's name became great, and both sides of the country of Lakhanawaṭi—the one part which they style Rāl which is towards Lakhan-or, and the other is named Barind on the side of Basan-kot—became one, and came into Malik Tughril's possession."² The Rāl of this writer evidently refers to northern Rādhā. The Rādhā, north and south, would be comprised roughly in sarkārs Mandārau, Sharifābād, E. Sulaimanābād, N. Satgāon, Audumbar and Lakhnauti of Todarmal's rent-roll.

The capital of old Rādhā is not known. The traditionary Sīmhapura cannot be located. Koḍivarisam resembles Koṭivaraṣa, a *viṣaya* in Paundra-varddhana. Coming lower down, the *Prabodha-candrōdyā* places Rādhā-purī in Gauda.³ In the map of De Barros, Rara is put on the west bank of the Ganges, opposite Gouro; and Blaev (165a) shows in the same place Para, probably a mistake for Rara. The name disappears from subsequent maps, and can not be traced in Todarmal's mahals.

On the other hand, Tribeni, mentioned in the *Pavana-dūtam* as the place where the branches separated,⁴ rose into more importance. By the time Zāfar Khān's mosque (698 H.), and Madrasah were built, it must have been the head-quarters of the local governor; and soon after the adjoining town Satgāon became so important as to be selected for a mint. The earliest existing coin with this mint was struck in the name of the Delhi emperor Tughlak and is dated 730 H. The head-quarters continued there till Akbar's time, when a change in the river courses forced its removal to Hughli, six miles down.⁵ The mint at Satgāon disappeared by the end of fifteenth century.

¹ Sanskrit Literature in Bengal during the Sena Rule, J.A.S.B., 1906, p. 176, note 3.

² Raverty, pp. 584-6, 737.

³ *Gaudam nāṣṭram-anuttamam nirupamā tatr-āpi Rādhā-purī*, Canto II, 7, p. 58.

⁴ J.A.S.B., 1905, pp. 44, 58, verse 33.

⁵ Sarkār Satgāon and Arsā Satgāon, Jarrett, II, 124, 149-1; J.R.A.S., 1896, 102-105. Ruins described by Blochmann, J.A.S.B., 1870, p. 280.

V. VARENDRA.

Varendra is spoken of in contrast with Rādhā. The name must be older than the Sena rule, as it is mentioned several times in records of that time. In the Kamauli plate of Vaidyadeva (? 1142 A.D.), the donee Śrīdhara's grandfather Bharata appeared in the village Bhāra in Vārendri.¹ Vijayasena's inscription of Pradyumneśvara temple (middle of the twelfth century) was engraved by the Rāṇaka Śūlapāṇi, the crest-jewel of the guild of Vārendra artists.² In the *Dāna-sāgara* of Ballālasena (1169 A.D.) his guru Aniruddha is described as famous in Varendri tract.³ *Rādhīya-vārendraik* have been several times referred to in the *Brāhmaṇa-sarvasva* of Halāyudha (fourth quarter of the twelfth century).⁴

In the Mussalman period, the extracts from *Tabakāt-i Nāsiri* show that Varendra lay to the east of the river Ganges. The Yavana females of Rādhā and Varendra are mentioned in the Eastern Gaṅga plates of Orissa, indicating that in the time of Narasimhadeva I⁵ (1238-1264) Varendra and Rādhā (N. Rādhā) had been in the possession of Mussalmans. The eastern boundary was evidently the Karatoyā river, and the southern the Padmā. The northern boundary was ill-defined, but in the *Tab. Nās.*, Diw-kot, modern Debi-kot parganā of Dinājpur District, is said to have been within it. In the Brahmāṇḍa section of the *Bhaviṣyat Purāna*, Varendra is described as lying east of Padmāvati, and containing towns: Pudiḷā near the Nārada river; Nātāri (mod. Nātore); Capalā on the Varalā; Kākamāri; and Syamataka on the Calana Bil.⁶ Roughly, the tract comprised sarkārs Bārbakābād and W. Bazūhā of Todarmal's rent-roll.

Nothing is known about the head-quarters of this tract, although it was of such importance in old days as to give rise to a distinct class among Brāhmans, Kāyasthas and other castes.

VI. TĀMRALIPTA.

This name, under various forms, appears in works of the epic period. Originally it formed a part of Suhma or Vaṅga, for it is not mentioned in the group of five tribes said to have been descended from the sage Dirghatamas. But later on it formed a separate tribe, as is evident from the references in the *Mahābhārata* and

¹ Ep. Ind., II, 352, ll. 37-8, *Bhāva-grāme pravisara-yasāh śasan-ogre Varendryām.*

² Ep. Ind. I, 311, l. 32, *Cakhāna Vārendraka-śilpi-goṣṭhī-cudā-manī Rāṇaka-śūlapāṇih.*

³ J.A.S.B., 1906, p. 158, note 1, *śāghyo Varendri-tale.*

⁴ J.A.S.B., 1906, p. 176, note 3.

⁵ J.A.S.B., 1903, pp. 120-123.

⁶ Ind. Ant. XX, p. 420.

[N.S.]

Harivaṃśa.¹ In Bhīma's conquests (Sabhā-P^o), it is placed between Vaṅga on one hand and Karvṛata with Suhma on the other.

The *Records* and the *Life* of Yuan-chwang² describe *Tan-mo-lih-ti* (Tāmra-liptī), he having travelled westwards over 900 li from *San-mo-ta-t'a* (Samatata). The country was about 1,400 li in circuit, and therefore not a large one. The land was low and moist, forming a bay where land and water communications met. The climate was hot. By good farming fruits and flowers abounded. The inhabitants were generally prosperous (by trade), having many rare valuables. Though their customs were rude, they were courageous. Of Deva temples there were more than 50, and of Buddhist monasteries above ten with more than 1,000 brethren. Besides Buddhists, there must have been Nigranthas, as in the list of Jaina Sthaviras, the first *sākhā* or branch of the ancient Godāsa Gaṇa was named Tāmraliptika.³ The Chinese pilgrim Hiu-en-ta calls it "the southern district of E. India."

The country was evidently included in the empire of Śāsāṅka, and after Śāsāṅka of Harṣa, for the empire of both extended southwards up to Koṅgeda or Gaḷjām. In the *Viṣṇu-purāṇa* (IV, xxiv 18),⁴ it is recorded "Devarakṣita will guard Kosālas, Odras, Tāmraliptas and the sea-coast town" (? sixth century). No further record has been found about the separate existence of Tāmralipta as a kingdom.

More famous was the capital, after which the country and

Capital.

the people were evidently named. It is frequently mentioned in Jaina, Buddhist, Brahmanical and other works. It must have existed before the birth of Christ. Ptolemy noticed *Tamalites* in his geography as being on the river Ganges (BK. VII, Cap. I, § 73); and McCrindle identifies it with the people Talucate named in Pliny.⁵ In the Jaina *Bhagava-i*, fourth upaṅga, *Pannavaṇa* (Sans.

¹ The references may be classified thus:—

- (i) Tāmralipta—MBh., Ādi-P^o, CLXXXVI, 13; Sabhā-P^o, XXX, 24, LI, 18. *Atharva-pariśiṣṭa*, LVI, 4. Cf. Parāsara, l.c., Utpala's commentary on *Bṛhat-saṃhitā* XIV, 5-7, and *Samāsa-saṃhitā*, Do. under XIV, 29-31.
- (ii) Tāmraliptaka—MBh., Bhīṣma-P^o, IX, 57; Drona-P^o, CXVIII, 10; Karṇa-P^o, XXII, 2, 21. HV., Bhaviṣya-P^o, XLVI, 55. Cf. Bharata's *Nāṭya-śāstra*, XIII, 34. *Vāyu-P^o* (Anandāśrama series), XLV, 123 (p. 139). *Mārkaṇḍeya-P^o*, (Bib. Ind. translation), pp. 301, 329, 330. *Br. saṃ.*, XIV, 7.
- (iii) Tāmraliptī—cf. *Br. saṃ.*, X, 14; Parāsara, l.c. comm., under X, 18.

² *Records*, Beal, II, 200-1; Watters, II, 189-190; *Life*, Beal, p. 132.

³ *Sacred Books of the East*, XXII, p. 288.

⁴ Also, *Vāyu-purāṇa*, XCIX, 385, (Punā Ed.) p. 385:—

Kośalāṃś-c = Anāhira-Paundrāṃś = ca Tāmraliptān sa-sāgarān |
Campān c = aiva purān ramyān bhokṣyanti Devarakṣitām ||

⁵ *Ind. Ant.*, XIII, 364.

Prañjāpanā), the nine groups of Āriyas included *Tāmalitti Vañgāya* (Tāmrālipti in Vañga).¹

The mediæval Buddhists, specially the Chinese pilgrims, mentioned the town several times as the port where merchants and others embarked for Ceylon and further East. Fa-hian described it as being "at the sea mouth," nearly 50 yojanas eastwards from Chen-po (Campā); and here he shipped himself for Ceylon on board a great merchant vessel.² According to the *Records*, the capital, above 10 li in circuit, was near an inlet of the sea. According to the *Life*, Yuan-Chwang consulted about going thence by sea to Ceylon, but was advised to go by land and thus to avoid the monsoon storms.³ I-ching landed here from China⁴; Hwui-Lun, the Corean, remarked: "This is the place for embarking for China from East India, and close to the sea."⁵ I-ching, Hwui-Lun and Hiu-en-ta⁶ put its distance from Nālanda monastery at 60 or 70 yojanas (stages).

In the story of Mitrāgupta, Dāmālipta is described as being among the Suhmas, close to the sea and not far from the Ganges, frequented by sea-going boats of Yavanas and others, and on the whole prosperous.⁶ That it was a centre of much trade with many merchants residing is clear from other references in Sanskrit⁷; and its position near the eastern sea is mentioned in the *Kathā-sarit-sāgara* (III, 4. 291, *Tāmrāliptikā*).

The above references speak of old times, the one in the inscription being not later than eighth or ninth century A.D. Since then the town must have deteriorated immensely, as it is not mentioned in any subsequent works surviving only in lexicographies.⁸ The old maps show Hijli as an island, with an inner channel passing near Tamluk.⁹ This channel was apparently much broader and deeper in old days, allowing the free access of large vessels to Tamluk. The channel silted up and has now disappeared; and with its deterioration Tamluk ceased to be a sea-going haven, while Hijli rose into importance. Political changes probably hastened its downfall. It was annexed to Orissan kingdom by the powerful

¹ Sacred Literature of the Jains, Weber, Ind. Ant., XX, p. 375.

² *Fo-kuo-chi*, Ch. XXXVII, Beal, introduction, p. lxxi.

³ *Life*, Beal, p. 13.

⁴ Takakusu, I-tsing, pp. 185, 211.

⁵ *Life*, Beal, introduction, p. xxviii. (Hwui-Lun), p. xxx, (Hiu-en-ta).

⁶ *Daśa-kumāra-carita*, sixth ucchāsa, (N.S.P. Ed.), pp. 155-163, 176-177.

⁷ Dadhpāni rock inscription of Udayamāna, line 3,—*Atha kasminñci [t=sa] maye vanijo bhātāras-trayah | Tāmalipti [ma=A]yodhyāyā yuyuh pūrevam-vanijyayā |* Ep. Ind., II, 345. *Tāmrāliptā*, *Bṛhat-kathā-mañjārī*, Lambaka III, story third (Devasmitā), vv. 167, 173, 185; Lamb. IX, story fourth (Vinayavati), v. 139; Lamb X, story eighth (Kesaṭa), v. 209. *Tāmrālipti*, *Kathā-sarit-sāgara*, Lamb. II, Taraṅga fifth, v. 54; Lamb. XII, Tar. xiv. (Vetāl seventh), v. 58.

⁸ Hemacandra, 979,—*Tāmaliptam Dāmāliptam Tāmalipti Tamālini Tri-Kāṇḍa-śeṣa*, II. 191, *Velūkūlam Tāmaliptam Tāmalipti Tamālikā*. The last synonym, *Tamālikā*, might have given rise to modern Tamluk.

⁹ De Barros. (1553-1613); Blaeu (1650). In Valentyn's map the channel is not shown, having been nearly silted up. It is the first map to name Tamboli. In Rennell's Atlas, plate VII, it is shown as Tingercolly river.

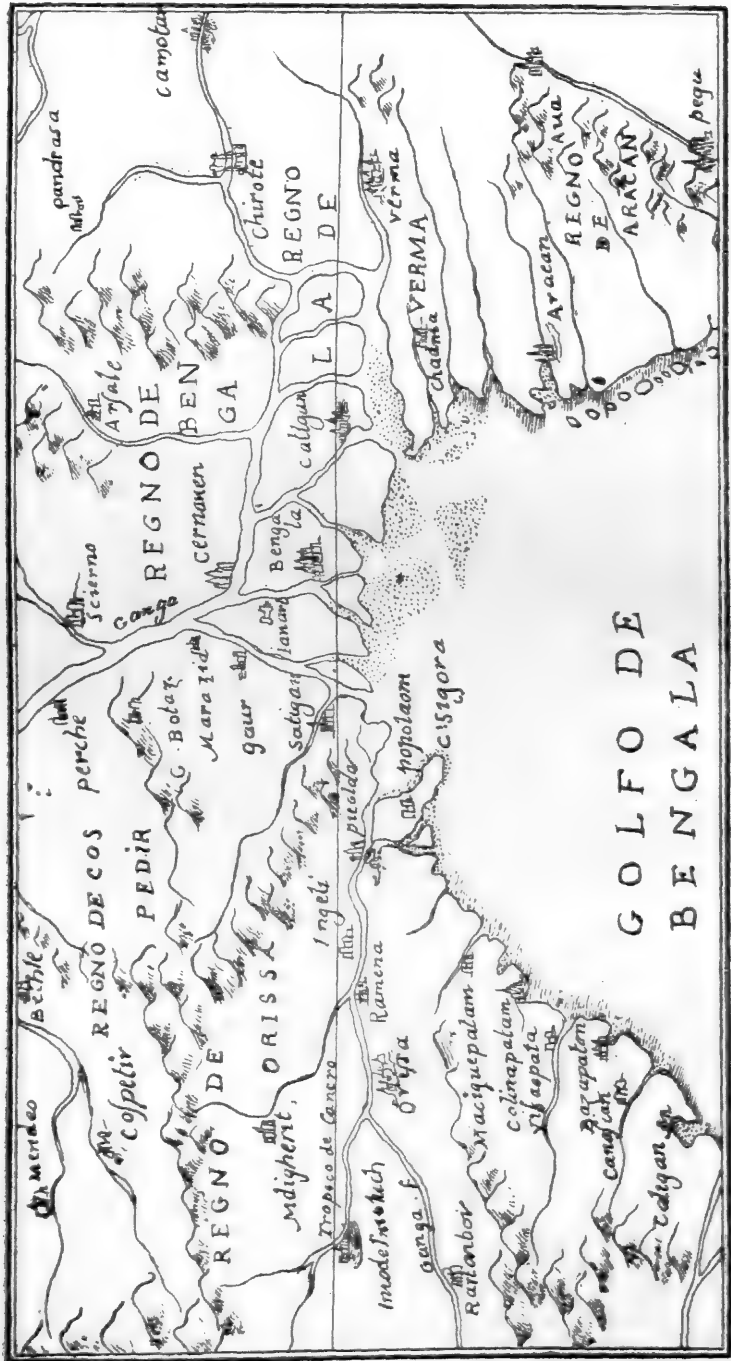
Gaṅga kings, and thus became a frontier town, far from the capital. It would naturally be looted first in every war with neighbouring kings; and the distance from the capital with the unsettled state of the country encouraged river pirates and land dacoits. The trade in this way dwindled until it became a shadow of its former self. Not improbably the river encroached and swallowed up the town or the greater part of it, thus giving the finishing touches.

Tāmbūlak appears as a mahal of sarkār Jalesar in Todarmal's rent-roll, with the note "cavalry 50, infantry 1,000, has a strong fort, Khandait"¹ in charge. The Portuguese appear to have occupied it for some time²; and for their piracy in the Ganges, notorious in those days, it would have afforded a good base. The present zemindār of Tamluk claims to be twenty-sixth in descent (fifteenth in direct descent) from a Kaivartta chief named Kālu Rāya.³ He must have got the zemindāri after the rent-roll, in which a Khaṇḍait is mentioned as the landlord.

¹ *Ain-i-Akbari*, Jarrett, II, 142. Correct Tāmbulak for its Tanbūlak, Beames, J.R.A.S., 1896, p. 749

² Dr. John Francis Gemelli Careri, *A Voyage Round the World*, in Church-hills' Collections of Voyages and Travels, Vol. IV., p. 109. "The Portuguese further subdued the city and fort of *Negapatam* in the kingdom of *Madure*; *Tambulin* in the kingdom of *Bengala*; and *Macassar* in the kingdom of that name."

³ Babu Sriscandra Ghoṣa, *Sāhitya-pariṣad-patrikā*, IX, pp. 54-55, giving a list of ancestors.



GOLFO DE BENGALA

SECTION FROM GASTALDI'S MAP OF ASIA, A.D. 1561

MAY, 1908.

The Adjoined Meeting of the Medical Section was held at the Society's Rooms on Wednesday, May 13th, 1908, at 9-15 P.M.

LIEUT.-COLONEL G. F. A. HARRIS, I.M.S., in the chair.

The following members were present:—

Dr. A. S. Allan, Captain F. P. Connor, I.M.S.; Dr. H. M. Crake, Lieut.-Colonel F. J. Drury, I.M.S.; Lieut.-Colonel C. R. M. Green, I.M.S.; Dr. E. A. Houseman, Captain J. G. P. Murray, I.M.S.; Major F. O'Kinealy, I.M.S.; Dr. J. E. Panioty, Major J. C. Vaughan, I.M.S.; Major L. Rogers, I.M.S., Honorary Secretary.

Visitor:—Captain F. A. F. Barnardo, I.M.S.

The Minutes of the last meeting were read and confirmed.

Captain Connor showed cases of a peculiar rash and of papellema and epithelima.

Captain Connor showed also some clinical cases.

Captain F. A. F. Barnardo, I.M.S., read a paper on "Some cases of puerperal eclampsia with suggestions for its treatment," postponed from February meeting.



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32. The Use of the Abacus in Ancient India.

By G. R. KAYE, *Bureau of Education, Simla.*

It has frequently been stated that the abacus was in common use in ancient times in India, and upon this supposed fact elaborate arguments have been built and theories founded; but it appears that these statements, although made by undoubted scholars, are not well authenticated; and it is proposed in this note briefly to examine them.

Sir E. Clive Bayley writes: "It need hardly be said that the use of the abacus is still common in every village bazar in India,¹ and has been universal apparently from time immemorial" (*Journ. Roy. Asiatic Soc.*, xiv, p. 14). Again he says (xv, p. 12): "Another example of the Roman abacus is a still nearer approach to the common form of the abacus usually employed at this day in India, China and Russia, being a frame of wood on which the lines themselves are represented (as in the Indian instrument) by wires."

Rodet writes: "En voyant l'usage du 'tableau à colonnes' répandu surtout en Perse et particulièrement dans la Khorāsān, tout à côté de l'Inde, je serais porté à croire bien plutôt que l'usage de ce tableau a été emprunté par les Persans orientaux aux Indiennes en même temps que l'usage des chiffres" (*Journ. Asiatique*, xvi, series vii, p. 463). Rodet again suggests (*Journ. Asiatique*, 1880) that Āryabhaṭa may have effected his calculations by means of the abacus, while the works of the learned Woepcke are largely concerned with the development of the science of arithmetic and our modern notation by the Indians from the use of the abacus (*Mémoire sur la propagation des chiffres indiens en Occident* and *Sur l'introduction de l'Arithmétique indienne en Occident*, etc.).

Burnell tells us that "the Indian abacus was by using heaps of cowries for the numbers, the number of these shells being equal to that of the number expressed, the cipher being a blank space. Thus $\cdot\cdot || \cdot\cdot = 303$; $\cdot\cdot | \cdot\cdot = 33$." He adds: "Warren (*Kala Sankalita*, p. 334) mentions a counter to express the cipher, but I have never found this to be done" (*South Indian Palæography*, p. 62).

¹ This is by no means true.

In 1825, Warren wrote (*Kala Sankalita*, p. 331) : " I had often read and heard of the singular process by means of which the common Indian almanac-makers computed eclipses, scoring their quantities with shells, instead of writing them in figures : and dispensing with the use of tables by means of certain artificial words and syllables. After a long search for one of these mechanical computers, a person was introduced to me by my venerable friend Abbé Mottel. . . . With regard to his calculating with shells and counters (the latter representing zeros) it amounts to nothing more than scoring any number of points when playing at cards with similar articles, but on a larger scale." Warren then gives the following "numerical account of the sounds" which were used in conjunction with the shells and counters to effect certain calculations :--

NUMERICAL ACCOUNT OF THE SOUNDS.

- 1 Ka, Tha, Pah, Ya or Yum, Kiah, Wia, Staha, Nuim.
- 2 Kha, Thaha, Paha, Rra, Ra, Ri.
- 3 Gheu, Dheu, Bheu, La, Kla.
- 4 Gaha, Dhaha, Baha, Va, Ve, Kooa.
- 5 Ghank, Nanh, Ma or Mun, Na, Sa.
- 6 Tsha, Ta, Tou, Shah, Utsha, Cshe, Recshe.
- 7 Tshaha, Taha, Saha, Za.
- 8 Dja, Deheu, Ha, Hi, Dheua, De.
- 9 Djiha, Dhaha, Lhah, Dha.
- 10 Guia, Na, Ni, Rno, A (the last, or zero, being always expressed with a counter).

He explains the use of this notation, which is the well-known alphabetic¹ notation somewhat modified, as follows : "When a regular technical term is too short to be split into as many syllables as the quantity which it expresses contains of digits, then they lengthen it at pleasure and construct by that means a *memorial* word which answers their purpose. This will be exemplified in the following exposition of the elements of the Vakiam process :--

The Vedam	...	Ve-do-da-Gnia-na-tou-Staha.
The Raza Gherica	...	Ra-za-Gheu-ri-ca.
The Kalanilam	...	Ka-la-ni-la.
The Devaram	...	Dheu-va-ra.

¹ As explained in my previous article (Journ. Asiatic Soc. Bengal, 1907, p. 479) the numerical values of the letters are—

1	2	3	4	5	6	7	8	9	0
k	kh	g	gh	ñ	c	ch	j	jh	ñ
t	th	d	dh	n	t	th	d	dh	n
p	ph	b	bh	m	...	...	...	...	...
y	r	l	v	ś	ṣ	s	h	l	...

Warren's table contains in all 56 symbols : perhaps the extra symbols are intended to correspond to the vowels, Ansuvara, etc.

These syllables they expound by inverting their arrangement, beginning with the last, and ending with the first; and scoring from the right, thus:—

Staba • tou ●●● Na ○ Guia ○ Dha ●●●●● Do ●●●●
 Ve ●●—a Vedam or 1600984 days.

Ka ● Ri ●● Gheu ●●● Za ●●●● Ra ●●—a Raza Gherica or
 12372 days.

La ●●● Ni ○ la ●●● ka ●—a Kalanila or 3031 days.

Rra ●● Va ●● Deheu ●●●●—a Devaram or 248 days."

Sir R. Temple (*Ind. Ant.* xxvii, p. 19) quotes an interesting example from rural Siam, but the calculator was of Chinese origin and had evidently learned the use of the *suapan*; and we naturally enough find similar examples of the occasional use in India of the abacus or its principle in modern times.

Of the examples quoted above, the modern ones are of little value. They, unless supported by more ancient examples, only show that the abacus is a foreign importation into India. Warren's supposed example (it really has nothing to do with the abacus) is of interest on account of its connection with the old Indian alphabetic notation. Burnell appears to have seen the principle used, but his citation is no evidence of its use in ancient India. Rodet gives no reference to the actual use of the instrument in India but infers that, because it was used in Persia and Khorāsān, it must have been borrowed from India, at the time of the introduction from India of our arithmetical notation! But it is even doubtful whether our modern notation was ever introduced from India (see *Journ. Asiatic Soc. Bengal*, 1907, p. 457 f.).

Woepeke on this point, and many others, was probably misled by the writings of the early orientalists; but, presumably, Bayley had some authority for making his general statement. He says that the use of the abacus has been universal in India apparently from time immemorial, but this statement is supported only by the reference of Rodet quoted above; and one can only conclude that Bayley did not comprehend the facts of the case. However, he even gives an illustration of the supposed Indian abacus, but this illustration has very much the appearance of a copy of the instrument that was a common ornament of the elementary schools of England in the middle of last century. Also Bayley writes further on the subject (xiv, p. 35) as follows: "The common Sanskrit term for the instrument seems to be *pāṭī*, which signifies 'a board' or 'calculating board'; but the exact derivation is not given with certainty in any dictionary which it has been possible to consult." Of course the meaning of *pāṭī* is well known, but it is no more an abacus than is the ordinary school slate to which it corresponds. As Mr. Dikṣit tells us (*Ind. Ant.*, xx, 54): "Hindu astrologers use a wooden plank, which they cover with dust. This plank is called *pāṭī*, hence arithmetic is called *pāṭīganita*." Because one form of the abacus consisted of

a tray covered with sand, Bayley concluded that the *pāṭī* was an abacus. In this he was altogether wrong for, as is well known, the *pāṭī* was, and is, simply a board for writing upon.

Bayley goes a step further and attempts to show that the Greek abacus was possibly obtained from India. "Perhaps," he says, "in the Greek form of the name of this instrument some trace exists of the use of 'aksharas' 'Αβαξ would thus in Greek mean 'speechless,' 'wordless,' or 'non-phonetic'—surely a very appropriate term¹ for a silent mode of calculation which succeeded the phonetic 'aksharas.'" But unfortunately for Bayley's argument, the phonetic 'aksharas,' in the sense used by him, never existed except in the imagination of some rather rash orientalist. Bayley's most learned article on the *Genealogy of Modern Numerals* largely deals with the use of the abacus; and unless it can be shown that this instrument was in common use in ancient India, all his eloquent reasoning is worthless.

There is an interesting and rather important question dependent upon the supposed use of the abacus in ancient India. This question relates to the origin of the 'zero' and of the term *cipher*. Taylor, Woepeke, Bayley, Burnell and others derive the Sanskrit numerical words that signify *zero* from the use of the abacus. These terms, they say, indicate the space not filled up by a counter, the 'place vide' of the 'tableau à colonnes.' All these terms indicate *emptiness*, or the *sky*, *ether*, etc., and may rationally enough be supposed to be connected with the abacus. As a corollary to this idea the term *cipher* is derived from *śūnya* through the Arabic.² "In Sanscrit," wrote Taylor in 1816, "the word *śūnya* signifies a circle, cipher, or vacuity; and the Arabs, on receiving the numerical notation from India, translated it by the word *syfr*, which in their language also means emptiness, vacuity, or nothing" (*Lilawati*, p. 11). Woepeke, Bayley and others repeated this statement which is commonly accepted as correct³ although it may be noted that according to Taylor the origin of the technical use of the word depends upon the *Arabs having received their numerical notation from India*, which is an altogether unwarranted assumption. On this point Bayley writes: "What has been said as to the intrinsic meaning of all the Indian names or 'aksharas' for zero, and the probable connexion of the idea which underlies them all with the 'place vide' of the 'tableaux à colonnes,' need not be repeated, though of course, this evidence affords in itself a strong argument in favour of the Indian origin of the sign—an argument

¹ "This name," writes Gow, "seems to point to the common *semitic* word *abaq* meaning 'sand,' and it is said that a board strewn with sand, on which lines might be drawn with a stick, was, and still is, a common instrument for calculation in the East [*Short History of Greek Mathematics*, p. 29].

² The term *śūnya* does not occur with this technical meaning in any Indian inscriptions before the 11th century A.D. at the earliest.

³ Dr. Murray's *New English Dictionary* has "cipher fr. Arab. *صفر*, *ṣifr*, the arithmetical symbol 'zero' or 'nought' a subst. use of the adj. *ṣifr*, 'empty,' 'void' f. *ṣafara*, 'to be empty.' The Arabic was simply a translation of the Sanskrit *śūnya*, literally 'empty.'"

which is still further supported by the manifest derivation of all the European terms for this sign from the Arabic word *صفر* (*ṣifr*), which it need hardly be said is itself a direct and literal translation of the Sanskrit 'śūnya.' It has the exact intrinsic meaning, in fact, of *śūnya*, and since, as it has been shown, the new Arabic arithmetic was avowedly derived from the Indian, the derivation of *ṣifr* from *śūnya* is beyond doubt" (xv, p. 39).

Enough has been said to show the importance attached to the use of the abacus in ancient India. At least the origin of our arithmetical notation and the development of the science of arithmetic appear to depend largely upon it. It will also be noted that the debt that the Arabs are said to owe to Hindu mathematicians is closely connected with the subject.

If our notation was not of Indian origin, and if the Arabs did not derive their arithmetic from the Hindus, then the whole of the elaborate arguments given by the writers referred to above fall to the ground. As a matter of fact the debt of the Arabs to the Hindus in this matter has been very much exaggerated, and possibly the debt is on the other side; also it has been shown that the Indian origin of our notation is, at least, not proven (Journ. Asiatic Soc. Bengal, 1907, p. 475 f.).

Surely, if such an instrument as the abacus were in use in ancient India some real evidence of its use would be forthcoming. Perhaps some readers of this journal may be able to produce such evidence.



33. Certain Unpublished Drawings of Antiquities in Orissa and Northern Circars.

(With two Photos).

By MONMOHAN CHAKRAVARTI, M.A., B.L., M.R.A.S.

These drawings I have lately discovered in the library of our society. They are in two folios and relate to sculptures and architectural details of temples. Though nearly a century old, they do not appear to have been ever before described. A brief description of their contents might therefore help future references.

The two folios belong to the remarkable collection of coins, drawings, manuscripts, and historical or ethnological reports gathered by Lieutenant-Colonel Colin Mackenzie, some time Surveyor-General of India.¹ When he died at Calcutta in 1821,² Professor Horace Hayman Wilson was deputed to report and took charge of the collection. The greater part of it are now deposited in the Indian Museum, Kensington, London. The Sanskrit MSS. lie in the India Office Library, while a number of other manuscripts are said to be in the Presidency College, Madras; and eleven folios of drawings with a number of miscellaneous papers enriched the Library of the Bengal Asiatic Society, having been received in December 1822.³ The whole collection was ultimately bought by the Government for a lakh of rupees; and Mr. Wilson gave a summary of the whole collection.

Wilson's list shows in the collection 2,630 original drawings, 554 duplicates, and 46 triplicates.⁴ The two folios dealt with in this article correspond to his Nos. 7 and 8, having the common heading "Hindu Antiquities in Orissa, etc."⁴ No. 7 is said to have 78 originals and 78 duplicates, and No. 8, 32 originals and 32 duplicates. In the Asiatic Society's Library, the larger folio (A) has 32 duplicates, and 2 originals; the smaller-sized folio (B) has 77 pages of original

¹ For a brief biography of Lieutenant-Colonel Mackenzie, see Sir A. Johnstone, J.R.A.S., O.S., I, p. 333; and the introduction of Mr. Wilson to "Mackenzie Collection" (Calcutta 1828, Madras Reprint, 1882).

² He died on 8th May 1821, aged 68, and lies buried in the great burial yard of South Park Street Cemetery.

³ Centenary Review of the Asiatic Society of Bengal, Part I, p. 23. "Ten" therein is apparently a misprint for "eleven"; see Bion's Catalogue of Books in the A.S.B., pp. 183-4. They have been included in books, though as drawings one would have expected them in the catalogue of painting, etc.

⁴ Mackenzie Collection, Wilson, p. 581.

drawings, or 85 originals, some of the pages having two drawings in one page. The originals of (A) and the duplicates of (B) are probably in the Kensington Museum, London.

Most of the drawings, original or duplicate, bear dates of drawings, and in duplicates also the dates of copying and the names of the copyists.

Names of Copyists.

From them I gather that the drawings were made in 1815, and that the party making the drawings travelled from Jājpur, Cuttack District, southwards to Āmreṣwaram near Bezwāda, Kistnā District. The earliest date of the original drawings is one of Jājpur, 7th March 1815, and the latest of Āmreṣwaram, 15th September 1815. The duplicates were made four years later, and range from 18th February 1819 to 1st July 1819. They were copied by J. H. Shanks (Schenks, Schencks), A. McPherson (A. McP.), Shaikh Najibullah (Najibellah), Peareelaul (Pearalall), J. Mustic, J. Gould, Sheik Abdalla (Abdulla), and J. Dumbleton. The originals bear no names of the artists, except two in (A) and one in (B) which have J. Newman. On classifying them according to places, the following facts are found:—

Names of Places, and Dates of Drawings.

Place.	Number.	Dates of Drawing.
1 Jājpur, Kaṭak District	... 11(B)	... 7-iii-1815 to 21-iii-1815.
	11(A)	... 20 (or 21)-iii-1815; 16 and 17-v-(? iii)-1815.
2 Bhuvaneśvara, Purī District	... 27(B)	... 5-iv-1815 to 11-iv-1815.
3 Makundapur Do.	... 1(B)	... 12-iv-1815.
4 Purī Do.	... 8(B)	... 27 and 28-iv-1815.
	1(A)	... 28-iv-1815.
5 Kaṇārak Do.	... 2(A)	... 2-vii-(v ?)-1815.
6 Śrī-Kūrmam, Gañjām District	7(B)	... 2-vi-1815 to 13-vi-1815.
7 Mukhaliṅgam Do.	... 4(B)	... 15-vi-1815.
8 Coopully (?)	... 2(B)	... 19-vi-1815.
9 Śimhācalam, Viśagapatam District	... 7(A)	... 30-vi-1815 and 3-vii-1815.
	4(B)	... 2 and 3-vii-1815.
10 Yellamanchelly, Godāvārī District (?)	... 9(B)	... 16-vii-1815.
11 Beecalloo, Do.	... 3(B)	... 20-vii-1815.
12 Draṅṣārāma Do.	... 6(B)	... 21-vii-1815 to 28-vii-1815.
	1(A)	... 21-vii-1815.
13 Bezwādā, Kistnā District	... 6(A)	... 21-viii-1815.
	2(B)	... 21 and 22-viii-1815.
	2(A)	... Nil.
14 Sītānagar, Do. (?)	... 2(A)	... Nil.
15 Āmreṣwaram (temple), Kistnā District (?)	... 1(B)	... 15-ix-1815.
16 Places not named	... 4(A)	... No dates, except one 13-i (?) -1815.
Total	... 34(A), 85(B).	

All the drawings except one are uncoloured; some of the pillars in (A) are shaded brown. The one coloured figure is of a copper image at Makundapur near Pipli in Puri District. From the dates it would appear that the party were travelling southwards, probably when Lieutenant-Colonel Mackenzie joined Madras, as local Surveyor-General, in 1815. The copies were evidently done in Calcutta where he lived in 1819 as Surveyor-General of India. Some of the dates of original drawing given in (A) appear doubtful on comparison with those in (B).

Of the antiquarian objects drawn in these folios, several have been since photographed; and therefore their drawings are of little use except for comparison. Most of the drawings, however, relate to sculptures and architectural details, little known and as yet unpublished. Consequently they are worthy of attention from archaeologists. The drawings are carefully executed; and in spite of great ignorance of Hindu mythology (witness many of the headings), seem fairly accurate in the details. Similar drawings of Amrāvati sculptures in the London Museum were well spoken of by Fergusson in his "Tree and serpent worship" and by Dr. Burgess in his "Archæological Survey Report of South India, Vol. I."

Considering the scanty data available for old temples, any little additional light thrown by these sketches would be useful. For example, take the two drawings of Kanārak sun temple. The first shows a lion on a crouching elephant, both on a high plinth. During the present "restoration" of the sun temple, the position of the pair of lions was a *vexata questio*.¹ The pair have now been placed in front of the eastern doorway of the magnificent porch. Judging from the sketch in A (No. 6) this "restoration" appears wrong. The high plinth on which the lion stands, appears to be part of an enclosure wall, and according to the heading, the lion was in front of the north gate.² The *Ain-i Akbari* is also clear on this point.³ By analogy from other temples in Orissa having enclosure walls, these animal figures used to be placed at the gateways thereof (cf. the Liugarāja Temple, Bhuvaneśvara, and Jagannāth Temple, Puri).

The second sketch (No. 20 of A) shows apparently the flight of steps leading to the porch doorway, with carvings of two chariots and two horses (broken). It may be compared with the finely carved chariots laid bare by recent excavations. The two rows of

¹ Archæological Survey, Bengal Circle, Annual Report for 1902-03, Part II, p. 5, para. 5.

² "Figure of a lion upon an elephant in front of the north gate of the temple at Kunuarac near Juggernaut."

³ *Ain-i Akbari*, Jarrett, Vol. II, pp. 128-9. The enclosure wall "has three portals. The eastern has carved upon it the figures of two finely designed elephants, each of them carrying a man upon his trunk. The western bears sculptures of two horsemen with trappings and ornaments, and an attendant. The northern has two tigers each of which is rampant upon an elephant that it has overpowered."

lions and geese on the parapet are worth examination. Photos of the two Kanārak sketches are attached. As any light on this great temple would be welcome, I extract a passage from the *Mādālā pāñji* in Appendix C. It purports to give measurements of the temple in 1627 when almost entire. A discussion of the measurements will be left for a subsequent article.

Interesting informations regarding Hindu mythology are available from these drawings. For example the *sapta-mātṛs* or "seven mothers" can be studied from the three monolithic images and seven smaller images of Jājpur, or seven similar images on the Mārkaṇḍa tank, Puri, or the three "mothers" at Yellamunchelly. Two well-carved specimens of the Sun-god, one with seven horses and one with five horses, are given from Bhuvaneśvara-Siva, Pārvati, Gaṇeśa, Kārttikeya, Virabhadra and Viṣṇu in various forms and are shown in these drawings. Besides the gods, ascetics, kings, queens, *nāgas* and lions are also shown, while side figures of several kinds abound. In addition to sculptures, pillars of different types have

and of Pillars. The (B) folio is entirely devoted to Hindu figures; the (A) is also mostly Hindu, and has only towards the end four Jaina drawings. Many of the sculptures can no longer be traced, and the architectural details, where they exist, are in several cases more or less distorted by whitewashings and plasterings. Hence the drawings have a permanent value for the archæologist. Along with those in the other seven antiquarian volumes, these drawings will, I hope, be studied at leisure by some scholars and their best specimens printed, as was done by Fergusson and Burgess regarding the sculptures of Amarāvati.

A brief description of each drawing with all its headings, measurements and dates is given in Appendices A and B. The descriptions should not be taken as exhaustive; but are, I trust, sufficient for future identification and for giving a general idea.

APPENDIX A.

THE FOLIO CALLED A.

A bound book, binding loose, oblong, 1.5" × 11½". The label on the front board runs:—

"Journey from Bengal through the Wodia and Calinga Dasum to the coast of Coromandal, 1815."

The first nine leaves of the books are blank, then on a guard flap comes the tenth leaf with the first drawing and then follow folios, each having a drawing. Except one, all the drawings are large, and occupy three-fourths of the page lengthwise and often breadthwise.

1. (Heading) "Baharie." 9 ft. 8 in. × 5 ft. 10½ in.

Note.—Vārāhī, one of the seven mothers, with the face of a boar, a child on her left lap, and a

boar below as symbol. No name of the copyist or date of drawing. Statue now in the compound of the Sub-divisional Officer, Jājpur.

2. "Jumkemah." 5 ft. 2 in. × 2 ft. 4 in. "20th March 1815" in pencil. "Copied by J. H. Shanks, 20th February 1819."

Note.—The hideous sitting figure of Yama's mother, with the ribs visible, and ornaments on the forearm, arm, ear, neck and leg. Below, two devotees. This is one of the "mothers" kept in the terrace behind Jagannāth Temple, Jājpur.

3. "Durgah." 9 ft. 4 in. × 5 ft. 8½ in. "These figures are lying at the back of Baukerie-tomb on the left of the road opposite to the mosque." Copied by A. McPherson, 1819.

Note.—Indrāṇī, one of the seven mothers, crown on the head, ornaments on the neck, waist, arm, leg. The forearm and the right foot gone, cloth from the waist down to foot. The remains of legs of a child on the left lap, elephant below (*vāhana*). Now in the compound of Jājpur Sub-divisional Officer, removed from Bokhāri Shāh's tomb, opposite the court.

4. [No heading], 9 ft. 8 in. × 6 ft. "At Jehaujpoor, 21st March 1815." Copied by A. McPherson.

Note.—The hideous Chāmuṇḍā, with a necklace of skulls, broken at the sides and not continuous. The ribs and veins drawn in a fearfully natural way, left leg on the Mahādeva below, lying prone with folded hands. Now in Sub-divisional Officer's compound.

5. "Drawing of the Black Pillar in front of the Temple of Jagannath which is said to be about 40 ft. 26th April 1815." [Plinth] 9 ft. × 7 ft. 6 in. [Diameter of shaft] 4 ft. 11 in.

The well-known Sun-pillar, removed from Kaṇārak to Jagannāth temple toward the close of eighteenth century by the Guru Brahmachāri of the Marāṭhā Deputy. On the top is shown a tailed monkey (and not Aruṇa).

6. "Figure of a lion upon an elephant in front of the north gate of the Temple at Kunnaruc near Jagannath, 21st April 1815." [Plinth] 10 ft. × 6 ft. [and with the lion, high] 19 ft. Copied by Shaikh Najibella, February 1819.

This is one of the pair guarding the north gate of the enclosure wall. Now put in front of the eastern doorway of the porch by mistake.

7. "Figure of Nursinghee, commonly called by the country people the old man," 5 ft. 3 in. × 2 ft. 9 in. At Jehaujpoor, 16th May 1815.
 Viṣṇu in the incarnation of man-lion, crowned, maned, ornamented, palms gone, and lower part effaced. On his left lap a male (Hiraṇyaka-ṣipu demon?). In a frame, above which are Vidyādhara and Kinnaras (winged man-birds); at base corners, two females with fly-whiskers and in base centre two groups of devotees. Present location uncertain, possibly in the Varāhanāth Temple.
8. [No heading], 6 ft. 6 in. × 3 ft. 4 in. At Jehaujpoor, 16th May 1815. Copied by J. H. Schencks.
 Vaiṣṇavi, one of the seven mothers, crowned, ornamented, four-handed, the upper one holding wheel, the other conch shell, the lower right blessing and the lower left hold a child (head gone) on the left lap. Below *vāhana*, the winged human-faced Garuḍa. In the terrace behind Jagannāth's Temple.
9. [No heading], 6 ft. × 3 ft. 5 in. At Jehaujpoor, 17th May 1815. Copied by J. H. Schencks.
 Indrāṇī, cf. No. 3. In the terrace behind Jagannāth's Temple.
10. [No heading], 6 ft. 6 in. × 3 ft. 6 in. At Jehaujpoor, 16th May 1815. McPherson (in pencil).
 Kaumārī, one of the seven mothers, crowned, ornamented, four-handed, the two upper holding a club and a trident, the lower right gone, probably blessing, the lower left holding a son on the left lap. The *vāhana*, a peacock below. In the terrace behind Jagannāth's.
11. "Parbuttee," 6 ft. 3 in. × 3 ft. 9 in. At Jehaujpoor, 16th May 1815.
 Pārvasī or Aiśāṇī, one of the seven mothers, crowned, richly ornamented, four-handed, the upper two holding a rosary and a trident, the lower right blessing, and the lower left holding a boy on the left lap. The right leg on the *vāhanū* below, a bull.
12. [No heading], at Jehaujpoor, 17th May 1851. 8½ ft. × breadth not given. Copied by Shaik Najibullah, 18th February 1819.
 Vārāhī, cf. No. 1. More complete, four-handed, the two upper holding fish and cup.
13. [No heading]. At Jehaujpoor, 17th May 1815. 8½ ft. high (no breadth).
 Chāmundā, cf. No. 4. In the terrace behind Jagannāth's Temple.

nāth's. More complete. Four-handed, the upper two holding a straight broad-bladed sword, and a club, the lower two a cup and a demon's head by the hair.

14. "An ornamented sculpture in the wall of the Temple of Semachellum" drawn by J. Newman, 30th June 1815. Copied by Peareelaul. July 1819. 11 ft. 3 in. \times 4 ft. 7 in.
 Two pilasters and the niche between. The pilaster has figures in the lowest, but one central compartments, and mouldings elsewhere. Human pairs (obscene) in the lowest but one compartment; two soldiers and a seated warrior in the central. The niche has a throned four-handed Viṣṇu at the base, behind his shoulder was a twining plant, in the loops of which are a Kinnara at the base, animals in the centre and birds at the top.
15. "One of the enclosed pillars in the Temple of Semachellum." [Base] breadth 2 ft. $\frac{1}{2}$ in., [height] $2\cdot8\frac{1}{2}'' + 2\cdot7\frac{1}{2}'' + 1\cdot7'' + 2\cdot4'' + 1\cdot5\frac{1}{2}'' + 0\cdot10''$, [top breadth] $2\cdot2''$.
 An elaborately carved pillar in the Simhācalam Temple, Vizagapatam District.
16. "Drawing of one of the 64 pillars which stand in the outer building within the Inclosure—Of an octagon order." $11\frac{1}{2}$ ft. [high]. Copied by J. Mustic, 29th June 1819.
 Probably of the same Simhācalam Temple.
17. "Pillar in the outer building of the enclosure at Semachellum." [Base breadth] $2\cdot6''$, [middle] $4\cdot10''$, circumference, [top width] $2\cdot9''$, [total height] $11\frac{1}{2}$ ft. Copied by J. Mustic.
 Round the centre runs an Oriyā inscription in eight lines the front of which is only given in the drawing. I read the first line of this part as *Vī* [* ra] *śrī (ī)-Gajapatī Gaud-esara. . . samasta 4* and so on. From the title, the king would appear to be one of the Sūryya-vaṃsa dynasty of Orissa.¹
18. "Drawing of one of the 20 pillars which support the walls of the First Hall or Court at Semachellum, 3rd July 1815. "[Base] 4 ft. 11 in. diameter, [top width] 4 ft. $7\frac{1}{2}$ in., [height] $3\cdot7'' + 1\cdot1'' + 2\cdot3\frac{1}{2}'' + 2\cdot0'' + 2\cdot10''$. Copied by J. Gould.
19. Drawings of one of the 84 pillars in the Choultry at Semachellum, 3rd July 1815.
 It contains in the lower half a nāyikā with a fly-whisker in the right hand.

¹ For these kings, see my article, J.A.S.B., 1900, pp. 180-189.

20. "Drawing of the Chariot which is said to be the same as the one at Kunnaruc, 2nd July 1815." Copied by A. McPherson, April 1819.
The parapet of the flight of steps has two rows of carvings at the top, the upper one of lions, and the lower one of geese. Below them two chariots. In front of the chariots a well-caparisoned horse (head broken) on a fat person (trampling a demon?). The head of the horse on the other side visible over the steps.
21. "Drawing of one of the 84 pillars in the Choultry at Semachellum, 23rd July 1815." Copied by A. McP., April 12th, 1819.
The base is carved with two-hooded *nāgas*; and in the centre two snakes intertwined with the hoods raised on each side. Between the two hoods and on their body stand a deity (Kṛṣṇa?). At the top, two geese face each other and are flanked by a lion rampant on each side.
22. "Drawing of Nundee-Iswar at the door of the temple at Dracheram, 21st July 1815." Copied by J. H. Schencks.
A sitting bull with strings of bells, the *vāhana* of Siva.
23. "Sculptures in a cavern at Bezawara supposed to belong to the Jaina religion, August 21st, 1815." Copied by Sheik Abdulla, 1st July 1819. 5 ft. 5 in × 4 ft. 6 in.
The compartment contains in the centre a standing Tirthaṅkara, naked, ears long and hands hanging. He has on each side a standing female, with matted hair, unornamented (only one having wristlet), and cloth falling from the waist to the foot nearly. Beyond the compartment to the left (spectator's) is another standing naked Tirthaṅkara.
24. "Jain images cut on the rock of one of the caverns at Bezawara, August 21st, 1815." Copied by Shaik Abdulla, 1st July 1819. 8-7½" × 7-9".
The compartment contains in the centre a standing naked Pārśvanāth with five hoods of a serpent over his head, the serpent rising from the ground. On the top left-hand corner three ascetics on their knees, and on the right-hand corner a Vidyādhara, below at the base right hand a male devotee sitting, and on the left hand a female standing and holding an umbrella over the Jaina saint.
25. "The principal object of worship (the figure somewhat defaced) carved on the rock in the interior apartment of the cavern at Bezawara called by the

- natives Ramaka Deeve." 2'3" x 7'6" x 5'3". Copied by J. Gould, 30th June 1819.
- The compartment has in the centre a dhyāni Mahāvīra sitting with one leg over the other and both the hands over the feet. Hairs woolly, *bhā-maṇḍala* round the head, and an umbrella above of fine make. On each side of him is a standing male with a fly-whisker. On the base are carved three lions.
26. [No heading, a smaller paper loose]. Original pencilled by J. Newman, 13th January 1815.
A *sārdula* pillar.
27. "Figures supposed to belong to the Jaina worship, carved on the walls of a cavern nearly on a level with the ground N.-W. of the Pettah of Bezawara, 21st August 1815." 6'11" x 3'11". Copied by Shaikh Abdalla, 1st July 1819.
A compartment containing a standing naked Tirthānkara. Beyond it, on each side is one standing naked Tirthānkara.
23. "Sketch of a Pillar north of the pillar near the Temple of Mahadeo at _____, 24th August 1815." It remains unfinished on account of the builder's death. Copied by Shaikh Abdullah, 3rd July 1819. [No measurements].
Place not given.
29. [No heading]. Copied by Pearalall.
Viṣṇu lying on the serpent Ananta (six hoods appearing behind the god's head). Four-faced Brahmā (three only shown) on the lotus throne, with other devas restraining a male coming towards the god armed with a club. Below Viṣṇu a god, and behind his *vāhana*, Garuḍa.
30. [No heading]. 10 feet in length (in pencil). Copied by Pearalall.
Viṣṇu with the breast girdle (*Kaustubha*), cf. 33, four-handed (only three shown).
31. "Sculptured figure of Man-calli cut on the rock near the temple at Bezawada."
A peculiar figure. A warrior with 18 hands holding various weapons, right leg advanced as if to march, near the head are carved four rows of faces, 10 + 9 + 9 + 9, 37 in all. At first sight looking like Rāvaṇa, but having one head and two hands less.
32. "Sculptured figure of Nursinga Swami and his consort carved in the rock which were formerly adored by the Bramins, but since the building about them fell down, they have been abandoned by their votaries at Bezawada, 21st August 1815." Copied by J. Gould.

In the centre a four-handed man-lion incarnation of Viṣṇu, upper two holding wheel and conch shell, the lower right blessing and the lower left holding lotus and also Lakṣmī on the left lap. On his left sitting a four-handed god (Brahmā ?), his upper two holding lotus, and the lower two blessing and offering gift; on his right a standing two-handed god, hands folded, with a necklace of skulls (Siva ?). At the top an arch carved with the ten incarnations (the last but one Buddha).

33. "Image of Ranga Naikudu cut in the rock represented lying at length in a ruined temple at Seetanuggur, 2nd September 1815."

It shows Viṣṇu lying, his left leg being shampooed by Lakṣmī (head nearly effaced), and a lotus-handed god (Brahmā ?) sitting beyond the legs.

34. "A pillar covered over with copper plates highly gilt which stands in front of the Soom Iswar Swamy Temple at Seetanuggur. The pillar was erected by Vasu-reddy Venkatadri Naidu, Rajah of Chintapilly Tullacoo, who at present resides at Amriswerum. 2nd September." [Base] 5 rulers and 2 inches × 3 rulers 6 inches (in pencil).

APPENDIX B.

THE FOLIO CALLED B.

11" × 8½", bound, binding loose, with the following title on the third leaf inside:—"Drawings of antique sculptures at different stallums or places of religious worship, and other ancient Hindu structures, taken in the course of a journey from Calcutta through Cuttaek by Ganjam and Chicacole, the ancient Wodia and Kalinga countries, to Condapilly, Ellore and Guntoor immediately on the Kistna in 1815."

From the 8th leaf begin the drawings. A number of pages are given to each place, its name written on the first page of each in pencil. The pages are numbered. The last drawing is on page 225. Each written page has generally one drawing, occasionally two; while blank pages often intervene. No name of the draughtsman appear; on the fly-leaf only the words "by Mackenzie" are written by some unknown hand. One drawing (No. 45) bears the name of J. Newman.

1. (P. 1). "Figures at the Temple of Hankenlishwar, at Geogepoor." March 7th, 1815. 3'8" [high] × 1'11".

Note:—A standing Siva, four-handed, the two upper holding a rosary and a trident, the lower right holding a demon by the hair and the lower left resting on the matted hair of an ascetic, head haloed and matted, ornaments on the ears, neck, forearm, arm, breast and waist, wearing embordered *jāñghīā*. "Hankenlishwar" seems to be

a variation of the name Ākhaṇḍaleśvara, a temple in Jājpur Bazār, not far from the Vaitaraṇī river.

2. (P. 5). "Sculptured figures on the Temple of Roggonajee-Taunkoor at Geogepoor." March 20th, 1815. (a) 1'8" (high) × 9" (wide); (b) 1'6" (high).
 (a) Man-lion, four-handed, two upper holding a wheel and a conch shell, the two lower tearing the bowel of the demon Hiranyakaśipu held on his thighs. At base a male and a female worshipper with folded hands.
 (b) A maned lion rampant, body broken, tongue protruding.
3. (P. 7). [No heading]. 1'1½" [high]. March 20th, 1815.
 A goddess, haloed, crowned, four-handed, the two upper effaced, the two lower holding a spear and something circular (?). Two fallen demons at foot.
4. (P. 11). "Figure in Hankenlishwar Temple at Geogepoor." March 20th, 1815. (a) 2'¾" × 2'¾"; (b) no measurements.
 (a) A god, head and upper trunk gone, riding a caparisoned horse, with a man behind holding an umbrella (its top gone); below the horse, two Yakṣinis and then a Yakṣa holding up the horse's hoof on his left palm. All on a throne of lotus. The Kalkī incarnation probably.
 (b) A seated Yakṣa with curled hairs.
5. (P. 13). "Lingum at the Temple of Hankenlishwar at Geogepoor." March 20th, 1815. [Base width] 1'4"; [liṅga height] 4 ft.
 The Liṅga of Ākhaṇḍaleśvara, 4 ft. high, the lower part to ¾th height carved with battlements in 12 rows; inserted into a quadrangular base.
6. (P. 14). [No heading]. March 20th, 1815. (a) 1'8" × 1'10"; (b) none.
 (a) A moulding with an ascetic carved on the upper part. The ascetic has legs one over the other, and hands folded.
 (b) A four-handed standing god flanked on each side by a pilaster. The pilaster is carved in four compartments, lowest effaced, then a *ghaṭa* with foliated turn-overs, next the upper half of a full-blown lotus, and at the top the lower half of a full-blown lotus.
7. (P. 17). [No heading]. March 20th, 1815. [No measurement].
 A grinning lion with the tongue protruding. The lower trunk and body gone.

8. (P. 21, instead of 19). "Gaurood." March 21st, 1815.
1·10" [high] \times 1·3 $\frac{1}{2}$ ".
Viṣṇu seated on lotus throne, four-handed, the two upper and the lower right holding something like Buddhistic praying wheels, the lower left holding a conch shell, crowned with ornaments in the ear, neck, wrist and waist (two necklaces). A female worshipper at the left corner of the base. A peg at the bottom indicates that the slab was fixed to some niche.
9. (P. 23). "Chunder Ishwar at Bobun-Ishwar." 3·5" [high] \times 1·9". April 5th, 1815.
Sun-god standing on a chariot driven by Aruṇa, and drawn by seven horses. God, two-handed, fore-arms gone, crowned, ornaments in ear, neck, arm, waist, legs booted; surmounted by a trefoil-arch, springing from two *makaras*, and having in the key a lion flanked by two females. At each top corner a Gandharva with an Apsarasa sitting on his bent thigh. To the right of the god an amazon drawing a bow and behind her a bearded ascetic; to his left, a similar amazon and behind her a guard with a straight sword and shield. A well-carved piece.
10. (P. 25). "Sculptured figure on the wall of the Bhavane-Shunker Temple at Bhubun-Ishwar." 3·5" \times 1·10". April 5th, 1815.
Bhagavati standing on a lotus throne flanked on the right by a lion, four-handed, the upper left holding a full-blown lotus with stalk rising from the ground, the forearms of the three other hands gone. Crowned, with ornaments on the ear, arm, neck, waist, calf and the foot. An arch above, with *makaras* at its base and a lion flanked by two male worshippers in the key. At the top corners a Gandharva with an Apsarasa on his bent thigh. At the base on each side, a standing female with a fly-whisker. The temple cannot be traced.
11. (P. 27). "Figure in the Temple of Mage-Ishwar at Bhubun-Ishwar." 3'0" \times 2'0". April 6th, 1815.
Siva (three faces only shown) with Pārvati on his left lap, seated on a throne. On the right three hands shown, one holding a battle-axe, one a rosary, and the third blessing; on the left only two hands shown, one holding a lotus, and the other holding fast Pārvati. Both figures richly ornamented. At the base two female and one ascetic worshippers on their knees in the right and a male (king?) sitting in the left, all facing a *ghaṭa*, four *dhūpa*-sticks, a conch shell and two lotuses.

12. (P. 29). "Figure in the Temple of Mage-Ishwar."
 3'11" × 1'11". April 6th, 1815.
 Kārttikeya standing on a lotus throne, below a
makara-based, lion-keyed trefoil arch. God four-
 handed, the upper right holding a trident, the
 upper left caressing the tail of a cock held up by a
 female, the lower right blessing and being pecked
 at by a peacock, the lower left on the body of the
 above cock; close to the peacock is a male armed
 with a curved sword. At each top corners the
 usual Gandharva and Apsarasa. Below the throne
 worshippers facing a *ghaṭa* with foliated turn-
 overs, three on the right and two on the left. It is
 the statue on the back or west side of the tower
 of Megheśvara temple.
13. (P. 31). "Figure on the Temple of Kadaar-Ishwar,
 north of Bhobun-Ishwar." April 7th, 1815. 6'0" ×
 3'9".
 A standing deity (?), two-handed, the right holding a
 stone or a bunch, the left a bud. To his right a
 tailed monkey (?). A sitting female between his
 legs, under which a Rākṣasa lying prone on the
 ground. The image has the usual ornaments.
 Kedāreśvara is south of Mukteśvara.
14. (P. 33). "Figure of Gunnish on the Temple of Kedar-
 naat." 4'6" × 2'5". April 7th, 1815.
 Ganeśa, elephant-trunk, pot-bellied, heavy-legged,
 standing on a lotus throne, under a lion-keyed tre-
 foil arch. He is four-handed, the two upper
 holding a peg (?) and a cup filled with fruits, the
 lower right holding a rosary and the lower left
 resting on a club; on the right side a standing
 female with an offering and on the left a male
 with a curved shield; near the female the *vāhana*
 mouse. At each top-corner a Gandharva with an
 Apsarasa on his bent thigh. The statue in the
 south niche of the tower of Kedāreśvara Temple.
15. (P. 35). "Figure in front of Mooko-Ishwar Temple."
 4'1" × 1'7". April 7th, 1815.
 A seven-hooded crowned *nāga* king holding up with
 both hands a *ghaṭa* with foliated turn-overs. Lower
 body not shown. Mukteśvara Temple.
16. (P. 37). "Female figure on the Temple of Coopallee-
 Ishwar at Bhobun-Ishwar." 2'8" × 1'5". April 8th,
 1815.
 A female standing in a niche flanked by two pilas-
 ters; two-handed, the left on a club and the right
 holding a flower. Kapālīni temple, miscalled
 Vaitāla Deuḷa.

17. (P. 39). "Female figure on the Temple of Coopallee-Ishwar at Bhubun-Ishwar." April 8th, 1815. [No measurements].
A standing female in a niche flanked by two-carved pilasters; both the hands holding a scarf, one end of which falls on a seated, bearded ascetic to the right. Adjoining the niche of 16th, in the tower of Kapālini or Vaitāla Deuḷa.
18. (P. 41). "Figures on the wall of the Temple of Coopallee-Ishwar." 2'6" × 1'10". April 8th, 1815.
A male and to his right a female (king and queen?), both standing, the male's right hand on the female's right shoulder and the female's left hand round the male's waist. Both heavily ornamented. The male with a sword in scabbard hanging from his left, the female's cloth falling gracefully from the waist to the foot. In a niche of the tower of Kapālini.
19. (P. 43). "Figure of a Sanasye in one of the small temples of Gooswarsarry at Bhubun-Ishwar." 3'8" × 2'0. April 8th, 1815.
A slab, with moulding at the base, and then on a lotus carved seat, seated, bearded, matted-haired ascetic; the whole under an arch *makara*-based, lion-mouth-keyed, springing from two *śārdūla*-pilasters. Below the seat are five worshippers. In the Gośahasreśvara group 300 yards off from Kapālini, northwards.
20. (P. 45). "Figure on the Temple of Gooswarsarry at Bhubun-Ishwar." 2'10' × 1'8". April 8th, 1815.
A standing god, haloed, two-handed, the left holding a long staff (trident?). Richly ornamented (including leg ornaments). To his left a female, two-handed. Standing.
21. (P. 47). "On the wall of a small Temple at Bhubun-Ishwar. Rudra Dancing." 3'6" × 2'9". April 10th, 1815.
Rudra in *Tāṇḍava* dance, ten-handed (six shown on the left and four on the right), the upper two holding a serpent, the next two a trident and a battle-axe, the next two a rosary and a bag (?), the next two the ends of a scarf; wearing tiger skin. To his right Gaṇeśa striking cymbals, and left Kārttikeya playing *dhola*.
22. (P. 49). "Figure of Seeda Eshwar standing near the outer wall of the Temple of Mooko Eshwar at Bhubun-Ishwar." 4'0 × 1'7". April 10th, 1815.
Sun-god standing on a chariot drawn by five horses and driven by Aruṇa. God clad in mail, haloed,

(legs not visible), with spreading rays (?) in hands. An amazon on each side drawing a bow (? Châyā and Sañjā, his two wives).

23. (P. 51). "A female figure in a small temple, S.-E. of the Great Temple of Bhubun-Ishwar." $3'8\frac{1}{2}"$ [high]. April 11th, 1815.

The river Gaṅgā standing on a *makara*, on the left palm a jar, and the right hand on the right thigh, under an umbrella held up by a female attendant standing to her right.

24. (P. 53). "Figure facing or opposite the last No. 19 at Bhubun-Ishwar." April 11th, 1815. [No measurements].

The river Yamunā standing on a tortoise, on the right palm a jar and the left hand on the left thigh, under an umbrella held up by a female attendant, standing to her left. Head-dresses of 23rd and 24th peculiar.

25. (P. 59). "Figure of one of seven Sanassee represented near the temple. It is said by the Bramins that these were the seven Sanasses who used to repeat their mhunters at the tank near the temple on seven stones which projects (sic ?) from the steps, and in remembrance of them their images were placed near the Pagoda." (a) $1'10'' \times 1'1''$; (b) $1'10'' \times 0'11\frac{1}{2}'$. April 11th, 1815.

(a) A seated, bearded, matted-haired ascetic, with a hand round his raised knees.

(b) A female on her knees with folded hands, on a lotus seat. To her right and left two smaller females on knees with folded hands. "The second Sanassee (a female)."

26. (P. 61). (c) "The third Sanassee." $2'0 \times 1'3''$.

A seated (one leg over the other) bearded, matted-haired ascetic, on a lotus seat.

- (d) "The fourth Sanassee." $2'1\frac{1}{2}'' \times 1'1\frac{1}{2}''$. April 11th, 1815.

A female devotee on her knees, with only one smaller female to her right, both with folded hands.

27. (P. 63). (e) "The fifth Sanassee." $1'10\frac{1}{2}'' \times 1'0$.

Kārtikeya standing on a lotus throne, to its right a standing male worshipper. God, four-handed. The right upper holding a trident, the right lower spread out and being pecked by a peacock, the left upper and lower, on the tail and body of a cock held up by a female.

- (f) "The sixth Sanassee." $1'11'' \times 1'1''$. April 11th, 1815. Similar to (b).

28. (P. 65). (g) "The seventh Sanassee." 1'10" × 1'4".
A worshipping female on her right knee, left raised.

N.B.—The head-dresses of all the seven, (25 to 28), are peculiar and interesting.

- (2) "Chatoor Mooka Mahadeva." April 11th, 1815.
[Base square] 10½".

A Liṅga carved on four sides with a face (three faces only shown), 2'1" high, on a quadrangular base.

29. (P. 67). "On the outer wall of Luckpoosy Narindra Mutt (N.W.) of Bhobun-Ishwar." 4'0 × 2'6". April 11th, 1815.

Siva, and to his left Pārvati, seated on a lotus throne. Siva haloed, four-handed, the right upper and lower holding rosary and *vinā*, the left upper touching Pārvati's chin and the left lower holding the upper part of the *vinā*, Pārvati's right hand on Siva's left shoulder. A trident above, over which a Gandharva in the top corner. Below the throne the bull and the lion.

30. (P. 69). "Female figure in one of the temples at Bhobun-Ishwar." 5'1" × 2'5½". April 11th, 1815.

Pārvati standing on a lotus seat; haloed, eight-handed, the right uppermost effaced, the other three either holding a straight sword, a rosary, or spread out to bless, the left ones holding battle-axe, shield, discus, and jar (of nectar?). Two attendants haloed, carrying a fly-whiskers, one on each side, the right-hand female's left hand resting on a lion's head. In the left top-corner a Gandharva with offerings on his left hand.

31. (P. 71). "Figure of Bhyroove on the wall of temple near Bhobun-Ishwar." 3'0 × 1'8". April 11th, 1815.

The Bhairava, one legged, two-handed (forearms gone), standing on a lotus seat, below a makara-based, lion-mouth-keyed arch. A Gandharva with an Apsarasa in each top-corner. Two *dvārapālas*, a spear-handed male to the right, and a trident-handed female to the left. Now in Yameśvara Temple, I believe.

32. (P. 73). "Copper figure of Chindra Seekur in the possession of a Bramin at the village of Mookundpoor." April 12th, 1815.

A four-handed Viṣṇu (or Kṛṣṇa), the right upper holding a dove, and the right lower spread out to bless; the left upper holding up a deer and the left lower in *mudrā* (thumb and index figure joined). Behind him rises a tree with branches, and buds, all within an arch having a dove at each side of

- the key. The only drawing in colours. Makundapur is 2 miles south of Pipli and about 25 miles north of Purī town.
33. (P. 85). "Eswar at a small house in front of Marcandah Tullow, north-west of Jagaunath Temple. One of the images of the Sant Bhyne or seven sisters." 4'6" × 2'3". April 27th, 1815.
Śiva, haloed, four-handed, seated on a raised seat; the right upper and lower holding a bud and a mallet-shaped axe, the left upper a jar, the forearm of left lower gone. Usual ornaments. Below the seat, bull.
34. (P. 87). "Bhrammanee, one of the sisters (so called by the natives) in front of the Marcandah Tullow. 4'5" × 2'2". April 27th, 1815.
Brahmāṇī, four-faced (three only shown), four-handed, the two upper holding wooden implements of vedic sacrifice (*śruk*?). the right lower blessing and the left lower holding a baby on the left lap. Seated on a seat, below which is a goose.
35. (P. 89). "Eshweree" or (in pencil) "Parvutty." 4'2" × 2'1½". April 27th, 1815.
Pārvati, another of the seven mothers, four-handed, the two lower, as usual, blessing and holding a son, the two upper holding a trident and a battle-axe; seated, below the seat a bull.
36. (P. 91). "Curtakainee or Savatree. One of the seven sisters in a small house in front of the Marcandah Tullow, north of Jagannath." 4'6" × 2'2". April 28th, 1815.
Kaumāri, another of the seven mothers, the two upper holding objects indistinct, the two lower as usual. A peacock below the seat.
37. (P. 93). "Narainee." 3'10" × 2'2". April 28th, 1815.
Vaiṣṇavī, another of the seven mothers, four-handed, two lower as usual blessing and holding the boy, the two upper holding a lotus and a nodule-like string. Below the seat winged, human-faced Garuḍa with hands folded.
38. (P. 95). "Indranee." 4'6" × 2'1". April 28th, 1815.
"Indrāṇī, one of the seven mothers, four-handed, the two lower as usual, the two upper holding a lotus bud and an *aṅkuśa* or goad. Below the seat an elephant.
39. (P. 97). "Vaharee or Baharee." 4'6" × 2'0. April 28th, 1815.
Vārāhī, one of the seven mothers, boar-faced, four-handed, two lower as usual, two upper holding a fish and a plate. Below the seat, a boar.

40. (P. 99). [No heading]. 4'6" × 2'2". 28th April 1815.
Cāmunda, seated on Mahādeva lying prone on a lotus seat; ribs and veins shown in a fearful way, a necklace of skulls, four-handed, the two upper holding a straight sword and a trident, the lower right a cup (of blood), the palm of lower lefts gone.
41. (P. 113). "Figure on the wall of the Gunga-Durra Fountain which runs underneath the Choultry." June 2nd, 1815. [No measurement].
In pencil "Sreecorma" a few pages before (p. 105). Nṛsiṃha seated with a boy in his left lap (Prah-lāda) four-handed, legs crossed.
42. (P. 115.) "Pillar on the east of the gate of the Temple of Stree Cormah." [Shaft] 5'9" × 1'½". [Top width] 2'¾". 13th June 1815.
An elephant-faced *śārdula* pillar of the Śri-Kūrmam Temple, eight miles east of Chicacole, near the sea coast.
43. (P. 117). "Pillar in the upper gallery of the gate of the Temple at Stree Cormah." 13th June 1815. [No measurement].
Another grinning maned *śārdula* pillar in the Sri-Kūrmam Temple.
44. (P. 119). "Pillar on the south of the gate of the terrace of the temple at Stree Cormah." [Shaft] 6'0" × 1'2". [Top width] 2'3". 13th June 1815.
A third grinning maned *śārdula* pillar in the same temple.
45. (P. 121). "Pillar in the upper gallery of the gate of the Temple of Stree Cormah." [Shaft] 6'0" × 1'6". [Top width] 2'3". J. G. Newman. 13th June 1815.
A pillar round at the base, square in the centre, and a foliage cup in the abacus.
46. (P. 123). "Figure at the entrance of the Stree Cormah Pagoda." 5'3" × 1'6". June 13th, 1815.
Viṣṇu as *dvārapāla* standing, four-handed, the two upper holding discus and conch shell, the two lower the right resting on a club and the other raised for blessing; usually the right hand is raised to bless.
47. (P. 125). "Figure at the entrance of the Stree Cormah Pagoda." 5'3" × 1'6". June 13th, 1815.
The counterpart of No. 46 on the same gate, other side four-handed Viṣṇu, the upper two holding conch shell and the discus; the lower right blessing and the lower left on a club.
48. (P. 127). "Figure of Durga on the Temple of Moohalingum." 2'3" × 1'3". June 15th, 1815.

Mukhaliṅgam in Pārlā Kimedi State, Gañjām District, is Kaliṅganagara of the mediæval period. Two-handed, standing Pārvatī with a female attendant to her right holding an umbrella over her, and a male to her left.

49. (P. 129). "Figure of Varauha-Avatārum on the south wall of Moohalingum." 2'3" × 1'3". June 15th, 1815.
 Standing boar incarnation, boar-faced, one-teethed, four-handed, the upper right holding a club (?), the upper left bent holding up the goddess earth on the elbow, the lower right touching the upper left, the lower left holding a discus; right leg on a Yakṣa or demon with folded hands.
50. (P. 131). Figure of Coomar-Swamy in one of the smaller temples of Moohalingum Pagoda." [Measurements in pencil not legible]. June 15th, 1815.
 Kārttikeya with his *vāhana* the peacock below the seat, two-handed, one lying on the knee and the left holding a trident, haloed, on each side of the top a Gandharva.
51. (P. 133). "Figure of Chendie-Keshwur by which the washing of the idol within the temple is emptied into the cistern." Five spans [high]. June 15th, 1815.
 A seven-hooded *nāga* king, two-handed, hands holding a circular lotus, in the middle of which is the drain; shown up to the waist.
52. (P. 135). "Sculptured figure north of the Choultry at Coopully." 2'6" × 1'5". June 19th, 1815.
 A god standing, haloed, two-handed, right holding a battle-axe and the left resting on a club, a dagger hanging from the girdle on the right side.
53. (P. 136). "Sculptured figure lying in the field neglected, 100 yards from the Temple of Coopully." 3'0" × 1'10". June 19th, 1815.
 A seated figure, two-handed, the right holding up a straight sword and the left on the left knee, with a peculiar crown on the head.
54. (P. 147). "A female figure on the left of the Gunga-Durra Fountain at Semachellum." 2'7½" × 1'2½". July 2nd, 1815.
 A standing goddess (Pārvatī ?) haloed, two-handed, the right holding a lotus bud, the left resting on a female attendant with a fly-whisker over her, an arch held up by two celestrals.
55. (P. 149). A female figure on the right of the Gunga-Durra Fountain." 2'5" × 1'4". July 2nd, 1815.

- A Mahiṣa-marddini form of Durgā, haloed, standing, eight-handed, the upper left three holding conch-shell, bow, shield, the lowest left lying on the thigh of the raised left leg, the upper right three with palms obliterated, the lowest right with a spear piercing the body of the demon Mahiṣa (human body, head gone), behind her right leg her *vāhana* the lion grinning.
56. (P. 151). "Figure at the back of the temple of Semachellum" (in pencil). 5'5" × 2'6." July 3rd, 1815.
The man-lion (lion face with human body) standing on a lotus-carved seat, four-handed (forearms gone), nose and left leg gone, a female attendant on each side. Four worshippers at the base, two on each side of the seat. Over the god an arch, *makara*-based with a grinning lion-mouthed key. At the right top-corner a Gandharva with an Apsarasa on his curved leg.
57. (P. 153). "Figure in the Temple of Semachellum, standing in the front courtyard against a pillar." 2'8½ × 1'4." July 3rd, 1815.
Viṣṇu, haloed, four-handed, the right upper holding a discus, the right lower with spread-out palm raised to bless, the left two holding a conch shell and a club, standing on an altar.
58. (P. 159). "Figure in the enclosure of the Veerabuddra Temple at Yellamunchelly." 3'2" [high]. July 16th, 1815.
Virabhadra standing, naked (?), hairs forming a *maṇḍala*, four-handed, the upper right raised, the lower right holding a snake-twined trident, the upper left holding a serpent, the lower left effaced. A necklace of skulls at which a wolf is sniffing.
59. (P. 16). "Figure in the enclosure of the Veerabuddra Temple at Yellamunchelly." 1 inch less 4 spans × 2½ spans. July 16th, 1815.
A Mahiṣa-marddini, standing with one leg on the back of the demon Mahiṣa, who is armed with a sword and a shield. His buffalo head is pierced by a spear held by one of the four right hands, the other three holding respectively a discus, a spear-end, and a straight sword; the left upper three hands hold a conch shell, a bow and a shield, and the lowest hand resting on the left thigh. To her right at the base a grinning lion.
60. (P. 163). "At Yellamunchelly." 3½ spans [high]. July 16th, 1815.
Kārttikeya, standing, haloed, four-handed, the upper right holding a trident and the upper left a club with a cock at the top, the lower right raised

and palm spread out to bless, the lower left resting on the left waist. The head of a peacock just visible behind.

61. (P. 165). "At Yellamunchelly." 3 spans \times $1\frac{1}{2}$ spans.
July 16th, 1815.
Brahmāṇī, seated, four-faced (three only shown), four-handed, the upper right and left holding a jar and a noose, the lower right raised to bless and the lower left lying on the left thigh. A goose below the seat.
62. (P. 167). [No heading]. 1 inch less 3 spans [high].
July 16th, 1815.
A *nāga* queen, probably seven-hooded (indistinct), two-handed, the two hands holding up near the breast a jar, the lower part in a snaky twine. The peg at the bottom indicates that it was fixed to some niche.
63. (P. 169). "Figure at Yellamunchelly." 2'7" \times 1'7".
July 16th, 1815.
Śiva seated, the hairs forming a *maṇḍala*, four-handed, the upper holding a trident and a rosary, the lower two holding a *vinā*; crescent moon above. a bull below the seat.
64. (P. 171). [No headings]. (a) 2'3" \times 1'3", (b) 2'3" \times 1'4".
July 16th, 1815.
Two of the Seven Mothers, Brahmāṇī, Vārāhī, with their respective symbols, goose and boar. Both haloed, four-handed, the two upper holding a rosary and a bud, the two lower, one blessing and the other lying on the left thigh. The slabs pegged at the bottom.
65. (P. 173). "At Yellamunchelly." 2'3" \times 1'5". July 16th, 1815.
Raudryā or Pārvatī, another of the seven mothers. Seated, haloed, four-handed, the two upper holding trident and discus; of the two lower, the right raised to bless, the left kept on the thigh. Bull below the seat. Slab pegged at base.
66. (P. 179). "Figure of Ranjaishwar Swamy in the Temple of Goolingaishwar Swamy at Beecaloo." 3'3" \times 2'0".
July 20th, 1815.
Durgā haloed, four-handed, the upper two holding a noose (?) and a conch shell, the lower right blessing and the lower left on the waist, standing on a buffalo head (Mahiṣa demon's head), with her *vāhana* the lion behind her legs. Slab pegged at base.
67. (P. 181). "Figure of Joggy-Eshwar." 1'8" \times 1'5".
July 20th, 1815.

Virabhadra, seated, haloed (hairs drawn curled in the halo), four-handed, the right two holding a trident and a straight sword, the left two a snake and a cup (of blood?), a necklace of skulls, body emaciated. Below the seat a fallen demon with the head turned up to the god, a sword and a shield in the hands, attacked at the waist by a wolf. Cf. Nos. 58, 71 and 73. The *vāhana* wolf is peculiar.

68. (P. 183). "Figure of Mai-Eskhwar in the Temple of Goolingaishwar Swamy at Beecalloo." 3'0" × 2'0". July 20th, 1815.

Śiva, seated, matted-haired, four-handed, the two upper holding a rosary and a trident, the lower right in *mudrā*, and the lower left on the left thigh. Below the seat, a bull.

69. (P. 193). "Image of Veerabudra in one of the apartments in the Temple of Draachanam Beem-Eshwar." 3'9" × 1½ spans. July 21st, 1815.

Virabhadra (?) standing on a pedestal, ten-handed, the right hands holding a trident, (other two indistinct), a goad (?), a dagger, in the left hands a double-headed axe, a bow, a goad, a shield, the last hand blessing. A female to the right and a male to the left with folded hands. In the temple of Bhīmeśvara at Drākṣārāma.

70. (P. 195). "Sculptured figures of Chuckruwuttee on the wall of the Draachanam Temple on the right hand of the door." 5'3" × 2'0". July 21st, 1815.

The standing figure of a richly ornamented king with folded hands, wearing cloth wrestler-like, over which a girdle, from which hangs at the right side a short dagger.

71. (P. 197). "Figure of ——— in one of the small temples at Dacharam." 5'3" × 2'3". [No date].

Virabhadra, standing, four-handed, the right lower and the left upper holding a trident and a battle-axe, the right upper raised and the lower left spread out to bless. A necklace of skulls. A goblin to the right and a female to the left, besides two wolves.

72. (P. 199). "Figure of Droondeeshwar in the Temple of Dracharram-Beem-Eshwar." 2'3" × 1'1." July 21st, 1815.

Śiva, four-handed, the two upper holding a book and an oblong-shaped article, the lower right blessing and the lower left turned down, trampling a fallen demon armed with a straight sword and a shield.

[N.S.]

73. (P. 201). "Figure of Lechmanee Swamy in the Temple of Dracharram-Beem-Eshwar." 2·9" × 1·3". July 21st, 1815.

Virabhadra. standing, four-handed, the right two holding a trident and a sword, the left upper a noose, the left lower forearm gone, necklace of skulls, waist bound with a snake with another visible just over it, a wolf to the right and a goblin to the left.

74. (P. 203). "Figure of Devanepulloocooloo-Swami(s)wara. On the left of the Temple of Nuggur-Eshwar." 5·10" × 3·6". July 28th, 1815.

Siva standing under an arch, four-handed, the right upper (forearm gone but probably) holding a trident, from the right lower hangs a lizard-marked club, the left upper holding a snake, the left lower resting on the waist.

75. (P. 213). "Sculpture on the rock near the Temple of Cunnuccu Durga Coil near Bezoara. Figure of Saraswuttee." [No measurements]. August 22nd, 1815.

Brahmā, four-faced (three heads only shown, necks shown separate), four-handed, the upper two holding something indistinct, the lower right blessing, the lower left hanging by the side, cloth worn like ascetics, falling below the knee.

76. (P. 219). [No heading, no measurements, no dates, only in faint pencil the following]. "Sculpture on the Mundupam representing a ? of musicians playing on the [illegible] Bezwara. 27th August 1815."

A group of seven heavenly musicians, the first two (from the right) and the last playing on harps, the third and sixth playing on cymbals, and the fourth and fifth on *dhol*s. Above third and fifth is carved sideways an ascetic.

77. (P. 225). "Figure of Aunnunt-Taushainoodoo in the Temple of Amreshwaram." September 15th, 1815. No measurements.

On a maned lion sitting a two-handed god (Siva ?), with a snake-twined trident behind his right hand, his left on a lotus stalk, above a full-blown lotus. The god's *mukuṭa* has a face carved in front like that in the Bodhisattvas.

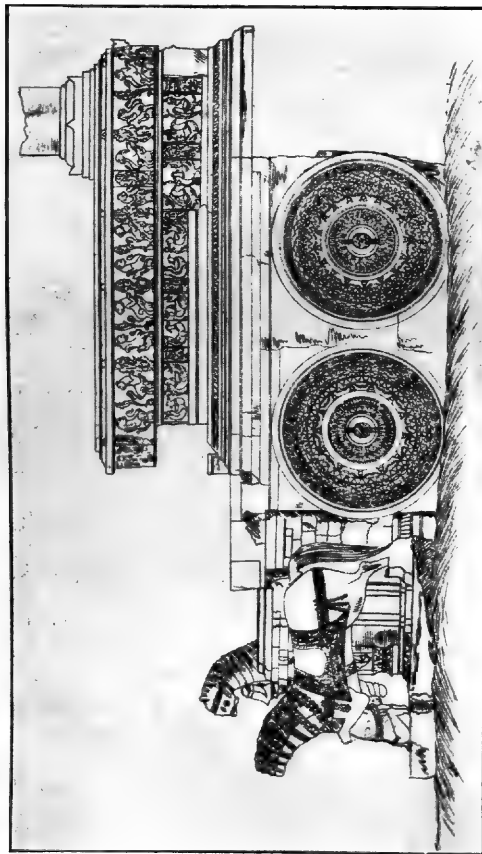
APPENDIX C.

श्रीरामचन्द्रदेवमहारायाङ्क नाती पुरुसोत्तमदेवमहारायाङ्क पुष्प
श्रीनरसिंहदेवमहारायाए अ ६ ङ्क मिन दि २१ ने सप्तमौ सोमवार ए
देउळ देखीवा नीमन्ते श्रीपुरुसोत्तमरु विजे करि याइ देखीले एदिनकु
दौलि वादसा साहासेलि वादसाङ्कर होइ ओडीसा सुवा वाखर खा
होइथिला-एदमन उपदर्प नीमन्ते मइत्रादिव्यवीरचिदेव श्रीपुरुसोत्तम
देउळे नीळाद्रीमहोक्वदेउळे वीये करिथिले । ए महारायाए तुक्कादेउळ
देखीवाकु वीये करि याइ एदेउळ मपाइले-आग्यां प्रमाणे श्रीपुरुसोत्तम
देउळ सुआंसिआ नाथ महापात्र मापि तलप कराइला प्रमाणे ए
महारायाङ्क श्रीहन्तरे अं २८ गुले श्रीहस्तकाठिमापरे ए वडदेउळकु[ः]
ए देउळ उपरे चुम्बकलुहाधारणा पोतावाहारे उभारे अक्कि काठी
हा १२॥ त, ए कपुरिमापकाठि अं ३ गुल ई ए गेरि काठी हा १॥
अळाउपरसिंहठाह गरुडतळसरिकी का १२ ठी । सिंहगरुडतळ पद्म-
एळसरिकी काठि ८॥, गाए का ११ई ठी । अं २० गुल छि, लुहा-
धारणा उभारे अक्कि काठी हा १२॥, देउळवर्तमाने अक्कि काठी
अं १०४ गुल ई, गाए प २ द का ११ई ठी आंगुल २०, एवाहारे पूर्वरे
थिला भागिं अक्कि कळस ए उपरे पद्मध्वय थिला काठि गाए प २ द
का ३ ठि आंगुल ८ गाए प २ द का १२० ठि ।

ए देउळरे मुखसाळी सानदेउळकु माप का ७३ ठि । ए देउळ आहत्ती
आगपाट अगणा पुवपक्किमहोइ का १ई ठि आंगुल ८, उतर दखिण होइ
का २३ ठि एपूर्वकु वर्तमाने अक्कि पाहाच गो १२ टी ए गो १ टी लम्ब का १३
ठि ८ आंगुल ओसार का २ ठि लेखाए । ए पूर्व दुआर तोरणा खम्ब गो
१ टी ओसार का ४ ठि लेखाए खम्ब गो २ टी ए खम्बसिरा दिसुअक्कि
गो १७टी, ए दुआर पाहाच गो ५ टी एधिरि लम्ब का १०॥ ठि ओसार
का २ ठि । दुआर ओसार का ४ ठी २ आंगुल पाखे वडमुगुनी पाट गो

२ टौ गोटीय ओसार का ३॥ ठि उच्च का ७॥ वहळ का ० । ॥ ठि [१]
मुखसाली देउळ दुइखम्ब मभी ओसार का ६॥ ठि एखम्ब ओसार का
५ ठि लेखाए दुइखम्ब ओसार का १० ठि, एखम्ब उतारु दुइ पाआभाग
ए पाआभाग गो १ टौ का ७॥ ठि लेखाए गो २ टौ का १५ ठि, गाए
मुखसाली देउळ ओसार का २८ ॥ ठी । ए वाड वहळ का ८ ठि लेखाए
दुइ वाडकु का २६ ठि । गाए मुखसाली सानदेउळ ओसार वाडमध्यकरि
का ४५ ॥ [१] वडदेउळर अणसरपिण्डी उतर दखिण काश्य ओसार का
६ ठि । पुर्वपक्किम होइ लम्ब का १० ठि ४ आंगुल, दुआर ठारु उतर
पाहाचतळ एरगडा याए का ५७ ठि । भितर दुआर ओसार का ३ ठि
२६ आंगुल ए उच्च का ७॥, ए दुइ पाट वळे काठि । ॥ लेखाए एपाट
ओसार का ३ ॥ लेखाए भितर गम्भिरा पुर्वपक्किम होइ लम्ब का १८
ठि । उतर दखिण होइ का १८ ठि ८ आंगुल [१] सिंहासनलम्ब का ७ ठि
ओसार का ५ ॥ ठि एउठ का २ ॥ ठि, एउपरसिंहासन गो १ टौ लम्ब
का ३ ठि आठ आंगुलि ओसार का २ ठि उच्च का १ ठि [१] अरुण
खम्ब मोट का ३ ॥ ठि उच्चमाप का ठि । उतर वाडुपादुकनळा वाड
ओसार का १८ ठि । दखीण वाडओसार का १८ ठि । गाए दुइवाड
ओसार का ३६ ठि । देउळ पक्किमवाड ओसार का १८ ठि । भीतर दुआर
ठारु तळ पाहाचसरिकी वहळ का १२ ठि । एप्रकारे माप होइला ।

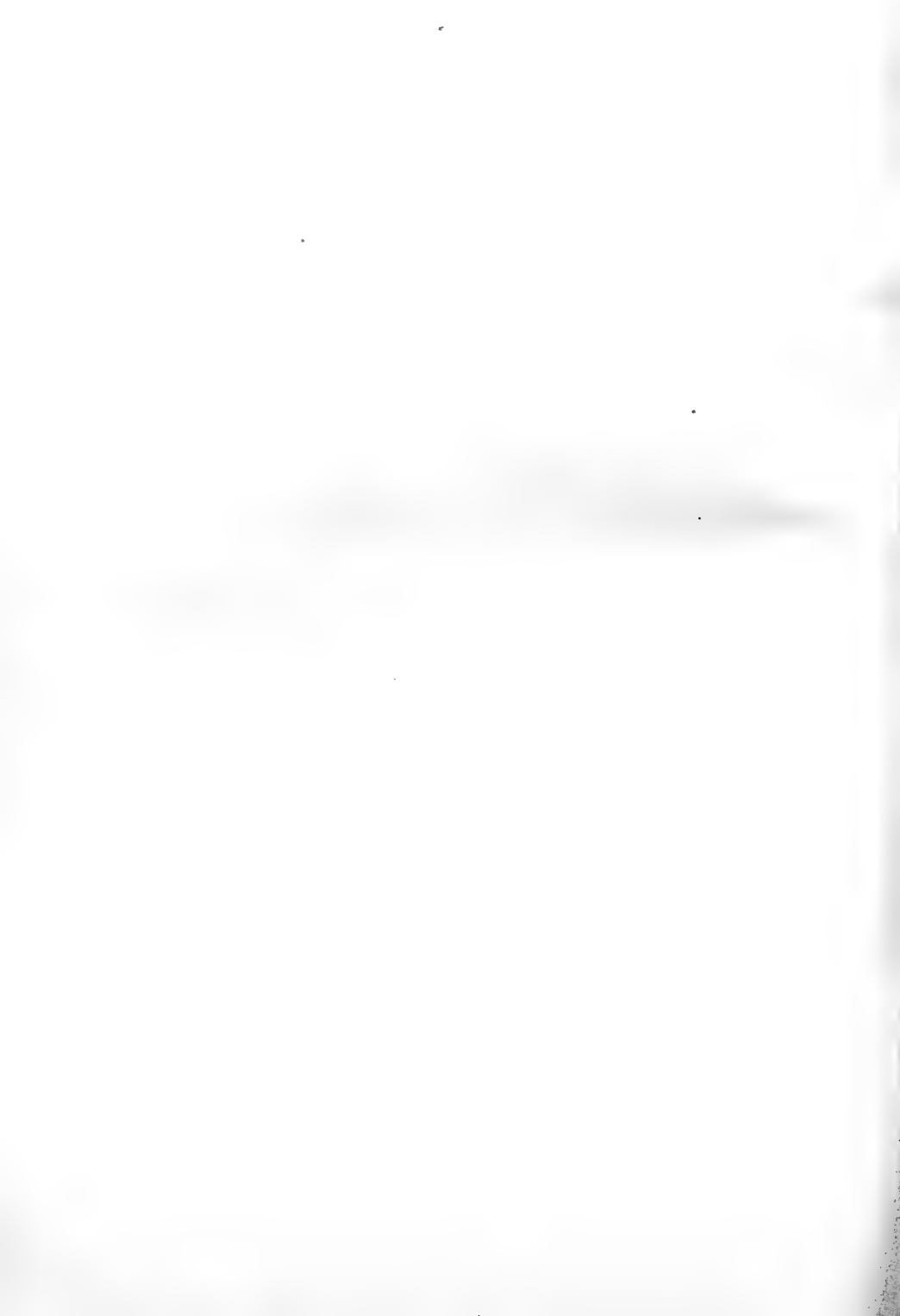
MS. *Mādala-pāñjī*, or Palmleaf Chronicles of Jagannātha
'Temple.



Temple of Kanarak, No. 20 of Folio A.



Temple of Kaṇārak, North Gateway. No. 6 of Folio A.



34. The Age of Kālidāsa.

By PROF. SARADARANJAN RAY, M.A.

TRADITION.

The Indian learns in his childhood that Kālidāsa, the greatest poet of India after Vyāsa and Vālmiki, was one of the "nine gems" of the court of a certain prince named Vikramāditya. Tradition also has it that the Samvat era, which is still current, was introduced by this prince to commemorate his accession to the throne of Ujjayinī. It is the 1964th of the Samvat era to-day. Hence 1964 years ago, in the first century B.C., Kālidāsa wrote his immortal works.

FERGUSSON'S ATTACK.

Against this we read: "It has long been an open secret however . . . that there is absolutely no documentary evidence of the existence of such a king Vikramāditya in the first century B.C. But the puzzle has always been, how the belief in such a king, living in the first century B.C. . . . could have arisen, and this puzzle has at last been solved . . . by . . . Mr. Fergusson . . . I cannot help thinking that in the main his solution will turn out to be correct." Thus writes Prof. Max Müller in his "India: what can it teach us?" The "solution" is that King Harsha of Ujjayini, surnamed Vikramāditya, defeated the Mlechchhas at the great battle of Korur in 544 A.D., expelled them from India, and, in commemoration of the victory, founded the Vikrama era. He dated this new era 600 years back, thus making it appear as if it commenced in 57 B.C. The Vikrama era "cannot, therefore, occur in any historical document before" 544 A.D. Along with Vikramāditya, Kālidāsa is brought down to the middle of the sixth century A.D.

CORROBORATION OF FERGUSSON.

(i) Prof. Max Müller believes that Mallinātha corroborates Fergusson's theory while commenting on the 14th verse of the Meghadūtam. "Whatever we may think of the pointed allusion which Mallinātha discovers in Kālidāsa's own words to Nikula and Dignāga—and I confess that I believe he is right—there can be little doubt that Mallinātha must have known of both Nikula and Dignāga as contemporaries of Kālidāsa, before he could have ventured on his explanation . . . We shall probably now feel more confident in placing Kālidāsa in the middle of the sixth century." Max Müller, "India: what can it teach us?"

(ii) An indirect corroboration is also seen in the fact that

Kālidāsa uses the word Jāmitra in Kumāra VII, 1. This word is borrowed from the Greeks. The great borrower in this respect was Āryabhaṭa whose approximate date is 499 A.D. Kālidāsa, therefore, must have lived pretty long after 499 A.D.

CORROBORATION OF LITTLE VALUE.

Before discussing the theory itself I shall take up the corroborations as noted above.

In the first place, Prof. Macdonell says on Mallinātha's interpretation: "This explanation . . . is extremely dubious in itself. Then it is uncertain whether Mallinātha means the Buddhist teacher Dignāga. Thirdly, little weight can be attached to the Buddhistic tradition that Dignāga was a pupil of Vasubandhu, for this statement is not found till the sixteenth century. Fourthly, the assertion that Vasubandhu belongs to the sixth century depends chiefly on the Vikramāditya theory, and is opposed to Chinese evidence, which indicates that works of Vasubandhu were translated in A.D. 404."

Secondly, I believe Kālidāsa himself never thought of such an explanation. This is obvious from the verse itself. The text is—

स्यानादस्मात् सरसनिचुलादुत्पतोदङ्गुखः खं
दिङ्नागानां पथि परिह्वरन् स्थूलहस्तावलेपान् ।

I doubt if स्थूलहस्तावलेप can be legitimately compounded to mean "foolish vauntings as expressed by gesticulations." Even if this point is allowed, the plural in दिङ्नागानाम् becomes indefensible. When the word दिङ्नाग is not intended for many individuals, the plural will indicate respect (गौरव) for दिङ्नाग on the part of the poet. Would that be consistent in the case of a "hated rival," contempt for whom is already expressed by the ridicule in स्थूलहस्तावलेप?

Prof. Max Müller makes much of the fact that Mallinātha believed Nichula and Dignāga to be contemporaries of Kālidāsa. In other words he accepts the belief of a single individual (Mallinātha) against that of the whole of India that Kālidāsa and Vikramāditya were contemporaries in the first century B.C.

Referring to the astronomical argument, Prof. Macdonell says: "But it has been shown by Dr. Thibaut that an Indian astronomical treatise, undoubtedly written under Greek influence, the Romaka Siddhānta, is older than Āryabhaṭa, and cannot be placed later than A.D. 400."

Max Müller refers with approval to the stress laid by Prof. Jacobi on the appearance of the word जामित्र in Kumāra. This approval implies two things:—

- (1) That the word is exclusively Greek.
- (2) That the Indians borrowed it not long before the 6th century.

Prof. Macdonell's reply quoted above demolishes the 6th-century theory. But it does not go far enough. जामिच and Diametron may mean the same thing, yet neither need be the progenitor of the other. The supposition is possible that both come from a certain primitive word which like पिब, माह, ब्राह. दुहितृ. etc., the nations possessed in common when they were together before the migrations. When the primitive Aryan householder, after the day's toil, sat chatting with his family, the vessel of drink (call it Soma, or Amrita if you like) going round, he could not have helped noticing the utility of sitting all in a ring, and the ease with which every diametrically opposite pair can then speak to each other. It is not then unlikely that a name was given to diametrically opposite positions, and along with it to the diameter also.

Again, even if we admit the borrowing, the word is so common that no one need be surprised if it was appropriated when the very first batch of Greeks set foot on India.

But I believe we are beating an empty bush here. In the present instance Mallinātha seems to afford us an illustration of the habit of seeing new ideas in old expressions. The main, in fact the only, reason for taking जामिच as derived from the Greek Diametron, is that the word is supposed to have no derivation in Sanskrit. It is extremely hazardous to say that a purely Sanskrit derivation cannot be found for जामिच। जामि is known to mean "daughter." The वाचस्यत्य gives this meaning on the authority of the शब्दार्थचिन्तामणि। जामिं दुहितरं वायते gives जामिच with the affix क attached to the root वै to protect. The sense is "That which guards the daughter from evil." This derivation is sanctioned by the rule आतोऽनुपसर्गं कः। No possible objection can be urged against it. If this is allowed, जामिच derived thus, or in any other legitimate way, may exist side by side with the technical, let us say, for argument's sake, Greek derivative जामिच without either interfering with the scope of the other's usage. Instances of such double existence are numerous. The words आख्यात, संचिन्ता, etc., have special meaning in grammar. They are constantly being used in other senses also. Even in scientific works the same word may be used technically and in the ordinary sense as well. A Geometer arguing with an adversary is not barred from exclaiming, "What is the *point* of your argument?" though his science gives a special meaning to the word "point." All depends upon the context. I believe जामिच as I have derived it, actually suits the context better than जामिच, in the sense of Diameter. I quote the sloka :—

अथौषधीनामधिपस्य वृद्धौ त्रिथौ च जामित्रगुणान्वितायाम् ।
समेतवन्मुहिंमवान् सुताया विवाहदीक्षाविधिमन्वतिरुत् ॥

In the first place, what is **गुण** of **जामिच**? Mallinātha explains, saying **गुण** means **शुद्धि**. Even then **शुद्धि** of **जामिच**. "purity of the diametrically opposite place," is unintelligible. because Astrology defines **जामिच** with reference to the **लग्न** and not to the **तिथि** as the context has it here. Mallinātha's defence, that what attaches to the **लग्न** may be attributed to the **तिथि** also, does not seem satisfactory. This leads me to suspect that **जामिच** is not here used in the sense Mallinātha takes it.

My suspicion is strengthened from another consideration. I am told—I speak under correction—that, at marriages, the purity of **त्रिकोण** (the two positions 90° either way from the **लग्न**) has to be considered, while the purity of the **लग्न** itself is at least as important as that of the **जामिच**. It is imperative to avoid **जामिचवेध** and **युतवेध**—impurities of the **लग्न** and the opposite place. Why then is the poet silent about impurities at **त्रिकोण** and the **लग्न**. It will not do to say that if the **जामिच** is pure, impurities elsewhere do not matter. For **युतवेध** is as bad as **जामिचवेध**. Besides, who are the parties involved? The parents of the Universe are to be united; on the issue of the union depends the welfare of the whole host of gods and men. Such an occasion has to be accompanied by a combination of all auspicious circumstances, and must not be burdened with such shortcomings of the **लग्न** as an ordinary Bengali father of an **अरवलीया कन्या** has to put up with.

I therefore take **जामिच** here in the sense I have already explained. The sloka then means that—Himālaya performed the **आभ्युदयिक** ceremony for his daughter's marriage at a phase of the moon that was calculated to ward off evil influences from her married life.

Hence Jāmitra offers no corroboration :—

- (1) Because Jāmitra in the sense Diametron does not suit the context. therefore it is a different word derived from Sanskrit.
- (2) Because even if Jāmitra has the sense of Diametron, the supposition that the two come from a common primitive is possible. That Diametron has a Greek derivation does not bar the supposition; for **पितृ**, **मातृ**, **दुश्चिद**, etc., have Sanskrit derivations.
- (3) Because, if borrowed, there is nothing to exclude the hypothesis that it came to India with Seleucus.

FERGUSSON'S THEORY UNTENABLE.

These considerations show the character of the corroborations of Fergusson's guess. On the theory itself, Prof. Macdonell remarks : " The epigraphical researches of Mr. Fleet have destroyed Fergusson's hypothesis. From these researches it results that the Vikrama era of 57 B.C., far from having been founded in 544 A.D., had already been in use for more than a century previously under the name of the Mālava era."—*History of Sanskrit Literature*.

Victories are commemorated by pillars with inscriptions. These were called जयस्तम्भ in Kālidāsa's time and are more than once referred to in the Raghuvamsam. An era commemorates the installation of a king. But be it the commemoration of a victory or of a coronation, the *ante-dating* affair is ridiculous. The additional years joined will mislead people and make them forget the very date intended to commemorate. Mr. Fergusson's Vikramāditya could not have been in a very enviable state of mind when he instituted the era and threw back its commencement 600 years to 57 B.C. to perpetuate the memory of his great victory at Korur in 544 A.D. !

Vardhamāna, the author of the Ganaratnamahodadhi, closes his work with the sloka :—

सप्तनवत्यधिकेऽब्देऽष्टादशसु शतैस्वतीतेषु ।
वर्षाणां विक्रमतो गयारत्नमहोदधिर्विहितः ॥

He does not refer to the Samvat. The नसु in विक्रमतः is very significant. It means " from the time of Vikrama," whether from the time of his coronation or from that of his death is not clear. What would the advocates of " ante-dating " think of this " commemoration " if the Samvat era had misled Vardhamāna into this statement. If, on the other hand, Vardhamāna had independent means to calculate 1,197 years " from Vikrama," the value of the sloka cannot be over-rated.

Here is an instance of its utility. Mallinātha is supposed to belong to the 14th century. He frequently quotes the Ganaratnamahodadhi in his commentaries. If 1350 be taken as Mallinātha's approximate date, then, supposing the Ganaratnamahodadhi to be at least a hundred years older than Mallinātha so that it could be considered by him an authority worth quoting from, the book was written not later than about 1250 A.D. Vikrama preceded the book by 1,197 years. Hence Vikrama reigned before 53 A.D.

THE LATEST THEORY.

Prof. Macdonell says in his *History of Sanskrit Literature* that Kālidāsa flourished in the reign of King Chandragupta II, at the beginning of the 5th century A.D. There is no evidence to connect this prince with our Kālidāsa except that Chandragupta II. was named Vikramāditya, and that the existence of an earlier

Vikramāditya has not yet been traced. This is rather slippery ground to base a theory upon.

With the existence of more than one Vikramaditya,¹ attempts to determine the age of Kālidāsa through him must be more or less unsatisfactory. But independent evidence of his age from the writings of the poet is not altogether unobtainable. I note a few below.

EVIDENCE OF THE PERSIAN NAVY.

We may take it that descriptions of people and countries conform to belief current at the poet's time. In Raghu, Canto IV. we read :—

पारसीकास्ततो जेतुं प्रतस्थे स्थलवर्त्मना ।

इन्द्रियाख्यानिव रिपूंस्त्वत्त्वज्ञानेन संयमी ॥

From the west coast of India it was easy to cross over to Persia by sea. Yet Raghu preferred the troublesome land route. Mallinātha explains the preference, saying that sea-voyage was prohibited in the Sāstras. This could not be the reason, because the prohibition is for the Kali Yuga only. The reason has to be sought in the simile.

There are two ways in which people try to conquer the senses. The first is by satiety (भोगमार्ग), the second by तत्त्वज्ञान (योगमार्ग). The first is pleasant to practise, but it is not easy to obtain the desired result by means of it. The second, though troublesome to follow, is more likely to bring success. The land route is compared to योगमार्ग and implies the comparison of the sea-route to भोगमार्ग. Hence the verse suggests : As the senses cannot be conquered by भोग, so the Persians cannot be conquered by the sea-route. The belief in the invincibility of the Persians at sea was therefore current at the time of the poet. We know that the Persian Navy was annihilated in the 5th century B.C. at the battle of Salamis. Considering the difficulty of communication in those days, and the distance of the place of occurrence, it is possible that the news of this disaster took a very very long time to reach India. But it is hard to believe that if our poet lived after Christ, he would still speak of the Persian Navy with awe.

EVIDENCE OF STYLE.

Kālidāsa's prose, as we have it in his dramas, is charmingly simple. Yet it is remarkably terse and vigorous. Absence of

¹ From the Kathāsaritsāgara we learn that the Brihatkathā, which is supposed to have been written in the 1st or 2nd century A.D., mentions a Vikramāditya of Pātaliputra and also one of Ujjayini. The latter was a redoubtable exterminator of the Mlechchhas (see Kathāsaritsāgara, 7th Lambaka, 4th Taranga, and the whole of the 18th Lambaka). The Rājatarangini refers to a Vikramāditya in the 2nd Taranga.

diffuseness and long compounds is characteristic. It is *natural* prose. Now and then it reminds us of the prose of the Mahābhāshya, and also, though less pointedly, of one or two of the prose pieces of the Mahābhārata. The preference for the नपुंसके भावे क्त where it is usual with others to have भावे लृट्, the use of यत्प्रत्ययान्त words as attributives in disagreement with the gender of the corresponding substantive, Kālidāsa has in common with Patanjali. Whether these are personal or characteristic of his age it is difficult to say. But it is to be noted that as we go back to older and older writers, the prose comes up more and more to this standard of natural as distinguished from artificial prose. Thus Bāna, Subandhu, Dandin are less and less artificial in order. Prof. Macdonell notes artificiality of style in an inscription composed by Harishena in the 4th century. But of the Gīrnār and Nāsik inscriptions of the 2nd century, the learned professor says that "they are altogether less artificial than the prose parts of Harishena's Kāvya and a fortiori than the works of Dandin. Subandhu and Bāna."

These considerations justify the inference that the older the writer the less artificial he is. We are, however, concerned with the converse proposition, *viz.*, the less artificial the writer the older he is. If the converse is allowed then Kālidāsa is older than the Gīrnār and Nāsik inscriptions. As a rule, in such cases, the converse comes out to be true. Yet here we shall not take it for granted without further proof.

EVIDENCE OF LANGUAGE.

When a language is in the stage of formation, fresh words are imported; sometimes old words fall into disuse or change meaning. Change of meaning may imply that the language is growing; it is certainly a sign that the language is not dead yet.

Now take the word परमेष्ठिनः। This word is not sanctioned by पाणिनि। Kātyāvana allows it. Amara Siṅgha, in the sixth century at the latest, declares it as a संज्ञा of ब्रह्मन्। But Kālidāsa does not treat it as a संज्ञाशब्द। He speaks of Vishnu "भूतार्थव्याहृतिः सा हि न कृतिः परमेष्ठिनः"। Of Rama as Vishnu he makes परशुराम say "आहितो जयविपर्ययोऽपि मे श्लाघ्य एव परमेष्ठिना कथा"। Referring to ब्रह्मन् he says "दिवमध्यास्व शासनान् परमेष्ठिनः"। If it were a संज्ञाशब्द at his time, he would not have used it promiscuously for ब्रह्मन् as well as विष्णु। The lexicographer records usage, he does not invent meanings. Hence long before अमरसिंह the word had acquired the character of a संज्ञा। This would not have been possible if the language were dead at the time of Kālidāsa.

Again Vāmana, the rhetorician, writes in the 8th century that पेल्लव is a word that involves an obscene idea (पञ्चोलायं) and

should not find a place in polite literature. This is not Vāmana's personal opinion. Popular verdict at his time must have been to that effect. Mammata, towards the latter part of the 11th century, echoes Vāmana's condemnation. The साहित्यदर्पण is of the same tenor.

It is strange, however, that पेलव is one of Kālidāsa's favourite words. Not only he does not hesitate to use it, but he actually prefers it to the usual word कोमल in describing delicate objects. Thus referring to Pārvati's penance he writes: "मृणालिकापेलवमेवमादिभिः" though मृणालिकाकोमलमेवमादिभिः preserves the metre as well, and perhaps improves the diction. Some of his female characters in the highest society have said "धनुषः पेलवपुष्पविणः" "अपराधा पेलवयापि तद्रम्" "नवकुसुमपेलवा तम्" "प्रकृतिपेलवा प्रियसखी" etc. He makes the mother address the daughter—"तपः क्व वत्से क्व तावकं वयुः । पदं सहेतु भ्रमरस्य पेलवं शिरौषपुष्पं न पुनः पतविणः ॥"

What a revolutionary change of meaning has overcome the word which was once so chaste in its signification! I believe this cannot be accounted for except on the supposition that Sanskrit was the spoken language of the learned when Kālidāsa flourished. Without entering into the question, "At what time did Sanskrit cease to be the spoken language of the learned?" it may be safely said that this points to a time *before* rather than *after* Christ.

EVIDENCE OF GRAMMAR.

Kālidāsa was a profound grammarian. The consummate skill with which he handles intricate points of grammar betrays the specialist. From among a host of instances, we may refer to the distinction made between प्राहि with two accusatives and the same with one accusative only (*cf.* तं सुतां प्राहयितुम्. तं पाणिमप्राहयत्, जायाप्रतिप्राहितगन्धमास्याम् etc.); between the तद्धित affix चण causing चादिष्टि, and the same with उभयष्टि (*cf.* क्षणभिक्षुसौहृदः, समवयोषपरमणीयं भवतीनां सौहाईम् etc.); between the क्त्य affix in agreement with the substantive and the same in disagreement (*cf.* कार्य्यां मालिनी, शक्यं पवनः etc.); between the प्रयोजक without षिच्, and the same with षिच् (*cf.* सर्वशैला दुदुर्धरित्रीम्, माता तां प्रब्रज्य etc.); and so forth. His deep insight into the philosophy of grammar is seen in the sloka—"चतुर्मुससमीरिता प्रष्टनिरासीच्छब्दानां चरितार्या चतुष्टयी ।"

Grammar was his favourite study, as is evident from the number of similes he has derived from that science (*cf.* "प्रत्ययप्रकृतियोगसङ्गमः" "पश्चादध्ययनार्थस्य धातोरधिरिवाभवत्" "धातोः ज्ञान रवादेमं सुधीवं संन्यवेद्यत्" etc.). He begins his great work, the Raghuvansam, with a simile from the science of grammar "वामर्याशिव संश्लो

जगतः पितरौ'। This simile is again seen in Kumāra "तमर्थमिव भारत्या सुतया योक्तुमर्हसि"।

Yet anomalous grammatical forms are common in his writings. In Kumāra. Canto III, he writes : त्रियम्बकं संयमिनं ददर्श । He was not unaware of the usual form, for he writes अकौर्यत अम्बकपादयुले, and elsewhere जडौकृतस्यम्बकवीक्षणेन etc. Nor was the anomaly necessitated by the metre : for विलोचनं संयमिनं ददर्श agrees with the metre and avoids the anomaly. He knew that विलोचन was a name of Siva as he writes विलोचनस्तामुपचक्रमे च : How then are we to explain this apparently wanton violation of grammar? Only one answer seems reasonable. Kālidāsa believed that he had the option to write त्रियम्बक or अम्बक. In other words, त्रियम्बक came to be restricted to the Vedas after the time of Kālidāsa.

In another place he writes "मोहेनात्कर्त्वरतनुरियं मुच्यमाना विभाति गङ्गा रोधःपतनकलुषा गच्छतीव प्रसादम्"। We cannot say he did not know that the usual form was गच्छन्ती and not गच्छती. Compare "बभौ तमनुगच्छन्ती" "गच्छन्तीनां रमणवसतिम्" etc. Nor was the metre in his way, for he could have easily written गङ्गा रोधःपतनकलुषा विधतीव प्रसादम् । As before, here too he thought it was legitimate to write गच्छती or गच्छन्ती ।

Again we find him writing "मन्दं मन्दं नुदति पवनम्"। Usually the duplicated form मन्दं मन्दम् is treated like a कर्मधारय compound, and takes the shape मन्दमन्दम्. Our poet knew this, for he writes also "निहितमसङ्गदुःखदुःखेन गात्रम्" "अङ्गरपि कथं मन्दमन्द्यातपं स्यात्" etc. The explanation is the same as before. *viz.*, the poet thought he had the right to treat or not to treat the duplicated form like a कर्मधारय compound.

Here is another instance. Kālidāsa writes "तं पातयां प्रथममास" instead of the usual form पातयामास : in place of प्रथमयास्यकार he has प्रथमयां यो नृत्तर्ष चकार; for संयोजयामास he writes संयोजयां विधिवदास । As before the explanation is that he believed the अवधान between the आश्रय and the अनुप्रयोग was legitimate.

Before quoting more instances I may note that the examples given above seem unmistakably to point to the inference that the rigour of Pānini's grammar was not yet adopted in popular writings when Kālidāsa flourished. It is very important to remember that not a single one of the above is an example of grammatically *incorrect* usage. They are instances of विकल्प, of usages which Pānini denies to लौकिक writers, but to which वैदिक writers are fully entitled. The Mahābhāshya recognises the

principle सर्वे विधयश्चन्द्रसि विकल्पन्ते। Kālidāsa here exercises rights of which पाणिनि has deprived लौकिक writers.

Hence at the time of the poet the form of the language, *i.e.*, of भाषा as distinguished from इन्द्रस्, was not yet cast in the unalterable mould forged by Pānini. When an उपसर्ग precedes a root, we say, after पाणिनि, that it is placed *before* the root; “ते प्राग्धातोः” are Pānini’s words. But Kālidāsa says it is *after* the root (*cf.* “पञ्चादध्ययनार्थस्य धातोरधिनिवामवत्” quoted above). Indeed, the great grammarian did not at all influence the poet. We say then that Kālidāsa is a writer of the period of *transition* from the Vedic literature (इन्द्रस्) to the Sanskrit literature (भाषा). Thus though Kālidāsa writes in भाषा, his भाषा has points of resemblance with इन्द्रस्।

I note here a few more points of resemblance. The सुक् preceding शानच् is absent in “कामयानावच्छो राजा”। The root सृह takes the वैदिक affix षि in “तुरासाहं पुरोधाय,” “तुरासाहिव शार्ङ्गिणम्” etc. वञ् is absent in “कुसुमावचयवचस्ता”। उपस् is used in the feminine in “इन्द्रराजया नवोषसा”। Vaidika metre is used in the verse—

अमी वेदिं परितः क्लृप्तधिष्णागः समिहन्तः प्रान्तसंस्तीर्णदर्भाः ।

अपन्नन्तो दुरितं हथ्यगन्धैर्वैतानान्त्वां वज्रयः पावयन्तु ॥

If we suppose that Pānini flourished about 300 B.C., and that it took about 200 years for his system to establish a dominant influence over the language, we are brought to a period covering the 1st and 2nd centuries B.C. which may be taken as the period of *transition* at which भाषा may be expected to bear such a resemblance to इन्द्रस्। Hence Kālidāsa probably lived some time in the 1st and 2nd centuries B.C.

EVIDENCE OF THE SAKUNTALAM.

The Sākuntalam ends with a prayer. The poet first prays for princes प्रवर्त्तनां प्रकृतिहिताय पार्थिवः—Let rulers work for the good of the people. We note that he does not say प्रकृतिरञ्जनाय, to *please* the people, but प्रकृतिहिताय—for the *good* of the people. His prayer is: May kings in their undertakings consider if good will result to the people. Next comes the prayer for the people—सरस्वती ऋतिमहतां नद्वैयताम्: Let the declarations of those that are learned in the Vedas gain respect, *i.e.*, May people have implicit faith in what learned Brāhmanas declare. Last is the prayer for self—ममापि

[N.S.]

च क्षपयतु, नीललोहितः पुनर्भवं परिगतशक्तिरात्मभूः— and may Siva remove my re-birth.

This is typical of the true Brāhmana—the Brāhmana to whom even when he is performing the ऋद्धि of his father the thought does not occur to offer the first share of the पिण्ड to the soul of his sire, but to those who have “न माता न पिता न वन्धुः”; the Brāhmana who, even after this first share is disposed of, does not think of offering the rest to him for whom the ceremony is intended, but approaches the priest with the query शेषमङ्गं क्व देयम्; the Brāhmana whose father goes without a share of the पिण्ड until and unless the priest utters the permission इच्छाय दीयताम्। What an example of self-sacrifice! क्व देयम् is the query, not कस्मै देयम्. Even the idea of an offer is absent, not to say of the departed dear one who is to receive the offer.

Such a Brāhmana is praying. The last clause of the prayer suggests that to him the glow of life has faded. The time has come when he is reminded of a re-birth. At such a moment, with the noblest work of his life finished, the prayer must have proceeded from the bottom of his heart and embodies his dearest wishes, not to himself but to others—the princes and the people. The verse deserves, and will repay, careful study.

The prayer शरस्वती श्रुतिमहतां महीयताम्—Let the declarations of those that are learned in the Vedas gain respect—is out of place unless we suppose that it refers to *current contempt* of Vedic teachings. Along with this let us read the last line of the opening verse—प्रत्यक्षाभिः प्रपन्नस्त्रुभिः etc.—Siva known by his directly perceived forms, etc. A plain statement like अथतु व ईशः—May the Lord protect you—is a perfect form of आशिस्। Why then this solicitude to tell people how ईश is known? An exactly similar anxiety is shown by the poet elsewhere where he says स्थाणुः स्थिरभक्तियोगमुलभो निःश्रेयसायास्तु वः—May Siva, who is easily reached by steady devotion, promote your welfare. There too स्थाणुः निःश्रेयसायास्तु वः would have been a complete and welcome benediction. But the poet is not satisfied without telling in the same breath with the benediction that स्थाणुः is स्थिरभक्तियोगमुलभः। Kālidāsa never says anything superfluous. If any poet in India may boast of the avoidance of व्यर्थविशेषण, it is he. I really do not see how to explain the presence of प्रत्यक्षाभिः प्रपन्नस्त्रुभिः and स्थिरभक्तियोगमुलभः except on the supposition that, when the poet lived, the country was full of sceptics who ridiculed Vedic rites and disputed the very existence of God. His third drama is more explicit.

There he says **सन्मार्गलोकनाय अपनयतु स वस्त्रामसीं वृत्तिमौशः**—May the Lord remove those propensities in you that are caused by ignorance so that you may discern the course followed by the wise (or discern the righteous course). This seems to be a pretty broad reference to Buddhism under the influence of which people, at the time of the poet, adopted an evil course (**तामसीं वृत्ति**) and began to ridicule the ways of the wise (**सन्मार्ग**). Even the lowest stratum of society must have been convulsed, or the simple fisherman would not have said it with warmth to the face of the head of the city police—

सहजं किल यत् विनिन्दितं न हि तत् कर्म विवर्जनीयम् ।

पशुमारण्यकर्मदारुणोऽनुकम्पाम्दुरपि श्रोत्रियः ॥

“I am not going to give up my profession because of your ridicule. I kill fish no doubt, but that does not show that I am heartless. Why, the Brāhman kills animals at sacrifices. Yet how kindly disposed he is. Who ever thinks he is cruel?”

The poet here exposes his aching heart. The *Sākuntalam*, as I shall show in detail elsewhere, is the protest of injured Brāhmanism against aggressive Buddhism.

It is not clear whether *Kālidāsa* wanted to be offensive while protesting. But even if he had wished and tried to be so, he could not have made the opening lines of the *Sākuntalam* more aggressive towards Buddhist feelings. He begins with the killing of an animal, not killing at a sacrifice, which too the Buddhists condemn: nor again, killing for food which, though extremely bad, has a sort of excuse, however lame it may be; but wanton killing—killing for pleasure, for killing's sake. Nay, he makes his hero minutely describe the distress of the victim with evident relish:—

ग्रीवाभङ्गाभिरामं मुञ्जरनुपतति स्यन्दने दत्तदृष्टिः

पश्चाद्धनं प्रविष्टः शरपतनभयाद्भ्रूयसा पूर्वकायम् ।

दर्भैरर्द्धावलीङ्गैः श्रमविवृतमुखभङ्गिभिः कीर्णवर्त्मा

पश्योदग्रजुतत्वाद्वियति बद्धतरं स्तोकमुर्थ्यां प्रयाति ॥

Referring to the line **प्रवर्तनां प्रकृतिहिताय पार्थिवः**—Let the king work for the good of the people—I may say it would obviously sound ridiculous at the time of *Rāma*, or *Yudhisthira*, or any other good king. I believe when the poet said so he had in his mind instances of kings who did *not* work for the good of the people. He says **हिताय नो रञ्जनाय**. We know the poet holds the view that a king is a king because he *pleases* the people—“**यथा प्रजादनाचन्द्रः प्रतापान्तपनी यथा—अन्वर्थो राजा प्रकृतिरञ्जनात्**”। **रञ्जन** is the nature of **राजा**. Just as the **चन्द्र** ceases to be **चन्द्र** by not gladdening the heart of men, the **तपन** (sun) is no longer **तपन** if he does not heat: so the **राजा** is not **राजा** without **रञ्जन**। When such a person omits

रञ्जन in his prayer for the राजा and substitutes रिन, it cannot be without a purpose. We have seen above the mood our poet is in, and what is preying on his mind, when he writes these lines. It is easy to see then what he considers रिन and what अरिन to the people. To him, as to every devout Brāhmana, the spread of Buddhism is an अरिन. This line, therefore, is a prayer that princes may not interest themselves in Buddhism.

Thus the sloka, taken as a whole, tells us that when Kālidāsa flourished the effect of Buddhist teachings was manifest all round and the memory of the efforts made by kings for the spread of Buddhism was still fresh. We therefore place him after Asoka who reigned in the 3rd century B.C., but he did not come long after. First to second century B.C. is a likely period.

EVIDENCE OF ASVAGHOSHA.

Asvaghosha's *Buddhacharita* is an old book written in the first century A.D. The language bears marked resemblance to the writings of Kālidāsa. Words that are peculiar to Kālidāsa such as धिष्णु in the sense of "resting place," निर्वाहण to express "carrying away," etc., are found in the same sense in Asvaghosha also. Identically the same compounds are used in the same sense by the two poets, and this so frequently that it is difficult to believe that they were separated by a very long interval of time, unless one of them is a close and clever imitator of the other.

In spite of this close resemblance, however, there seem to exist grounds to say that Asvaghosha represents a later stage of the development of the language.

In the first place, from a cursory examination of the *Buddhacharita*, I could not detect in it a single वैदिक form except the व्यवधान between the अमप्रत्यय and the अनुप्रयोग. But this व्यवधान alone cannot be decisive. For though कात्यायन prohibits the व्यवधान in भाषा, later grammarians do not respect the prohibition. The भट्टि allows it. Haradatta refers to it with a sneer. I think, therefore, *Asvaghosha came after the period of transition*.

Secondly, the form of the language appears to be finally fixed already at the time of Asvaghosha. The Buddhist is thoroughly under the influence of Pānini's grammar. So much so, that he devotes a section of the second book of his *Buddhacharita* to illustrate certain rules of Pānini in a way that makes it possible to pass them off as extracts from the *Bhāttikāvya*. Thus "बाहपरिष्ठी रमः" is illustrated by "शमेऽभिवमे विरराम पापात्." "स्वरितञितः क्वैभिप्राये क्रियाफले" by "भेजे दमं संविबभाज साधून्." This is verse 33. "विपराभां जेः" is illustrated by the next verse:—

नाधीरवत् कामसुखे ससञ्जे न संरञ्जे विषमं जनन्याम् ।

दृष्टेन्द्रियाश्चांशुपलान् विजिग्ये बन्धून्श्च पौरांश्च गुणैर्जिग्याम् ॥

The verse following is devoted to “विभाषा सुदुल्लङ्घोः” Thus—

नाध्येष्ट दुःखाय परस्य विद्यां ज्ञानं शिवं यत्तु तदध्यगौष्ठ ।

He proceeds till the end of Book II in this strain. For instance we find आनर्च, जहाव, ददौ in II. 36 ; सन्नौ, पयौ in II. 37 ; वभाषे, जजल्प, अशक्तु in II. 38 ; प्रपेदे, सिषेवे, मेने in II. 39 ; अचेच्छिदिष्ट, अवेभिदिष्ट in II. 40 ; विनिये जुगोप, तत्याज, ररत्त, प्राप, बुबुधे, जज्ञे, प्रजज्ञौ in II. 41 ; अजोचनत्, ददर्श, बबन्ध in II. 42 ; आचारीत्, आचामीत्, आपत् in II. 43 ; अजिह्वीषीत्, अचिकीषीत् अविवचौत् अदिधत्तौत् in II. 44 ; and so on.

After this it is no matter for surprise that his style is more artificial than that of Kālidāsa. He does not hesitate to sacrifice sense to sound. He opens his book with a rhyme :—

श्रियं परार्द्धां विदधद्विधाटजित्, तमो निरस्यन्नभिभूतभानुभृत् ।

नुदानिदाघं जितचारुचन्द्रमाः, स वन्द्यते ऽर्हन्निह यस्य नोपमा ।

Slokas 14, 15, 16, of Book I, are illustrations of चन्दा and मध्यमक । Instances like “रत्नप्रभोद्भासिनि यव लेभे तमो न दारिद्र्यमिवावकाशम्”, “सूक्ष्मत्परार्द्धांऽपि सपत्त एव प्रहृतदानोऽपि सदानपेतः” furnish us with the germ of that tendency to pun which subsequently attained full development at the hands of Bāna and Subandhu. As an instance of fanciful description we may note, among others, the following verse of Book I :—

रामासुखिन्दून् परिभूतपद्मान् यत्रापयतोऽप्यविमान्य भानुः ।

सन्तापयोगादिव वारि वेष्टुं पश्चात् समुद्राभिमुखः प्रतस्थे ॥

“The moons of the faces of the females there had disgraced the lotuses. The sun, passing over these moon-faces without punishing them, burns within with pent-up rage, and proceeds to the sea itself for a good supply of water for a plunge to allay the burning.”

This reminds us of the following from the Naishadha :—

निजांशुनिर्दग्धमदङ्गभस्मभिर्मुग्धा विधुर्वाञ्छति लाञ्छतोन्मुजाम् ।

तदास्यतां यास्यति तावताऽपि किं वधूवधेनैव पुनः कलङ्कितः ॥

“The moon requires a supply of good quality ash to remove his stain. Hence he is burning me up under his personal supervision with his own rays. But the fool does not see that even then he cannot resemble the face of Nala, because this very act of killing a woman will cause fresh stains to appear on him !

Thus, at the time of Asvaghosha, (1) Vaidika forms have disappeared from भाषा, (2) the study of लौकिक grammar has become

popular so that Asvaghosha deems it necessary to add illustrations to facilitate the study, (3) people's taste is changing and artificiality is replacing the natural poetry as seen in the writings of Kālidāsa. At least a century may be allowed to bring about these changes. Hence, if Asvaghosha lived late in the 1st century A. D., Kālidāsa may be placed early in the 1st century B. C.

I am surprised to find that Prof. Cowell places Asvaghosha before Kālidāsa. In the preface to his edition of the Buddhacharita, referring to Slokas 5—12, Raghu VI, he says : " I can hardly doubt that Kālidāsa's finished picture was suggested by the rough, but vigorous outlines in Asvaghosha . . . One verse certainly in Asvaghosha seems to me to have been directly taken and amplified by Kālidāsa."

Those who have followed me thus far will see the injustice of this charge. The physical impossibility of the suggestion did not strike Prof. Cowell, because he was labouring under the delusion of the now exploded 6th-century theory.

The scholarship and erudition of the learned professor, however, demand an independent examination of the question.

The description in Raghu runs thus :—

ततस्तदालोकनतत्पराणां सौधेषु चामीकरजालवत्सु ।
 बभ्रुरिरित्यं पुरसुन्दरीणां त्यक्तान्यकार्याणि विचेष्टितानि ॥ ५ ॥
 आलोकमार्गं सहसा व्रजन्त्या कयाचिदुद्दृष्टनवान्तमाल्यः ।
 बन्धुं न सम्भावित एव तावत् करेण रुद्धोऽपि च केप्रपाशः ॥ ६ ॥
 प्रसाधिकालम्बितमग्रपादमाक्षिप्य काचिद्द्वरागमेव ।
 उत्सृष्टलौलागतिरा गवाक्षादलक्तकाङ्गां पदवीं ततान ॥ ७ ॥
 विलोचनं दक्षिणमङ्गनेन सम्भाष्य तदक्षितवामनेत्रा ।
 तथैव वातायनसन्निकर्षं यथौ श्लाकाकामपरा वदन्ती ॥ ८ ॥
 आलान्तरप्रेषितदृष्टिरन्या प्रस्थानभिन्नां न ववन्ध नौवीम् ।
 नाभिप्रविष्टाभरणप्रभेण हस्तेन तस्याववलम्ब्य वासः ॥ ९ ॥
 अर्धाक्षिता सत्वरमुख्यितायाः पदे पदे दुर्निमित्ते गलन्ती ।
 कस्याश्चिदासौद्रसना तदानीमङ्गुलमूलार्पितसूत्रशेषा ॥ १० ॥
 तासां मुखैरासवगन्धगर्भैर्याप्तान्तराः सान्द्रकुर्वहलानाम् ।
 विलोचनेत्रभ्रमरैर्गवाक्षाः सहस्रपत्राभरणा इवासन् ॥ ११ ॥
 ता राघवं दृष्टिभिरापिवन्त्यो नार्थो न जग्मुर्विषयान्तराणि ।
 तथाहि शेषेन्द्रियदृष्टिरासां सर्वात्मना चक्षुरिव प्रविष्टा ॥ १२ ॥

स्थाने वृता भूपतिभिः परोक्षैः स्वयंवरं साधुममस्त भ्योज्या ।
पद्मेव नारायणमन्यथासौ लभेत कान्तं कथमात्मतुल्यम् १३ ॥

Asvaghosha has the following—

ततः कुमारः खलु गच्छतीति श्रुत्वा स्त्रियः प्रेष्यजनात् प्रवृत्तिम् ।
दिदृक्षया हर्म्यतलानि जग्मुर्जनेन मान्येन कृताभ्यनुज्ञाः ॥ १४ ॥
ताः सस्तकाक्षीगुणविभ्रिताश्च सुप्तप्रबुद्धाकुललोचनाश्च ।
दृत्तान्तविन्यस्तविभूषणाश्च कौतूहलेनापि भृताः परीयुः ॥ १५ ॥
प्रासादसोपानतलप्रणादैः काक्षीरवैर्नूपुरनिखनैश्च ।
विभ्रामयन्त्यो गृहपत्तिसंघानन्योन्यवेगाच्च समाक्षिपन्त्यः ॥ १६ ॥
कासाक्षिदासान्तु वराङ्गानां जातवराणामपि सोत्सुकानाम् ।
गतिं गुह्यत्वाज्जगृह्विंशालाः श्लोकीरथाः पीनपयोधराश्च ॥ १७ ॥
श्रीभ्रं समर्थापि तु गन्तुमन्या गतिं निजग्राह यथौ न तूर्णम् ।
ङ्गिया प्रगल्भानि निगूह्यमाना रहः प्रयुक्तानि विभूषणानि ॥ १८ ॥
परस्परोत्पौडनपिण्डितानां समर्दसंशोभितकुण्डलानाम् ।
तासां तदा सखनभूषणानां वातायनेष्वप्रशमो बभूव ॥ १९ ॥
वातायनेभ्यस्तु विनिःकृतानि परस्परोपासितकुण्डलानि ।
स्त्रीणां विरेजुर्मुखपङ्कजानि सक्तानि हर्म्येष्विव पङ्कजानि ॥ २० ॥
ततो विमानैर्युवतीकलापैः कौतूहलोद्घाटितवातयानैः ।
श्रीमत् समन्ताद्भ्रगरं वभासे विर्यदिमानैरिव साप्सरुभिः ॥ २१ ॥
वातायनानामविशालभावादन्योन्यगण्डार्पितकुण्डलानि ।
मुखानि रेजुः प्रमदोत्तमानां बद्धाः कलापा इव पङ्कजानाम् ॥ २२ ॥
तस्मिन् कुमारं पथि वीक्ष्यमाणाः स्त्रियो बभ्रुर्गामिव गन्तुकामाः ॥
उर्ध्वान्मुखाश्चैनमुदीक्ष्यमाणा नरा बभ्रुर्गामिव गन्तुकामाः ॥ २३ ॥
दृष्ट्वा च तं राजसुतं स्त्रियस्ता जाज्वल्यमानं वपुसा श्रिया च ।
धन्यास्य भार्येति धनैरवोचन् मुद्गैर्मनोभिः खलु नान्यभावात् ॥ २४ ॥

In the lists above, Prof. Cowell thinks Sloka 11 of Kālidāsa is directly taken from Slokas 20 and 22 of Asvaghosha ; and the entire description in the former is suggested by that in the latter. I see, however, very little in common in the two descriptions

except the fundamental idea that females rushed to have a look at the prince. The rush of females towards windows and terraces to witness marriage processions is of every-day occurrence in every city in India, and no Indian is in need of this idea of a rush of females being put into his head by another person. The details of the description will of course vary with the writer. In the above, we have only two points of detail that are common—the idea that *with the female faces crowding there, each window looked as if decorated with so many lotuses*; and the remark made by the females. We have to find out to whom these are due—to Asvaghosha or to Kālidāsa.

Before proceeding further we note that all the slokas quoted above from the Raghuvamsam, along with a very large number of other slokas not quoted, occur in the Kumārasambhavam also, with slight verbal changes, where necessary, to suit the context. Besides, there are several others in the two poems Kumāra and Raghu, which embody the same thought in different words. When an author repeats in one book what he has written in another, it is a sure sign that he is repeating his favourite ideas. On this consideration, the presumption is that Kālidāsa is the author of these common ideas. If he were not, he would not have paraded them in this way. The thief does not make a display of stolen goods.

On the other hand, an examination of Asvaghosha's Buddha-charita shows that, with all his mastery of the language, the writer is poor in ideas. Fine ideas abound in his work, it is true, but in almost every case I have been able to trace them to Vālmiki, or Vyāsa, or Kālidāsa. Asvaghosha is an expert in adapting other people's ideas to serve his own purpose. His description of the scene, as quoted above, is apparently a nice piece of poetry. But it does not contain a single idea which Kālidāsa has not expressed in his works. The difference is that the ideas are scattered in Kālidāsa, but focussed in Asvaghosha. Let me try to prove what I say.

The 15th verse of Asvaghosha quoted above presents the picture of women with jewellery misplaced (दृत्ताम्बुविव्यस्य) through eagerness, and with their progress hampered by the waist-chain which has slipped down.

Kālidāsa describes the misplacing of jewellery in Kumāra I. 4.—“यथा शरीरविभ्रममखनानाम्,” etc. The waist-chain interfering with motion is described in Kumāra III. 55—“स्रस्तां नितम्बाद्वलम्बाम्ना पुनः पुनः केशरदामकाक्षीम्”।

The idea of haste expressed by this sloka of Asvaghosha does not seem to suit the occasion. Preparations for the prince's going out were going on for days as is obvious from verses 3, 4, 5. The time for the start was also fixed (see verse 6). Verses 10, 11, 12 show that the prince's chariot was moving very slowly (शनैः शनै राजपर्यं जगच्छे) with a view to give an opportunity to such of the citizens as wished to have a good look at him. The citizens, too,

males and females, came out of their houses and prostrated themselves before him. The females of position waited upon their elders for permission to go up to the roofs of the houses to witness the prince passing (sl. 13). Up to this point, everything was progressing leisurely. But all of a sudden people had to be roused from sleep; they had to dress dreamily and jewellery got misplaced. The prince did not pass at midnight, and it is difficult to understand this sleep in high quarters.

Asvaghosha's verse 16 says: "so many females rushed together that the tumult and clinking of anklets frightened the birds in the house."

Exactly the same scene is given by Kālidāsa, Raghu XVI, 56:—

सा तीरसोपानप्रधावतारादन्योऽन्यकेयूरविघट्टिनीभिः ।

सनूपुरक्षोभप्रदाभिरासौदुद्विप्रहंसा सरिदङ्गनाभिः ॥

Here, in Asvaghosha, the roof and the staircase resounded with the noise of hasty footsteps. Does not this imply people running up the steps? But in the previous verse the females are described as obliged to move *slowly* (सककाशीगुणविप्लवताः). Verse 16 assumes not only great speed but a large jostling crowd also (अन्योऽन्यवेगात्समाक्षिपन्त्यः). There was no occasion for the crowd. It was not that every house was celebrating a marriage at the time to account for the presence of so many females.

Kālidāsa's sloka, on the other hand, describes the जलक्रीडा of the inmates of the vast harem of prince कुश in the river सरयू, and suits the occasion very well.

(Asvaghosha, verse 17).—The picture is that of females eager to run fast but unable to do so because of their heavy hips and breasts.

This is just the picture we see in Kumāra, I. 11:—

उद्वेजयत्यकुलिपार्थिभागान् मार्गे शिलीभूतहिमेऽपि यत्र ।

न दुर्वहश्रोणिपयोधराती भिन्दन्ति मन्दां गतिमश्वमुख्यः ॥

(Asvaghosha, verse 18).—Obscene. For an exact parallel however, see Kumāra VIII. 87.

This, too, of Asvaghosha is incongruous. She should not have thought of this at a time when she was so eager to see the prince. Besides, with the eye of all on the prince, there was none there to notice her.

(Asvaghosha, verse 19).—Crowd—jingling of jewellery—tumult at the windows. This is almost a repetition of verse 16, and is fully met by the verse quoted above—Raghu XVI., 56.

(Asvaghosha, verse 20).—Crowd so great that ear-rings came into contact. The faces thrust out through the windows looked like so many lotuses attached to the houses.

Compare Kālidāsa sl. 11. above.

[N.S.]

(Asvaghosha, verse 21).—The houses looked like so many heavenly cars, and the females like celestial nymphs in the cars.

Kālidāsa has a similar idea when he says in *Raghu* VI. 1, that the princes at the *Svayamvara* of *Indumati*, seated on stages, looked like so many gods seated on celestial cars :—

स तत्र मञ्चेषु मनोज्ञवेशान् सिंहासनस्थानुपचारवत्सु ।
वैमानिकानां महतामपश्यदाक्ष्यलीलान्नरलोकपालान् ॥

(Asvaghosha, verse 22).—Crowding at the windows. Earrings in contact. Faces like so many lotuses bound into a bundle.

Compare Kālidāsa, sl. 11 above.

As I have already remarked, the occasion was not one at which every house was expected to be over-crowded. Hence verses 18 to 21 of Asvaghosha will take a lot of explaining. Moreover, if we remember that the females had permission to get up to the terraces (see verse 13), the necessity for over-crowding the windows is not clear.

Thus, though Asvaghosha's ideas, considered singly, are good, they either do not suit the occasion, or clash with one another. His entire scene is a piece of patch-work poetry, rather clumsily done up, with the seams clearly visible.

The suspicion is unavoidable that the ideas are borrowed from Kālidāsa, in whose works they all occur; but the context being different, their combination in Asvaghosha has produced a heterogeneous mass.

(Asvaghosha, verse 22).—All were so eagerly looking at the prince that the females appeared as if they wanted to go down, and the males as if they wanted to go up.

Just now I do not recollect where I have seen this in Kālidāsa, though the idea seems to be a familiar one.

(Asvaghosha, verse 23).—Seeing the beauty of the prince, the females exclaimed : "How lucky must be his wife."

See *Raghu* 13 above. Also compare *Kumāra* VII. 65 :—

स्थाने तपो दुस्वरमेतदर्थमप्रार्थया पेलवयापि तप्तम् ।

या दास्यमयस्य लभेत नारी सा स्यात् कृतार्था किमुताङ्गप्रथ्याम् ॥

The postscript in Asvaghosha श्रद्धैर्मनोभिः खलु नास्वभावात्—with a chaste heart and not from any other motive—is suspicious. It looks like a fling at *Kumāra* quoted above, in which the remark या दास्यमयस्य, etc., does not indeed appear to be wholly innocent. Kālidāsa, too, has altered the second half in *Raghu* so as to leave no room any longer to doubt the motive of the females. Had Asvaghosha's book been before him to guide him as a model, as Prof. Cowell supposes it was, he would not have written या दास्यमयस्य लभेत in *Kumāra*. This slip, and the subsequent correction in *Raghu*, seems to be in itself a proof that Kālidāsa supplied the original, which Asvaghosha copied.

RECAPITULATION.

I conclude with a summary of the results. I have tried to establish :—

- (1) That neither Prof. Max Müller nor Prof. Macdonell has given good reasons to disbelieve the tradition assigning 57 B.C. to Kālidāsa.
- (2) That from the way Kālidāsa speaks of the Persian Navy it is not likely that he came after Christ.
- (3) That from the absence of artificiality in his style he appears to be older than the Gīrnār and Nāsik inscriptions of the 2nd century A.D.
- (4) and (5) That from the history of certain words, Sanskrit seems to have been the spoken language of the learned at the time of Kālidāsa. From the free use of Vedic forms in his writings he seems not to have been influenced by Pānini's grammar, and to belong to the post-Pāinean period of transition from Vedic to Sanskrit literature which probably extended from 300 B.C. to 100 B.C.
- (6) That from allusions to Buddhism and its patronage by royalty, in the Sākuntalam, the poet seems to have flourished soon after Asoka. This, too, points to the period 300 to 100 B.C.
- (7) That from considerations of style, taste, etc., our poet seems to have been older than Asvaghosha, the Buddhist poet of the first century A.D.

CONCLUSION.

It will not therefore be unreasonable to place *Kālidāsa midway between Asvaghosha (79 A.D.) and Asoka (227 B.C.), i.e., early in the first century B.C.*

This represents him as a young man in the full vigour of his giant intellect at 57 B.C., and confirms the tradition still current in India.

35. **Reduction of Fehling's Solution to Metallic Copper—
a Method of Depositing a Shining, Mirror-like
Film of Copper on Glass Vessels.**

By PAÑCHĀNAN NEOGI, M.A., *Professor of Chemistry, Rajshahi
College.*

Liebig first demonstrated that silver may be deposited on glass vessels by reducing an ammoniacal solution of silver oxide by means of chemical reagents (Liebig, *Annalen*, 1835, xiv, 133). The method has received an industrial application in the preparation of mirrors; and various substances such as tartarates, sugars, etc., are now used in order to obtain a shining deposit of silver on glass. Copper, which is analogous to silver in the cuprous condition, is difficult to obtain by reduction from cupric compounds by means of organic reagents, as the reduction should pass through an intermediate stage of cuprous compounds before metallic copper may be deposited. In the case of silver, however, the reduction of silver salts to metallic silver is direct.

Faraday (*Phil. Trans.* 1857, p. 145) obtained a deposit of metallic copper by dissolving copper oxide in olive oil, and heating plates of glass in the oil up to the decomposing temperature of the latter. Another method by which he obtained the same result (*Phil. Trans.* 1857, p. 154) was by deflagrating the metal in the neighbourhood of the glass by means of a Leyden battery in an atmosphere of hydrogen. Wright (*Silliman's Amer. Journ.*, 1877, 3, xiii, 49) obtained some brilliant mirrors of copper on the inner surface of exhausted glass tubes by passing through them an electric discharge between copper electrodes. The firm of Weiskopf obtained it by a complicated chemical process. Chattaway in a paper read before the Royal Society of London on November 21, 1907, has obtained shining deposits of copper by first reducing an ammoniacal solution of copper hydrate by means of freshly-distilled phenylhydrazine, and then heating the solution with 10 per cent. caustic potash solution. In the present investigation it has been shown that brilliant deposits of copper may be obtained on glass vessels by reducing Fehling's Solution, under special circumstances, by means of formaldehyde.

Fehling's Solution (*Annalen* 72, 106; 106, 75) as is well known, is reduced by aldehydes and other organic reducing agents to red cuprous oxide, but the reduction of the solution by means of formaldehyde to metallic copper which deposits on glass vessels as a shining layer is, to my knowledge, new. The following details, if followed, give good results. The usual solutions of copper sulphate and alkaline tartarate are prepared and kept in separate bottles. The copper sulphate solution is poured in the test tube, beaker or any other glass vessel to be "cuppered," and

the alkaline tartarate solution is gradually added until the precipitate of copper hydrate first formed is *just* re-dissolved. Excess of the alkaline solution is to be avoided. Strong formaldehyde is then added until the solution smells perceptibly of the reagent. The solution is tilted to one side and heat is applied to that side until a little shining layer of copper forms on the glass. At this moment the glass vessel is given a rotatory motion by the hand when the deposition of copper takes place *of itself* all round the glass surface. If the deposit is not uniform, the experiment is to be repeated until a uniform deposit is obtained. No perceptible gas evolution has been noticed and the deposit is extremely brilliant, showing the pleasing "coppery" colour of highly-polished copper. The deposit is very firm and seems to be more so than that of silver. The general effect is only satisfactory when the glass vessels are scrupulously cleaned beforehand. High temperature is essentially necessary, and in fact the mixed solution was kept in boiling water without any perceptible deposition of copper. Formaldehyde vapour was passed over hot Fehling's Solution without much success.

Grape-sugar and milk-sugar were substituted for formaldehyde, but in these cases red cuprous oxide was, as is well known, alone precipitated.

That the deposit really consists of copper and not cuprous oxide has been confirmed by an analysis of it. The deposit was scraped off, dried, dissolved in nitric acid, precipitated and weighed as oxide. The percentage of copper was found to be 98.6. The copper was slightly blackened in the course of drying.

It is difficult to say whether metallic copper is deposited directly or that the reduction passes through the intermediate stage of the formation of a cuprous compound. Chattaway (*loc. cit.*) has obtained his deposits from a solution containing cuprous hydrate in excess of ammonia, and says that the formation of Cu_2O is analogous to that of silver from Ag_2O . But in this case the reduction of the cupric compound is a complex one, for in addition to the deposition of metallic copper a greenish precipitate mixed with cuprous oxide is also formed.

It has always puzzled chemists to ascertain the conditions which determine the deposition of silver sometimes as a finely-divided powder and sometimes as a shining mirror. Vogel (*Journ. Pract. Chem.*, 1862, lxxxvi, 321) in the course of his experiments on silver deposits, concludes that mirror is obtained when complete reduction takes place in one single stage, and the finely-divided powder is obtained when the reaction takes place in two stages, a lower insoluble oxide separating in the first place which is further reduced afterwards. In the case of copper deposits Vogel's conclusions are, as Chattaway (*loc. cit.*) has pointed out, hardly applicable, and specially so in the present investigation, as the deposition is not the result of a complete reduction, but of a complex reaction.

36. Geological Notes on Hill Tipperah (including the Lalmal range in Comillah District).

By HEM CHANDRA DAS GUPTA.

1. As far as my information goes, the State of Hill Tipperah has never been visited by any professional geologist. I availed myself of a college vacation in May 1906 to make a tour through a portion of the State, and am deeply indebted to Mr. Ramani Mohan Chatterjee, M.A., at that time minister of the State, for giving me every possible assistance. Unfortunately the time selected was inopportune. I reached Tipperah by the end of May; it was just at the commencement of the rains, and the interior of the country had become mostly inaccessible.

Introduction.

2. The main physical features of the State consist of a system of mountains and valleys parallel to one another, and running north and south. The average distance between any two consecutive ranges is about 12 miles, and as one proceeds from the west to the east, the ranges gradually increase in height. The principal river valleys are all longitudinal, *i.e.*, coinciding with the north and south ranges. None of the streams are navigable throughout the year, and only a few of them are so during the rains. These are the Gumti, Haora, Khoyái, Manu and Pheni. Just as there is a gradual rise in altitude of the successive ridges as we proceed from west to east, so do the floors of the intervening valleys also ascend independently of the slope of drainage. These orogenic features probably owe their origin to a single period of upheaval.

Physical aspect.

3. My observations were restricted to the western border of the hilly country. The oldest group of beds, I observed during my short tour, is represented by an unfossiliferous calcareous sandstone of great thickness which contained at its base some fragments of lignite. A woody structure is clearly observable in some of the specimens, and on analysis they give out about 40 per cent. of carbon with about 54 of volatile matter. Unfortunately this mineral fuel only occurs as small disconnected fragments disseminated through a hard sandstone. The lignite is sulphurous. This calcareous sandstone is abundantly developed in the Fatikuli-subdivision of the State; it is somewhat olive-coloured, and, besides quartz, contains grains of chloritised biotite, iron-ore and white mica. Zircon also occurs very sparingly.

4. The Fatikuli sandstone is overlaid by a layer of ferruginous concretions, perhaps of lateritic origin, which though much decomposed in the contact sections, seem to be very abundant, and in a comparatively good state of preservation near the town of Agartala. A good exposure of this is to be found at the locality known as Kunjaban, near the town. In some cases these concretions are found to be covered over by sand five or six inches deep. No bedding could be observed in the concretionary layers. The concretions are pisolitic, though often gravelly, the pebbles sometimes measuring about three inches across. They often assume a coating of dark brown colour due to subaerial decomposition, and when specimens from the surface are broken the fracture appears of a brick-red colour. These ferruginous concretions are generally used for road metalling, for which purpose they answer excellently well, as is always the case with gravelly forms of laterite. These concretions consist mainly of limonite.

5. There rises, about five miles to the west of the town of Comillah, a small hill range, with an average height of 90 feet above sea-level, and 40 feet above the level of the plain. This low hill extends for a distance of about ten miles, north and south, and is known as the Lalmai range. It is made up of slightly micaceous, yellow-coloured sandstone and ferruginous concretions which, when decomposed, colour the top of the hill brick-red. The sandstone is not much indurated and appears to lie horizontally. There are also horizontal intercalations of clay, only a few inches thick, and occasional occurrences of argillaceous nodules. The clay varies in colour from white to dark black. Some pebbles of quartz were also observed, but they were extremely rare. At the southern extremity of the range the character of the rock somewhat changes. The extreme southern portion is known as the *Chandimoorah* (moorah=hill, a local term); it contains no micaceous material and consists of a conglomerate of decomposed rocks which are chiefly sandstone with occasional lumps of soft shaly mudstone. Ferruginous concretions and pebbles are very rare, but the most striking feature here is the abundant occurrence of fossil wood. The fragments sometimes attain considerable dimensions with a diameter of several inches. They are completely silicified and are well exposed in a section near Chandipur, and all lie horizontally; I failed to discover any in an erect posture. They apparently lie parallel to one another and might have been drifted by a strong current. Slides of this fossil wood were kindly examined by Mr. Burkill, who is unable to identify it, but it is apparently not lower in the system than Pinus.

6. In the midst of the fertile alluvial plain, there is a peculiar uncultivable area about $\frac{1}{2}$ a mile long and $\frac{1}{3}$ th of a mile broad, locally known as the *pyaro-land*, which is covered over with turf

floating on a muddy subsoil. It is bounded by uncultivated land on the north, the Deo Sora on the east and the south, and the Juri river on the west. The oldest inhabitants of the locality informed me that when they came to settle in the country, the plain was overgrown with reeds of different kinds and the "pyaro-land" restricted to a very small area. With the clearing away of the jungle, the "pyaro-land" gradually encroached and is still tending to spread. I was shown the ruins of a house deserted some time ago, on account of the conversion of the courtyard into a quagmire of this sort. The depth of the "pyaro" is variable, the layer of turf being about $\frac{1}{2}$ an inch thick while the liquid mud seemed to be about seven feet deep. Water oozes out on the surface, and when the Juri is in flood, during the rains, the subsoil water also seems to rise. During the great earthquake of 1897, water came out in torrents from underneath, and the depth of the "pyaro" is reported to increase annually. On this land cultivation is impossible.

7. The find of fossil wood in the Lalmai range is interesting because it helps us in correlating the

Correlation.

Tipperah rocks with the other Indian rock-systems, the age of which has been more or less definitely fixed. Fossil wood has been found in many parts of India, but the most notable of them is Burma,¹ and a considerable importance has been given to it in the literature of Burman geology, where the expression "fossil wood" group has been used to represent the topmost tertiary beds overlying the Pegu system, for which Dr. Noetling proposed the name "Irrawadi division."² It is probable that the Lalmai range corresponds to the Lower Series of the Irrawadi division, *i.e.*, fossil wood group of Burma, and this correlation is further corroborated by its association with ferruginous concretions as described before. The calcareous sandstone of Fatikuli perhaps belongs to the Pegu system (Oligocene and lower Miocene) of Burma. This system has been divided into two series,³ the Yenangyoung and the Prome; but from the extremely fragmentary knowledge at our disposal, it is impossible to point out the series that the Fatikuli sandstone should be relegated to.

¹ Mem. Geol. Sur. Ind., Vol. x, p. 247.

² Rec. Geol. Sur. Ind., Vol. xxviii, p. 76.

³ *Ibid.*, Vol. xxviii, p. 64.

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37. **Diagnosis of a Living Species of the Genus
Diplonema (Psychodid Diptera).**

By N. ANNANDALE, D.Sc., *Superintendent, Indian Museum.*

The genus *Diplonema* appears to have been known hitherto from three tertiary species, which occur in Baltic amber, and from one quaternary form in fossil copal. The surviving form here described was taken by myself at Kurseong in the Darjeeling district (alt. 5,000 feet) in July. Three specimens (σ , 2 φ φ) were obtained. A full account will be published later in the *Records of the Indian Museum*.

Diplonema superstes, sp. nov.

σ , φ Total length 3 mm. ; expanse of wings 8 mm.

Colour sooty black with a strong white refulgence ; a broad white band on each tarsus.

Antenna with 15 joints ; the basal joint cylindrical, the second almost discoidal, these two (the scape) covered with scales ; each joint of the flagellum, except the last, bearing, in addition to a broad basal band of hairs, a large S-shaped chaeta on either side ; joints of the flagellum spindle-shaped, the distal end of each smooth, devoid of hairs ; the last joint bearing hairs only, produced at the tip into a minute, cylindrical, blunt process covered with exceedingly fine pubescence. Palpi 4-jointed ; the first joint short, the others longer, subequal ; the whole organ covered with flattened hairs, which gradually take the form of scales towards the base of the second joint.

Wings broadly heart-shaped ; the length to the greatest breadth as 4 to 3 ; the alula large, elongate, bearing a dense tuft of long hair ; the disk covered with overlapping, spatulate scales, which are narrower near the margins than at the centre and base ; the veins clothed with a double row of hairs ; the marginal fringes long ; a tuft of very long hairs at the posterior basal angle. Subcostal vein practically obsolete ; base of first (normal) vein approximating to the stem of the second, the two branches of which arise close together, both being nearer the base of the wing than, or as near as, the fork of the fourth vein ; the bases of the second and third and of the fifth and sixth veins united ; the fourth nearly straight ; seventh almost as long as the sixth.

Abdomen covered with bristling hairs, which are mixed with scales on the thorax ; the front bearing a dense tuft of semi-erect scales.

Male genitalia complicated ; a well developed intromittent organ present, consisting externally of two elongated, pointed valves ; inferior appendages borne at the end of a flattened sub-

genital plate, short, rounded, clad externally with long scattered hairs and bearing internally a number of racket-shaped spinules, the broader part of each of which is surrounded with a close-set fringe of minute, blunt projections.

JUNE, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 3rd June, 1908, at 9-15 P.M.

The HON'BLE MR. JUSTICE ANUTOSH MUKHOPADHYAYA, M.A. D.L., President, in the chair.

The following members were present:—

Dr. N. Annandale, Mr. I. H. Burkill, Mr. J. A. Chapman, Mr. B. Chaudhuri, Mr. L. L. Fermor, Mr. T. H. D. La Touche, Dr. Girindra Nath Mukhopadhyaya, Major L. Rogers, I.M.S., Dr. E. D. Ross, Rai Ram Brahma Sanyal, Bahadur, Mr. G. Thibaut, C.I.E., Dr. Satis Chandra Vidyabhusana, Mr. E. Vredenburg, and Rev. A. W. Young.

Visitors.—Mr. W. A. Freymuth, Hon'ble Mr. Justice H. Holmwood, and Babu P. Neogi.

The minutes of the April meeting were read and confirmed.

Seventy-four presentations were announced.

The Council reported that no meeting was held in May as a quorum of members was not present.

The President announced:—

1. That Mr. T. H. D. LaTouche has been appointed General Secretary in the place of Lieut.-Colonel D. C. Phillott, gone to Europe on leave.

2. That the Trustees of the Elliott Prize for Scientific Research have awarded the prize for the year 1907 to Babu Akshoya Kumar Mazumdar, of Mymensingh.

The General Secretary reported the deaths of Dr. H. C. Garth, Lieut.-Col. F. S. Peck, I.M.S. (Ordinary Members); Prof. L. F. Kielhorn (an Honorary Member); and The Revd. Father E. Lafont, S.J. (an Associate Member) of the Society.

The Council reported that in consequence of the deaths of Sir Michael Foster, Lord Kelvin, Lieut.-General Sir Richard Strachey, and Prof. L. F. Kielhorn, there were now four vacancies in the list of Honorary Members. The Council, therefore, recommend the four following gentlemen for election as Honorary Members at the next meeting:—

Lieut.-Col. Henry Haversham Godwin-Austin, F.R.S., F.Z.S., F.R.G.S., Surrey, England.

Prof. Melchior Treub, Buitenzorg, Java.

Prof. Herman Oldenberg, Kiel, Prussia, Germany.

William Irvine, Esq., I.C.S. (retired), London.

Lieut.-Colonel Henry Haversham Godwin-Austin, F.R.S., F.Z.S., F.R.G.S., etc., was educated at Sandhurst and joined

the 24th Regt. of Foot, 1851; he retired in 1877. He came to India in 1852 and served in the Second Burmese War and in the Punjab. He was appointed Topographical Assistant in the Trigonometrical Survey of India, and joined the Kashmir Survey Party in 1857. He surveyed a very large extent of country in Kashmir and Baltistan; in the latter country he was the first to discover the enormous glaciers at the head of the Shigar river and Hunza Nagar frontier, including the Baltoro glacier, coming down in part from the second highest mountain in the Himalaya, since named after him. He surveyed the lofty country of Rupshu and Zaskar in Ladakh, 1862; in July and August of that year he made 13 different ascents of a mean height of 17,900 ft., the highest peak, Mata, being 20,607 ft.; he took up the Survey of the Chanchingmo and carried the topography to the eastern end of the Pang-kong lake, close to Rudok in Chinese Territory, where he was met and stopped by the Lhasan Governor in 1863; in the winter of 1862-63 he was on special duty with the last mission to Bhutan and mapped the whole country between Darjeeling and Punakha. He was with the expedition against the Daffa tribe at the base of the Eastern Himalayas, when a large area of new country was mapped and many distant peaks fixed. He became President of Section E (Geography) of the British Association in 1883, and President of the Malacological Society, 1897-1899. He has published largely on the Land and Freshwater Mollusca of India, and very many papers in the Journals of various Scientific Societies on geology and physical features, ethnology, and natural history. He has been an enthusiastic member of this Society since 1861, has contributed many articles to its *Journal* and is still actively engaged in the study of Indian Malacology, having published papers during the year, and having other important monographs in hand. (NELSON ANNANDALE.)

Melchior Treub took his Doctor's degree at Leyden in the year 1873 with an inaugural dissertation upon the nature of Lichens, for the purpose of which he had successfully separated some half dozen into the fungus and the alga whereof they are constituted.

In 1876 he joined the staff of the Botanic Gardens at Buitenzorg, Java, as Botanical Assistant. At least thirty scientific papers, most of them of considerable size, were the output of his industry during the next ten years, and therein he was a pioneer in testing the resources of the tropics for microscopic work bearing on the problems of the day. He worked a great deal at the anatomy of the sexual organs: he studied the embryology of orchids: his researches on Cycads had considerable importance, and his researches on the prothallus of *Lycopodium* had great importance. He combined with this morphological and anatomical work a certain amount of work on the biology of plants.

In 1880 he became Director in succession to Dr. Scheffer: and

in 1885 we find him inviting botanists to work in Java, having persuaded his Government to go to the liberality of providing accommodation for them. This generosity has been appreciated. Nearly one hundred botanists have made use of it; and without doubt the value of their work has been not inconsiderable to the colony.

Traub, meanwhile in order still to carry on his scientific work without letting it interfere with his large administrative duties, worked, I believe, daily in his laboratory at the time when all Europeans in Java take a siesta. In 1888 he took an opportunity of visiting the island of Krakatoa, the scorched-up, ash-buried island of the great eruption of 1883, and recorded how the vegetation was returning to it, what kind of plants came first by means of their sufficient means of distribution, and what came after. In 1891 he astonished the botanical world with his discovery of "chalazogamy" or fertilisation of the ovule through its stalk. His long previous work had led up to this—no mere fortunate accident.

During these years Traub's staff had grown enormously by the addition to it of men to cope with economic problems, and about five years ago the Dutch Government decided on turning it and strengthening it into an Agricultural Department. Traub became Director of the new Department.

Buitenzorg remains his headquarters; the garden, small when he became Director, is now much larger, his Out-Experiment Stations are many—one for tobacco, others for sugar, another for Cinchona, and so on; the staff that he has built up has hitherto been the largest scientific staff in the tropics; their work covers the whole work of our Agricultural and Forest Research Institutes as well as work in Pharmacology and all the pure Botany of the Dutch Indies. The growth has been due to Traub's ability.

Traub has almost finished his service in the East, and it is appropriate that he as a pioneer botanist of the East should be one of our Honorary members. He has been a foreign member of the Royal Society since 1899 and of the Linnean Society since 1887, and the Crown of Holland has conferred on him the title of Professor.

He visited India in 1904, and is familiar with the status and work of our Society. (I. H. BURKILL.)

Professor Herman Oldenberg holds a conspicuous place in that generation of European Sanskritists which constitutes what we may call the *older* generation, now that almost all those distinguished Oriental scholars whose early works saw the light about the middle of the last century have passed away. Professor Oldenberg for a considerable time taught at the University of Berlin as "Privat Dozent" and "Professor Extraordinarius": later on he was appointed Ordinary Professor of Sanskrit in the University of Kiel, where he is living at present. His publica-

tions are very numerous, and nothing like a complete enumeration of them can be attempted in this place. His most remarkable work was done in connection with Buddhistic literature and faith on the one hand, and on the other hand with the Rigveda and Vedic religion. I need only mention a few of his most important publications in these fields—his great edition of the Vinaya Pitaka, his well-known book on Buddha, his Prolegomena to the Rigveda, and his Book on Vedic Religion.

Professor Oldenberg presents an astonishing combination of various great gifts. His scholarship—linguistic, philological, historic, antiquarian—is wide and at the same time minute; he possesses an unwearying industry in collecting and amassing facts and figures, but ever proceeds to analyse and combine them with surprising critical skill and acumen; he shrinks from no tedious detail, but never loses out of sight what is of essential and lasting significance in human life and history; he, in fact, is a philosopher no less than a scholar and critic. His insight into ancient phases of thought and belief is as keenly penetrative as it is deeply sympathetic, and it is in this field in fact that he has achieved his greatest successes. And to all this he joins a rare gift of eloquent, often truly brilliant, exposition. There are other contemporaneous Orientalists who equal, or may even excel him, in certain respects, but viewing the total sum of his endowments and performance we consider ourselves justified in saying that the position he occupies is unique. (G. THIBAUT.)

William Irvine, late Bengal Civil Servant (North-Western Provinces and Oudh) was educated at King's College, London, and was appointed to the Indian Civil Service after the examination of 1862. He arrived in India on 12th December, 1863, and served in the North-Western Provinces as Assistant Magistrate and Collector, Joint Magistrate and Deputy Collector, and Magistrate and Collector up to 26th March, 1888. He retired in 1888.

He is author of:—*Canal Rates versus Land Revenue* (*Calcutta Review* 1869). *The Rent Digest, or the Law Procedure relating to Landlord and Tenant, Bengal Presidency* (1869). *Bangash Nawabs of Farukhabad* (*Journal of the Asiatic Society of Bengal*, Vols. xlvii and xlviii of 1877-79). *Contribution to Gazetteer of Farukhabad* (1870). *Settlement Report of Ghazipur District* (1876). *The Army of the Indian Moghuls, its organisation, etc.* (1904). *Translator of "Storia do Mogor or Moghul India," 1653-1708, by Niccolao Manucci, Vols. i, ii, iii* (1907).

(E. D. ROSS.)

The Council also reported that there were now four vacancies in the list of Associate Members, and the Council therefore recommends the three following gentlemen for election as Associate Members at the next meeting.

1. Babu Dines Chandra Sen; Calcutta.
2. Mahamahopadhyaya Sudhakara Dvivedi. Professor, Government College, Benares.
3. Revd. Father J. Hoffmann, S.J., Ranchi.

Babu Dines Chandra Sen. B.A., author of a *History of Bengali Language and Literature* for which the Secretary of State gave him, upon the recommendation of Lord Curzon, a life pension. University Reader. (ASUTOSH MUKHOPADHYAYA.)

Mahamahopadhyaya Sudhakara Dvivedi, Professor, Government College, Benares, author of various works on Hindu Mathematics, which show great research. (ASUTOSH MUKHOPADHYAYA.)

The Revd. Father J. Hoffmann, S.J., well known as an authority on the languages and customs of the Mundas, and author of a recent paper in the *Memoirs* of the Society on the Poetry, Music and Dances of this tribe. (N. ANNANDALE.)

The General Secretary submitted obituary notices of the late Professor L. F. Kielhorn, an Honorary Member, and the Revd. Father E. Lafont, S.J., an Associate Member.

Professor Lorenz Franz Kielhorn, Ph.D., LL.D., C.I.E., was born in Osnabrück in Westphalia on the 31st May, 1840. He studied Sanskrit under Benfey, Stenzler, and Weber at the German Universities of Göttingen, Breslau, and Berlin. Thereafter he went to London and Oxford, where he assisted Max Müller in his edition of the Rigveda. In 1866 he was nominated Professor of Sanskrit in the Deccan College at Poona, and he held that post till his retirement in 1881. In the following year, 1882, he succeeded Benfey in the Sanskrit chair of the University of Göttingen. He died suddenly on the 19th March, 1908, before completing his 68th year of age.

Professor Kielhorn was beyond doubt one of the greatest European authorities on Classical Sanskrit. As far as his knowledge of the Indian system of Sanskrit Grammar was concerned, even the best among Indian Pandits bowed to his authority. For he combined the critical methods of the West with a most intimate acquaintance with all the technicalities of Eastern commentators, acquired by him during his sojourn in Poona, where some of the most learned Indian scholars have been working under him as his assistants. His edition of the Mahābhāshya is the classical work on Sanskrit Grammar according to the system of Pāṇini. Likewise, his book on "Kātyāyana and Patañjali: their relations to each other and to Pāṇini," which appeared first in Bombay in 1876, opened the way to a critical understanding of the Mahābhāshya, and traced the genesis of Patañjali's famous commentary.

After his retirement from the Indian Educational Service, Professor Kielhorn joined his friend and Indian colleague, the late Professor Bühler, as one of the pioneers in the field of Indian Epigraphy and Palæography. His editions of Sanskrit inscriptions, which make up about one-quarter or perhaps one-third of

all the published editions in that branch of Indian antiquarian research, are classical, and any future worker in that line may rest contented if his work comes up to the standard of Professor Kielhorn's editions. Although he never lost sight of the larger aspects of Indian history, to the proper understanding of which Epigraphy affords our main and unfortunately almost sole guidance, yet he did not refrain from all that drudgery in regard to details, which for epigraphical work in India is a *conditio sine qua non*, and for which most of the Indian scholars, who have taken up the same branch of study, appear to have an innate abhorrence. His two lists of Sanskrit inscriptions from Northern and Southern India, published with two of the last volumes of the *Epigraphia Indica*, are more than mere registers of Indian inscriptions down to modern times. Epigraphy has now been made easy to us, and we should never forget that we owe this to a very large extent to the late Professor Kielhorn. (T. BLOCH.)

The Society has lost the oldest of its Associate Members in the person of the Very Revd. Father E. Lafont, S.J., who died at Darjiling on the 11th of May, at the age of 71 years, leaving behind him a record of strenuous work in the cause of science and of the welfare of the institution, St. Xavier's College, where he filled the office of Rector from 1871 to 1878, and again from 1901 to within a short interval before the time of his death. He was elected an Associate Member of this Society in 1874, and for many years took an active interest in its discussions, but of late years failing health made it impossible for him to attend our meetings so frequently as before. Father Lafont was born at Mons in 1837 and entered the Society of Jesus in 1854, devoting himself mainly to the study of philosophy and natural science, pursuits which were destined to bear abundant fruit during his career in this country. He came to Calcutta in 1865 and immediately became attached to St. Xavier's College, where the chief of his duties was the teaching of experimental physics. It was mainly, if not entirely, due to his efforts that the College was endowed with an Observatory, and with a well-organised and equipped Physical Laboratory, where he got together a magnificent collection of instruments.

The distinction he won by his labours caused him to become the recipient of numerous honours. He was admitted a Fellow of Calcutta University in 1877, and was repeatedly elected a member of the Syndicate by his colleagues. In 1904 he was elected President of the Faculty of Arts, and in 1908, he was made an Honorary Doctor of Science. He was also a Foreign Member of the Institute of Electrical Engineers. In 1880 the Viceroy, Lord Lytton, conferred on him the honour of a Companionship of the Indian Empire; Lord Dufferin secured for him the distinction of Officer d'Academie of France; while in 1898 King Leopold conferred on him the Order of Leopold.

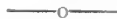
He lectured before the Indian Association for the Cultivation

of Science for 19 years, and was the senior Vice-President of that Association.

The influence of Father Lafont's genial personality and intellect will be long remembered by those with whom he was brought in contact, while the loss of his wide sympathies and interest in every movement for the public good will be widely felt by the community in the midst of whom he laboured for so long a period. (T. H. D. LA TOUCHE.)

The following six gentlemen were balloted for as Ordinary Members:—

Mr. C. M. Hutchinson, B.A., Scientific Officer to the Tea Association, Indian Museum, Calcutta, proposed by Mr. D. Hooper, seconded by Mr. I. H. Burkill; *Mr. A. M. Heron*, B.Sc., Geological Survey of India, proposed by Mr. T. H. D. La Touche, seconded by Mr. L. L. Fermor; *Mr. K. A. K. Hallows*, B.A., A.R.S.M., F.G.S., proposed by Mr. T. H. D. La Touche, seconded by Mr. L. L. Fermor; *Mr. H. Cecil Jones*, A.R.S.M., A.R.C.S., F.G.S., proposed by Mr. T. H. D. La Touche, seconded by Mr. L. L. Fermor; *Babu Surendra Chandra Roy Chowdry*, Zemindar of Shampur, District Rangpur, proposed by Babu Lakshmi Narayan Singh, seconded by Dr. Satis Chandra Vidyabhusana; and *Assistant Surgeon Rui Hiralal Basu, Bahadur*, Senior Demonstrator of Anatomy, Medical College, Calcutta, proposed by Major L. Rogers, I.M.S., seconded by Captain M. Mackelvie, I.M.S.



Dr. N. Annandale exhibited, on behalf of Mr. H. H. Hayden a series of photographs of Afghan antiquities.

The pillar stands on the summit of the Kotal-i-minar, at about seven miles to the south-east of Kabul, on the short-cut over the hills to Khurd Kabul.

Chakri Minár.

It is figured by Fergusson in his "Indian and Eastern Architecture" (p. 56). The figure is said to be from a drawing by Masson published in Wilson's *Ariana Antiqua*, but does not correspond with the drawing reproduced in the copy that I saw in the Asiatic Society's library.

The height of the tower is about 105 feet; this estimate is based on the height of a stick, 5 ft. long, placed against the tower and photographed with it; it consequently only gives an approximation to the true height, which is probably somewhat greater.

The photograph exhibited, no. 1, was taken from the S.S.W., and shows very clearly the bend in the tower at about one-third above the base. Photograph no. 2 is a view of the tower from E.S.E.

Both photographs were taken in December, 1907, by Mr. W. Donovan, of the Oriental Telephone and Electric Company, electrical engineer to the Amir of Afghanistan.

On the descent from the Palu Kotal to Bámián, and at about $1\frac{1}{2}$ mile below the top of the pass, two large blocks of limestone have rolled down from the small scarp above the road, and lie at the side of the footpath. Both of these are covered with cup-marks on the side next the path. On the top of each block is a heap of pebbles and several of the cups contain small stones. Many of the marks are quite fresh and show signs of recent excavation. It is therefore clear that the present Mahomedan inhabitants still continue to hollow them out as they pass by.

**Cup-marks in
Bámián.**

The local people appear to have no idea as to the true meaning of these cup-marks, and when asked merely say that the place is a "ziarat" and that a holy man presumably died on this spot. When he died or who he was they do not know, and there is no trace of anything resembling a grave.

Photograph no. 9 shows old cups below and freshly-cut ones, with pebbles in them, above. The other block, on the left-hand side of the picture, is covered with more numerous and much finer cup-marks, but when I saw it, I had unfortunately used my last film and was unable to photograph it.

It is interesting to find customs of this kind surviving in a Mahomedan community so strictly orthodox and so bigoted as that of Afghanistan, but this is by no means the only instance of the kind. Throughout the hill-country of Bámián and Saighán it is quite usual to find the hill-tops and passes crowned by cairns in which one is tempted to see a survival of the Buddhist "lá-tse" of Tibet. The cairns may be heaps of stones on which are planted sticks with white flags attached, or they may be built-up piles of horns of ibex and wild sheep. None of these, so far as I could ascertain, have any historical legend attached to them, although they are classed under the comprehensive term "ziarat." They are in just the places in which in Tibet one would confidently expect to find a "la-tse" erected in honour of such local deities as inhabit passes and mountain-tops. As in Tibet, too, solitary trees beside the mountain-streams are hung with flags and their branches adorned with horns, and although more rigid enquiries than I was able to make might elicit a story of some legendary saint, it is difficult to avoid the conclusion that the devout Mahomedan, who strokes his beard as he passes by, is unwittingly doing homage to the tutelary deity whose simple shrine has survived the iconoclasm that destroyed the more pretentious monuments erected to the founder of Buddhism and defaced the magnificent carvings in the valley of Bámián.

These carvings are well known and were long ago described

**The Bámián
Carvings.**

by Masson (*Journ. As. Soc. Bengal*, v, 707, 1836), but with the exception of an illustration of the largest statue published in Dr. J. A. Gray's "Life at the Court of the Amir," and Griffith's figure ("Posthumous papers, *Journal*, Calcutta, 1847, facing p. 398), no reproductions of them have, I believe, been published. Photographs 3 to 8 show the sites of most of the carv-

ings and their details. The size of the two largest may be gathered from photographs no. 6, in which a group of Afghans is seen on the head of the statue. Photograph no. 8 shows a smaller statue, which stands in a niche on the cliffs on the right bank of the Chapdara, a valley about two miles below Bâmiân village.

All the figures are carved out of tertiary conglomerate, composed of a fairly hard matrix of sandy clay full of small pebbles.

I was unable to obtain photographs of the frescoes above the heads of the statues. These are, as a rule, very dilapidated, but a few are still well-preserved and the colours bright and fresh. They are very similar to the frescoes found in Buddhist temples in Tibet at the present day. (H. H. HAYDEN.)

The following papers were read:—

1. *Tibetan Charms obtained by Lieut.-Col. S. H. Godfrey in Ladakh, one for chasing away evil spirits and the other for compelling fortune.*—By DR. SATIS CHANDRA VIDYABHUSANA.

This paper has been published in the *Journal* for May 1908.

2. *A polyglot list of Birds in Manchu, China and Turki.*—By DR. E. D. ROSS.

This paper will be published in the *Memoirs*.

3. *The Date of the Salimi coins.*—By H. BEVERIDGE.

This paper has been published in the *Journal* for May 1908.

4. *Materials for a Flora of the Malay Peninsula, No. 21.*—By SIR GEORGE KING and J. S. GAMBLE.

This paper will be published in a subsequent number of the *Journal*.

5. *Note on the Peregrine Falcon (Falco peregrinus).*—By LIEUT.-COL. D. C. PHILLOTT.

This paper has been published in the *Journal* for May 1908.

6. *The Use of the Abacus in Ancient India.*—By G. R. KATE.

7. *Plea for an Aquarium in Bengal.*—By RAI BAHADUR RAM BRAHMA SANJAL.

The question of founding an aquarium in Calcutta has during the last thirty-five years been discussed from time to time in the press, in zoological circles, and in the Council Chamber of Government. In 1875, a definite proposal was made by the Committee appointed for the establishment of the Calcutta Zoological Garden to construct an aquarium on the most approved plan after laying out the grounds, and providing suitable accommodation for the more important animals. Plans were obtained from Dr. Dohrn, the well-known founder of the Zoological station at Naples, and from other European experts. But the matter proceeded no further than that of exhibiting for some time gold and silver fish in globe aquaria.

In 1883-84 a temporary aquarium for the exhibition of fresh-water fishes, mollusks and crustaceans was built by Mr. Haden-

feldt in connexion with the Calcutta International Exhibition. The enterprise proved a great success financially and otherwise. At the close of the Exhibition Mr. Fornaro, who had bought some of the glass tanks, offered to build with them a new aquarium at the Zoological Garden at a cost of Rs. 25,000 to 30,000; but the Committee of Management of the Garden was obliged to decline the offer on financial grounds. The proposal was revived in 1898, and an aquarium in Calcutta might then, long ere this, have become an accomplished fact but for unfortunate opposition from unexpected quarters.

In April 1906 Mr. J. D. Nimmo, then a member of the Bengal Council, suggested, in the course of his budget speech, the desirability of establishing an aquarium at the Calcutta Zoological Garden, which he thought "would not only add to the attractions of the place, but would also have a certain educational and economic value in connexion with fisheries."

Aquaria have, of late years, assumed great importance as institutions of economic value affording opportunities for the study of the habits and environment of food-fishes and for experimental work on problems relating to fisheries. Regarding the importance of an aquarium in relation to fishing industry, the following extracts from Dr. Taylor's well-known book *The Aquaria* may be quoted:—

"To economists, aquaria cannot fail to be of the highest interest, for even within the last few years, observation at several of them has settled various most important facts relating to the life-history of some of those creatures which are most valuable to us as food. In one instance, at least, it was the means of preventing the framing of a law that was based on zoological ignorance, and which would have done as much harm to our fish supply as it was intended to do good. In 1865 a Royal Commission, on which several naturalists sat, met at some of our fishing ports, and took evidence from fishermen and others as to whether trawling did not do much harm, by breaking up the sea bed where the ova of fish had been deposited. The idea then was that the cod and whiting—two of the most abundant of our native food-fishes—deposited their eggs on the sea floor. Professor Sars, the well-known Danish naturalist, had expressed his opinion that the ova of these fish floated on the surface; but it was first substantiated in the Brighton Aquarium, where it was found that the ova both of these fish and mackerel, floated on the surface during the entire period of their development. Had it not been for this discovery, it is more than likely that by this time the fishing trade, as well as the fish supply, would have been crippled by a law which would have restrained trawling operations over cod grounds during the whole of the spawning season."

Just as the Brighton Aquarium has thus contributed to our knowledge of these three fishes, so Mr. Savile-Kent, at the Man-

chester Aquarium, has contributed towards the history of the common herring, from its young state. And the Brighton Aquarium has further contributed important information as to the rapidity of the growth of the salmon. Previously the growth of this fish had been thought to be much slower than observation and experiment have proved.

Among the numerous problems that await investigation in connexion with the fishing industry of India, the following few may be briefly indicated here:—

Food of fishes, its nature and quantity; the amount of food available has much to do with the fish supply.

Habits and Life-histories of Food-fishes.

Fish-culture.—The naturalist in charge of the proposed aquarium may be sent to China to study fish-culture in fresh-water ponds in that country, and to Japan and America.

The pond-culture of fish may be carried on in the same systematic way as it is done in Germany.

Artificial fecundation by mixing eggs and milt together is practically unknown in India. An aquarium will offer to naturalists splendid opportunities for carrying out researches on this line.

Disease of fish.—Thorough and persistent laboratory work is necessary to discover the various causes that bring about diseases in fishes. It is well known that parasitic worms, tiny crustaceans, leeches and other aquatic vermin find lodgment in fishes, and induce diseased conditions in them. Careful investigation into the nature and character of the fish parasites may lead to important discoveries. A Fish-scare caused by an influx of an unusually large number of diseased fishes into the market is not uncommon in Bengal. Several such scares have occurred during the last thirty-five years. In 1873-74, the writer of these notes had the privilege of dissecting, under proper guidance, a large number of fish of various kinds. Most of them were found to be infested with parasitic worms.

This list is not exhaustive.

Very little need be said on the profound scientific importance of an aquarium for the convenient study of biological problems, a great many of which would have remained yet unsolved, but for the fortunate existence of aquaria and zoological stations like those at Naples, Plymouth, and at other centres.

The following few extracts from an account of the Zoological station at Naples will serve to show the methods and aims of an aquarium conducted on scientific lines:—

“The Zoological station at Naples is an institution for the advancement of biological science—that is, comparative anatomy, zoology, botany, and physiology. It serves this end by providing the biologist with the various objects of his study and the necessary

appliances ; it is not a teaching institution On the first floor there is, facing south, the principal library ornamented with paintings, and facing north, a large hall containing twelve working tables, several smaller rooms, and the secretariat office. On the second floor is the physiological laboratory, and on the third floor the small library, a hall with several working tables, and the dark rooms used in developing photographs. The ground floor of the smaller building contains the rooms in which the animals are delivered, stored, and preserved, and the fishing tackle kept, together with the workshop of the engineer ; on the first and second floors are work-rooms, amongst others the botanical laboratory The materials for study which the station offers to the biologist are specimens of marine animals and plants which abound in the western part of the Mediterranean, and especially in the Gulf of Naples The students who work in the station have the first claim on specimens of plants and animals ; but specimens are also supplied to museums, laboratories and schools, and to individuals engaged in original research elsewhere."

Large numbers of such in parcels are despatched every year to distant places, and this side of the work has been of great value to science.

It may be hoped that a little unpretentious aquarium for the establishment of which in Bengal this is a plea, may, as time goes on, receive the same great impulse to which other similar institutions owed their birth, growth and expansion, and fulfil the same useful purposes.

<p>As a place for rational amusement it would be a novelty in Bengal, and as such its importance as a show-place should not be lost sight of.</p>	<p>Aquarium as a popular show-place.</p>
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<p>In spite of its many advantages, the suitability of Calcutta as a place for the establishment of an aquarium has been much doubted : whereas expert opinion points to the coast of Puri as the ideal place for such a purpose.</p>	<p>Ideal place for an aquarium.</p>
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In summing up his impressions of the Orissa coast from the zoological point of view, Lt.-Colonel Alcock writes as follows : " I look upon it as an ideal place for any one who wishes to study the complete life-histories of the Indian shore-fishes and Crustacea, and I believe that a Biological Station, established at Puri, would be in the highway of great discoveries."

Speaking on the subject of the economic possibilities of the Orissa coast, the same author remarks " that if the regulations of the salt-excite could be modified, and if capital on a liberal scale were forthcoming, it would furnish inexhaustible supplies of dried and smoked fish, fish-oil, isinglass and gelatines for the world in general, and of shark's fins for the China market in particular."

Although growing in importance as a seaside sanitarium, the Puri Shore is a monotonous and melancholy place for those over-worked and jaded business men and others who resort to it for a change. The establishment of a properly managed aquarium there, would, no doubt, be much appreciated by them as a place of rational amusement. Nor would it be less appreciated by the numerous pilgrims who visit Puri every year in quest of salvation.

Without entering into a detailed description of its plan of construction, it may be briefly indicated that the proposed aquarium should consist of a series of tanks of varying sizes arranged on two sides of a central passage. Attempts should be made to construct the bottom of the largest tank as a model sea-bed, bringing out, as far as possible, the details which may be met with in a journey across the dried-up ocean-bed (Bay of Bengal). Larger examples of piscine life peculiar to the Orissa coast would be exhibited there.

Strange jelly-fishes, Zoophytes and crustaceans of various kinds living in partnership with sea anemones, and "illustrating that happy bond of commensalism . . . which is one of the most valuable object-lessons for man's edification that marine zoology affords" might form the living contents of the other and smaller tanks. Among its other curiosities the musical fishes and those that "nourish their unborn young on a secretion analogous to milk" may be mentioned.

Careful attention needs to be bestowed upon the proper aërating of water in the tanks by mechanical contrivances, and by growing judiciously selected aquatic plants.

If funds permit, a small but properly equipped laboratory ought to be built as an adjunct to the aquarium for the purpose of carrying on researches in the field of marine biology.

The cost of building such an institution might be approximately Rs. 40,000 to Rs. 50,000.

With reference to Rai Bahadur Ram Brahma Sanyal's paper Dr. Annandale proposed that the question of instituting an aquarium in Bengal should be submitted for discussion to a committee of the Council.

8. *Some Songs of Chitral.*—By E. B. HOWELL.

9. *A descriptive list of Works on the Madhyamika Philosophy.*—By DR. SATIS CHANDRA VIDYABHUSANA.

10. *The Mechanical, Physical and Chemical Theories of the Ancient Hindus, Part I.*—By PRINCIPAL BROJENDRA NATH SEAL. Communicated by the President.

11. *Geometrical Theory of a Plane Non-cyclic Arc, Finite as well*

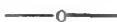
as *Infinitesimal*.—By PROF. SYAMADAS MUKHOPADHYAYA. *Communicated by the President.*

These papers will be published in a subsequent number of the *Journal*.

12. *A memoir on the Surgical Instruments of Greek, Roman, Arab and Modern European Surgeons, Part 1.*—By DR. GIRINDRA NATH MOOKERJEE, B.A., M.B.

13. *On Rationalisation of Algebraical Equations.*—By MAHENDRANATH DE.

This paper will be published in a subsequent number of the *Journal*.



The Adjourned Meeting of the Medical Section was held at the Society's Rooms on Wednesday, June 10th, 1908, at 9-15 P.M.

Lient.-Colonel F. J. Drury, I.M.S., in the chair.

The following members were present:—

Dr. Gopal Chandra Chatterjee, Captain F. P. Connor, I.M.S.; Dr. E. Houseman, Captain M. Mackelvie, I.M.S.; Dr. Girindra Nath Mukerjee, Major J. Mulvany, I.M.S.; Dr. J. E. Panioty, Major L. Rogers, I.M.S., Honorary Secretary.

Visitors.—Dr. J. Stuart Brooke, Assistant-Surgeon Ganguli Nath Mitra, and Assistant-Surgeon N. Mukerjee and another.

The minutes of the last meeting were read and confirmed.

Captain F. P. Connor read a paper "On the value of X-rays in the diagnosis of some surgical affections" (illustrated by lantern slides).

The discussion was adjourned until the July meeting.



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. I, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained by application to the Honorary Secretary, 57, Park Street, Calcutta.

PRIVILEGES OF ORDINARY MEMBERS.

- (a) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.
- (b) To propose and second candidates for Ordinary Membership.
- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
- (e) To take out books, plates and manuscripts from the Library.
- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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38. On Rationalization of Algebraical Equations.

By MAHENDRANATH DE.

1. The subject of rationalization is discussed in all the text-books of Algebra known to me in a most perfunctory manner. Even Chrystal's well-known treatise confines the discussion to a few particular cases.

2. In a paper on the subject ('On the Rationalization of certain Algebraical equations'—Cambridge and Dublin Mathematical Journal, Vol. viii), Professor Cayley gives a general method for the rationalization of equations of the form

$$\sqrt{a} + \sqrt{b} + \sqrt{c} + \dots = 0.$$

Following up a suggestion of Professor Sylvester he shows that a similar process would suffice for the rationalization of equations of the form

$$\sqrt[3]{a} + \sqrt[3]{b} + \sqrt[3]{c} + \dots = 0$$

His results, however, appear in the form of determinants of very high orders, the calculation of which is, in general, a work of tremendous labour. Thus, for instance, the result of rationaliz-

ing the equation $a^{\frac{1}{3}} + b^{\frac{1}{3}} + c^{\frac{1}{3}} = 0$ comes out in the form of a determinant of the 9th order. Strangely enough, Professor Cayley does not observe that a slight extension and a slight modification of his method would suffice for the solution of the problem of rationalization in its most general form.

3. In Vol. xv. of the "Messenger of Mathematics," there are two papers on rationalization over the names of Captain Macmahon and Mr. P. C. Ward. Captain Macmahon does not attempt the most general case of the problem, but his process is general so far as it goes. He incidentally states that the case of any number of quadratic radicals was fully worked out in Meyer Hirsch's Algebra, but he throws no light on the method employed.

The title of Mr. Ward's paper is "On the Rationalization of $a^{\frac{1}{n}} + b^{\frac{1}{n}} + c^{\frac{1}{n}} = 0$."

He does not, however, even so much as attempt to rationalize the equation $a^{\frac{1}{n}} + b^{\frac{1}{n}} + c^{\frac{1}{n}} = 0$, but contents himself with two or three particular cases, e.g., $a^{\frac{1}{3}} + b^{\frac{1}{3}} + c^{\frac{1}{3}} = 0$.

4. I have lately come across a short paper by Nripendra Nath Chattopadhyaya, in which the problem is treated in its most

general form. But while his process is perfectly general, it is neither convenient in practice nor does it lead to the result in its lowest terms.

He states 'that the equation $x = f(p^{\frac{1}{l}}, q^{\frac{1}{m}}, r^{\frac{1}{n}}, \text{etc.})$ provided l, m, n are integers, may be rationalized, and the rationalized equation will be of (k^a) th degree, a being the number of the different quantities $p, q, r, \text{etc.}$, and k , the L.C.M. of $l, m, n, \text{etc.}$ ' That this need not be the case will be evident from the following example:—

Let
$$x = a^{\frac{1}{2}} + b^{\frac{1}{3}}$$

then
$$(x - a^{\frac{1}{2}})^3 = b$$

or
$$x^3 - 3x^2\sqrt{a} + 3xa - a\sqrt{a} = b$$

$$\therefore (x^3 + 3xa - b)^3 = a(3x^2 + a)^3$$

whence $x^6 - 3x^4a - 2bx^3 + 3x^2a^2 - 6xab + b^2 - a^3 = 0$ which is of the sixth degree. Whereas Mr. Chattopadhyaya's method leads to an equation of the $(6)^3$ th, i.e., 36th degree.

In fact, it will be shown in a subsequent part of this paper

that if we rationalize an equation of the form $x = a^{\frac{1}{m}} + b^{\frac{1}{n}} + c^{\frac{1}{p}} + \dots$, the result will be of the $mnp \dots$ th degree in x .

5. It is easy to see that the most general algebraical equation

involving radicals may be written in the form $x = f(a^{\frac{1}{l}}, b^{\frac{1}{m}}, c^{\frac{1}{n}}, \text{etc.})$ by taking x for the part that is free from radicals.

To rationalize this, is essentially a problem of elimination.

For, if we put $a^{\frac{1}{l}} = y; b^{\frac{1}{m}} = z; c^{\frac{1}{n}} = w$, and so on, we get

$$\left. \begin{aligned} x &= f(y, z, w, \text{etc.}) \\ y^l &= a \\ z^m &= b \\ w^n &= c \\ \dots\dots\dots \\ \dots\dots\dots \end{aligned} \right\} \text{(a)}$$

Equations (a) are sufficient for the elimination of $y, z, w, \text{etc.}$, because the number of equations is one more than the number of variables to be eliminated. So that the problem *always admits of a solution*, and the result of elimination will be the rationalized equation.

6. In particular, let us consider the case when

$$x = f(a^{\frac{1}{m}}) \dots\dots\dots \text{(1)}$$

Let
$$a^{\frac{1}{m}} = y; \text{ then } y^m = a.$$

It is evident that equation (1) can be written in the form

$$\phi_1 + \phi_2 y + \phi_3 y^2 + \dots + \phi_m y^{m-1} = 0 \dots \dots \dots (2)$$

where $\phi_1, \phi_2, \dots, \phi_m$ are rational functions.

Multiplying (2) by y, y^2, \dots, y^{m-1} and observing that $y^m = a$ we get the equations:—

$$\begin{aligned} a\phi_m + \phi_1 y + \phi_2 y^2 + \dots + \phi_{m-1} y^{m-1} &= 0 \\ a\phi_{m-1} + a\phi_m y + \phi_1 y^2 + \dots + \phi_{m-2} y^{m-1} &= 0 \\ a\phi_{m-2} + a\phi_{m-1} y + a\phi_m y^2 + \dots + \phi_{m-3} y^{m-1} &= 0 \\ \dots \dots \dots & \\ \dots \dots \dots & \\ a\phi_2 + a\phi_3 y + a\phi_4 y^2 + \dots + \phi_1 y^{m-1} &= 0. \end{aligned}$$

These, together with equation (2), form a system of m equations.

Eliminating $y, y^2, y^3, \dots, y^{m-1}$ from these m equations, we get

$$\begin{vmatrix} \phi_1, \phi_2, \phi_3, \dots, \phi_m \\ a\phi_m, \phi_1, \phi_2, \dots, \phi_{m-1} \\ a\phi_{m-1}, a\phi_m, \phi_1, \dots, \phi_{m-2} \\ a\phi_{m-2}, a\phi_{m-1}, a\phi_m, \dots, \phi_{m-3} \\ \dots \dots \dots \\ a\phi_2, a\phi_3, a\phi_4, \dots, \phi_1 \end{vmatrix} = 0 \dots \dots \dots (3)$$

Thus, equation (1) can always be rationalized and the result expressed in the form of a determinant of the m th order.

We may observe, in passing, that when $a = 1$, the determinant (3) reduces to a very familiar one, which possesses interesting properties (see Arts. 23—25, Chapter viii, Scott and Mathews' Theory of Determinants).

7. When $x = a^{\frac{1}{b}} + b^{\frac{1}{m}} + c^{\frac{1}{n}} + \dots \dots \dots (4)$

Let $f(x) = 0$ be the rationalized equation when one of the terms on the right-hand side, say $c^{\frac{1}{n}}$, is left out.

If $y = x - c^{\frac{1}{n}} = a^{\frac{1}{b}} + b^{\frac{1}{m}} + \dots \dots \dots$
 it is evident that $f(y) = 0$ is rational in $a, b, \dots \dots$. Hence $f(x - c^{\frac{1}{n}}) = 0$ is rational in $a, b, \dots \dots$: Now if $f(x)$ be an algebraical function, $f(x - c^{\frac{1}{n}})$ must be of the form

$$\phi_1 + \phi_2 c^{\frac{1}{n}} + \phi_3 c^{\frac{2}{n}} + \dots + \phi_n c^{\frac{n-1}{n}} = 0,$$

And this can be immediately rationalized by the method explained in Art. 6.

So that, if we can rationalize an equation of the form (4) when there are p terms on the right-hand side, we can obtain the result, when one more term is added, in the form of a determinant. The method of rationalizing equations of this form is thus obvious.

It is further to be observed, that if $f(x)$ be of the k th degree in x and $f(x - c^{\frac{1}{n}})$ be expressed in the form $\phi_1 + c^{\frac{1}{n}} \cdot \phi_2 + c^{\frac{2}{n}} \cdot \phi_3 + \dots + c^{\frac{n-1}{n}} \cdot \phi_n$, ϕ_1 must be of the k th degree in x .

∴ It is clear from equation (3) of Art. 6 that the degree of the rationalized equation, when the term $c^{\frac{1}{n}}$ is added, must be $k \times n$.

Now if $x = a^{\frac{1}{l}}$, the rationalized equation is $x^l = a$

∴ if $x = a^{\frac{1}{l}} + b^{\frac{1}{m}}$, the degree of the rationalized equation must be $l \times m$, and so on.

Consequently when $x = a^{\frac{1}{l}} + b^{\frac{1}{m}} + c^{\frac{1}{n}} + \dots$, the degree of the rationalized equation in x must be $l \times m \times n \dots$

This is, of course, otherwise evident from a known property of eliminants.

8. To illustrate the method of Art. 7, let us take the equation, $x = a^{\frac{1}{2}} + b^{\frac{1}{3}} + c^{\frac{1}{5}}$.

If $x = c^{\frac{1}{5}}$, we have $x^5 = c$.

∴ When $x = a^{\frac{1}{2}} + c^{\frac{1}{5}}$; $(x - a^{\frac{1}{2}})^5 = c$

or $x^5 - 5x^4 a^{\frac{1}{2}} + 10x^3 a - 10x^2 a^2 + 5x a^3 - a^5 = c$

or $(x^5 + 10x^3 a + 5x a^2 - c) - a^{\frac{1}{2}}(5x^4 + 10x^2 a + a^2) = 0$

∴ $(x^5 + 10x^3 a + 5x a^2 - c)^2 - a(5x^4 + 10x^2 a + a^2)^2 = 0$

or $x^{10} - 5x^8 a + 10x^6 a^2 - 2cx^5 - 10x^4 a^3 - 20x^3 a^2 c + 5x^2 a^4 - 10x a^2 c + c^2 - a^5 = 0$.

This is our $f(x)$; if we expand $f(x - b^{\frac{1}{3}})$ in the form

$$f_1 + f_2 \cdot b^{\frac{1}{3}} + f_3 \cdot b^{\frac{2}{3}} = 0.$$

The rationalized equation will be

$$\begin{vmatrix} f_1 & f_2 & f_3 \\ bf_3 & f_1 & f_2 \\ bf_2 & bf_3 & f_1 \end{vmatrix} = 0 \text{ or } f_1^3 + bf_2^3 + b^2 f_3^3 - 3bf_1 f_2 f_3 = 0$$

which is evidently of the 30th degree.

If, however, we had rationalized the equation $x = a^{\frac{1}{2}} + b^{\frac{1}{3}}$ first, the result might easily be expressed as a determinant of the 5th order and so on.

9. There are two cases of equation (4) which can be rationalized by very elementary methods without the help of determinants, viz.,

- (1) when $l = m = n = \dots = 2$
- (2) when $l = m = n = \dots = 3$.

For $l = m = n = \dots = 2$,

$$f(x - c^{\frac{1}{2}}) = f_1 + f_2 \cdot c^{\frac{1}{2}} = 0,$$

$$\therefore f_1^2 - cf_2^2 = 0.$$

Again, when $l = m = n = \dots = 3$

we have $f(x - c^{\frac{1}{3}}) = f_1 + f_2 \cdot c^{\frac{1}{3}} + f_3 \cdot c^{\frac{2}{3}} = 0$

$$\therefore f_2 \cdot c^{\frac{1}{3}} + f_3 \cdot c^{\frac{2}{3}} = -f_1$$

cubing both the sides, we get

$$f_2^3 \cdot c + f_3^3 \cdot c^2 + 3f_2 \cdot c^{\frac{1}{3}} \times f_3 \cdot c^{\frac{2}{3}} \times -f_1 = -f_1^3$$

whence $f_1^3 + c \cdot f_2^3 + c^2 \cdot f_3^3 - 3cf_1 \cdot f_2 \cdot f_3 = 0$.

We can thus rationalize any equation of the form

$$\left. \begin{aligned} x &= a^{\frac{1}{2}} + b^{\frac{1}{3}} + c^{\frac{1}{2}} + \dots \\ x &= a^{\frac{1}{3}} + b^{\frac{1}{3}} + c^{\frac{1}{3}} + \dots \end{aligned} \right\} (\beta)$$

by quite elementary methods and without any knowledge of determinants.

The same methods would also suffice for the more general case when $x = f(a^{\frac{1}{2}}, b^{\frac{1}{2}}, c^{\frac{1}{2}}, \&c.) + \phi(l^{\frac{1}{3}}, m^{\frac{1}{3}}, n^{\frac{1}{3}}, \&c.)$ where f, ϕ are rational algebraic functions.

We might also rationalize equations of the form

$$x = f(a^{\frac{1}{l}}, b^{\frac{1}{m}}, c^{\frac{1}{n}}, \&c.),$$

where l, m, n are of the form $2^p \cdot 3^q$ (p, q being integers or 0) by means of suitable substitutions.

But the results are not, in general, obtained in their lowest terms and the method is practically useless.

Equations of the form $x = a^{\frac{1}{m}} + b^{\frac{1}{m}} + c^{\frac{1}{m}} + \dots$ where $m = 2^p \cdot 3^q$ can, however, be rationalized by means of elementary methods and the results obtained in their lowest terms.

Thus let $x = a^{\frac{1}{3}} + b^{\frac{1}{3}}$ and let $b^{\frac{1}{3}} = y$

when $x = a^{\frac{1}{3}}$, we have, $x^3 = a$,

\therefore If $x = a^{\frac{1}{3}} + y^{\frac{1}{3}}$, we have $(x - y^{\frac{1}{3}})^3 = a$

$$\text{or } x^3 - 6x^2\sqrt[3]{y} + 15x^2 \cdot y - 20x^2y\sqrt[3]{y} + 15x^2y^2 - bxy^2\sqrt[3]{y} + y^3 = a.$$

Transposing the terms not containing $\sqrt[3]{y}$ to the right-hand side and squaring we get an equation rational in x, y . If we write $b^{\frac{1}{3}}$ for y , this equation is reduced to the form $f_1 + f_2 \cdot b^{\frac{1}{3}} + f_3 \cdot b^{\frac{2}{3}} = 0$ which is easily rationalized.

10. The equations rationalized by Cayley are only particular cases of equations (β) of Art. 9 and can be obtained from them by putting $x = 0$.

Thus if we rationalize $x = \sqrt{a} + \sqrt{b} + \sqrt{c}$ by the method of Art. 9 we get

$$x^3 - 4px^2 + 2x^3(3p^2 - 4q) - 4x^2(p^3 - 4pq + 16r) + (p^2 - 4q)^2 = 0 \dots (5)$$

(where $p = a + b + c$; $q = bc + ca + ab$ and $r = abc$).

\therefore If $x = 0$, i.e., if $\sqrt{a} + \sqrt{b} + \sqrt{c} = 0$; we must have $p^2 - 4q = 0$ or $a^2 + b^2 + c^2 - 2bc - 2ca - 2ab = 0$.

Again, if we rationalize

$x = \sqrt{a} + \sqrt{b} + \sqrt{c} + \sqrt{d}$ by the same method we get

$$\begin{aligned} & \{x^3 + 4x^2(7d - p) + 2x^3(35d^2 - 30pd + 3p^2 - 4q) + 4x^2(7d^3 - 15pd^2 \\ & + 9p^2d - 12qd - p^3 + 4pq - 16r) + d^4 - 4pd^3 + 2d^2(3p^2 - 4q) - 4d(p^3 - \\ & 4pq + 16r) + p^4 - 8p^2q + 16q^2\}^2 - 64x^2d\{x^6 + x^4(7d - 3p) + x^2(7d^2 - 10pd \\ & + 3p^2 - 4q) + d^3 - 3pd^2 + 3p^2d - p^3 - 16qr + 4pq - 16r\}^2 = 0 \dots (6) \end{aligned}$$

If $\sqrt{a} + \sqrt{b} + \sqrt{c} + \sqrt{d} = 0$, we must have

$$d^4 - 4pd^3 + 2d^2(3p^2 - 4q) - 4d(p^3 - 4pq + 16r) + (p^2 - 4q)^2 = 0 \dots (7)$$

[where p, q, r have the same significations as in (5)]

$$\text{or } (p^2 - 4q + d^2 - 2pd)^2 = 64rd = 64abcd,$$

$$\text{i.e., } (a^2 + b^2 + c^2 + d^2 - 2ab - 2ac - 2ad - 2bc - 2bd - 2cd)^2 = 64abcd.$$

Observe that (5) reduces to (7) if we write therein d for x^2 , similarly if we write e for x^2 in (6) we can get the result of the rationalization of $\sqrt{a} + \sqrt{b} + \sqrt{c} + \sqrt{d} + \sqrt{e} = 0$. The reason is obvious because $\sqrt{a} + \sqrt{b} + \sqrt{c} + \sqrt{d} + \sqrt{e} = 0$ reduces to the form $x = \sqrt{a} + \sqrt{b} + \sqrt{c} + \sqrt{d}$ if $x = -\sqrt{e}$.

11. Equation (7) shows that there is a depression in the degree of the rationalized equation if we put $x=0$. It can be easily proved that if $\sqrt{a} + \sqrt{b} + \sqrt{c} + \dots$ to n terms $= 0$, the degree of the rationalized equation is 2^{n-2} .

Similar results, of course, hold for equations of the form $a^{\frac{1}{3}} + b^{\frac{1}{3}} + c^{\frac{1}{3}} + \dots$ to n terms $= 0$. Here the degree of the rationalized equation will be 3^{n-2} .

12. The rationalization of equations may be made to furnish a set of interesting identities.

Thus if we rationalize $x = a^{\frac{1}{2}} + b^{\frac{1}{2}}$ we easily find that

$$x = a(t_1 x^{n-1} + t_2 x^{n-3} + t_3 x^{n-5} a^2 + \dots - b)^2 \quad (8)$$

where t_1, t_2, \dots are the numerical coefficients in the expansion of $(x+a)^n$.

\therefore If we put $a^{\frac{1}{2}} = \alpha; b^{\frac{1}{2}} = \beta$ and consequently $a = \alpha^2; b = \beta^2$ equation (8) furnishes the identity

$$\{(a + \beta)^n + t_2(a + \beta)^{n-2} \cdot a^2 + t_4(a + \beta)^{n-4} \cdot a^4 + \dots - \beta^n\}^2 = a^2 \\ \{t_1(a + \beta)^{n-1} + t_3(a + \beta)^{n-3} \cdot a^2 + \dots\}^2$$

for all positive integral values of n .

As particular cases we may mention

$$(1) (a + \beta)^6 - 3(a + \beta)^4 \cdot a^2 - 2\beta^3(a + \beta)^5 + 3(a + \beta)^2 \cdot a^4 - 6(a + \beta)a^2\beta^3 + \beta^6 - a^6 = 0.$$

$$(2) (a + \beta)^{10} - 5(a + \beta)^8 a^2 + 10(a + \beta)^6 a^4 - 2\beta^5(a + \beta)^5 - 10(a + \beta)^4 a^6 - 20(a + \beta)^3 a^2 \beta^5 + 5(a + \beta)^2 a^4 \beta^5 + \beta^{10} - a^{10} = 0.$$

Similarly, from the equation $x = a^{\frac{1}{2}} + b^{\frac{1}{2}} + c^{\frac{1}{2}}$ we get

$$x^3 - 4(a + b + c)x^2 + 2x^2(3\Sigma a^2 + 2\Sigma bc) - 4x^2\{\Sigma a(\Sigma a^2 - 2\Sigma bc) + 4abc\} + (\Sigma a^2 - 2\Sigma bc)^2 = 0.$$

This equation furnishes the identity,

$$(a + \beta + \gamma)^3 - 4(a + \beta + \gamma)^2 \cdot \Sigma a^2 + 2(a + \beta + \gamma)(3\Sigma a^4 + 2\Sigma \beta^2 \gamma^2) - 4(a + \beta + \gamma)^2 \{\Sigma a^3 \cdot (\Sigma a^4 - 2\Sigma \beta^2 \gamma^2) + 4a^2 \beta^2 \gamma^2\} + (\Sigma a^4 - 2\Sigma \beta^2 \gamma^2)^2 = 0.$$

Identities of this nature may be multiplied without number.

In general, if we rationalize $x = a^{\frac{1}{l}} + b^{\frac{1}{m}} + c^{\frac{1}{n}} + \dots$ we have seen that the resulting equation is of degree $lmn \dots$ in x . Hence it is

clear that $(a+\beta+\gamma+\dots)^{lmn}$ can always be expressed as a rational function of $(a+\beta+\gamma+\dots)$ and of a^l, β^m, γ^n , etc.

And in particular, $(a+\beta+\gamma+\dots$ to n terms) mn can always be expressed as a rational function of $(a+\beta+\gamma+\dots)$ and of a^m, β^n, γ^nand so on.

[The remainder of the page contains extremely faint and mostly illegible text, likely bleed-through or very faded print, including some mathematical symbols and numbers.]

39. A Kharoṣṭī Copperplate Inscription from Taxila or Takṣaśilā.

By MAHĀMAHOPĀDHYAYĀ HARAPRASĀD ŚASTRĪ, M.A.

The discovery of this copperplate, which is 8½ inches in length, was announced, for the first time, by Sir Alexander Cunningham in the second volume of the Reports of the Archaeological Survey. It was discovered inside a small stūpa at a village named Shāh-Dheri in the Rawalpindi District, and is situated at a distance of five or six miles from the modern Railway Station Sarai-Kālā on the N.-W. Railway. The ruins of Shāh-Dheri have been discussed at various times by several scholars, and there seems to be good reason for identifying it with the ancient and renowned Takṣaśilā. Two inscriptions found in the ruins of Shāh-Dheri contain the word "Takhasilae or Takhasilaye" meaning in Takṣaśilā. There are :—

(1) The famous Taxila copperplate of the great King Moga,¹ which is at present in the Library of the Royal Asiatic Society of Great Britain and Ireland.

(2) The Taxila vase, which was discovered in a stupa by the side of the one in which this copperplate was found (Cunningham's No. 13 and 14, A.S.R. Vol. II., pl. LIX). This vase is at present in the Lahore Central Museum, and the inscription has recently been republished by Dr. Lüders of Rostock.²

As both of these records were found *in situ*, there seems to be no reason to object to the identification of the site of Takṣaśilā with modern Shāh-Dheri. Cunningham describes it as follows :—

All of these fourteen topes were opened some years ago by the villagers, from whom I ascertained that No. 13 yielded an inscribed stone vase and No. 14 a copperplate inscription in three or four pieces, which was given to Major Pearse eight years ago, or about A.D. 1855. The copperplate inscription, which is still in the possession of Major Pearse, is a short record of one line in Ariau-Pali characters which has not yet been made public.³

Cunningham read this inscription as follows :—

"Samvatsara (dasa) miti 10, tena Sabhayakena thuba Pratis-tavito Mata pitu puyāc aghara ca puyāc," and translates :—

"In the year 10, by one named Sabhayaka, this Thubā (tope) was erected in honour of his mother and father and in honour of (?)"

Cunningham's facsimile shows that the copperplate originally consisted of four pieces, but only three of these are at present in the Society's possession.

¹ Bühler, Epigraphia Indica, Vol. IV., p. 56

² Epigraphia Indica, Vol. VIII., pp. 296-98.

³ A.S.R. Vol. II., pp. 124-25.

Cunningham says the first letter is more like a than *Sa*, but his facsimile shows that it cannot be anything but *ta*. The second letter is undoubtedly *va*. I cannot make out the third letter, which he proposes to be the compound letter *tsa*, as it is indistinct in his facsimile. The absence of the original piece, and the general unreliability of Cunningham's facsimiles, make it very difficult to suggest any probable reading. Most probably it contained the name of the village to which the donor belonged. That the initial words are not "Samvatsara dasa miti 10" becomes at once apparent on considering that:—

(1) The first two letters are not *Sa* and *va*, but *ta* and *va*, and

(2) there is no room for four letters between *va* and *mi*.

The last letters are most probably three in number, and contain the last letter of the name of the village and the possessive case ending *Sa* and the initial letter of the donor's name. I read the inscription as follows:—

" . . . meti-akhena
sabhayakena thubo pra-
tistavito matapitn puyae
aghasa ca nayae."

Remarks.

(1) The first letter in the photograph published herewith is "*me*" and not *mi*.

(2) The second and third letters look more like *di* and *ca* than *ti* and *a*, which they really are, on account of the twistings and indentations on the plate.

(3) The fourth letter is *khe* and not *te*.

(4) The word *Sabhayakena* is not a proper name, but is equivalent to the Sanskrit word *Sabhāryakena*. *Bhayā* is the usual word for *Bhārryyā* in the Jaina inscriptions of the Scythian period from Mathurā, and in *Khurosthi* the word becomes *bhaya*.

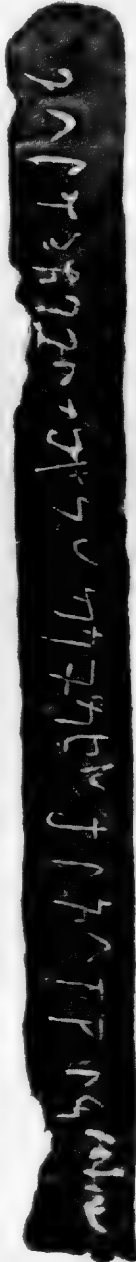
(5) The age of the copperplate can be determined from the characters of the inscription. The characters belong to the third, i.e., the Saka variety of *Khurosthi*.¹ The letter *Sa* differs from those of the Maurya and Indo-Greek varieties, in this that the vertical line does not touch the upper extremity of the curve. The letter *bha* and *ka* are angular and not cursive, and, last of all, the form of *Sa* in *aghasa* is to be found in this variety only.²

The *ca* occurs in some of the Maurya inscriptions³ and is rare in the Indo-Greek and later varieties.

¹ Bühler, *Indian Palaeography* Ed. Fleet pp. 21-25.

² Bühler's *Indische Palaeographie*, Tafel I, Col. vii. 36.

³ This form of *ca* occurs in the 7th edict at Shāh-Bāz-garhi. Z.D.M.G. Vol. XLIII., p. 151, and plate .



Translation.

“(This) Stupa was erected by . . . metiakha, (an inhabitant of) Taba . . ., together with his wife for the worship of his father and mother and for the destruction of sin.”

A great wave of activity has come over epigraphists all over the world and has manifested itself in the republication of ancient inscriptions, which were lying unheeded for the last forty years. The publication of Dr. Vogel's paper on “Inscribed Gāndhāra Sculptures” has been followed by Dr. Lüder's edition of the “Taxila Vase Inscription,” and Mr. Thomas' paper on the “Ma-thurā Lion-capital Inscriptions,” and the present paper is intended as a sequel to them.

The Kharoṣṭhi copperplate inscriptions differ materially from those of the Brahmi variety and its descendants, while the Gupta and subsequent copperplate inscriptions are deeds of gifts. The Sohgaura copperplate is unique in its nature.

The Kharoṣṭhi copperplate inscriptions contain dedications like the later formulæ “Devadharmoyān, etc.”

The three copperplate inscriptions discovered up to date are:—

- (1) The Taxila copperplate of Moga;
- (2) the Sue-vihār inscription of Kaniska; and
- (3) the copperplate which is discussed in this paper.

All of them contain dedicatory inscriptions, and are not deeds of award or grants.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author outlines the various methods used to collect and analyze the data. This includes both manual and automated processes. The goal is to ensure that the data is as accurate and reliable as possible.

The third part of the document provides a detailed breakdown of the results. It shows the trends over time and identifies key areas where improvements can be made. The data indicates that there has been a steady increase in certain categories, while others have remained relatively stable.

Finally, the document concludes with a series of recommendations based on the findings. These suggestions are aimed at optimizing the current processes and addressing any identified weaknesses. The author believes that these changes will lead to more efficient operations and better overall performance.

40. A Descriptive List of Works on the Mādhyamika
Philosophy, No. I.

By MAHĀMAHOPĀDRYĀYA DR. SATIS CHANDRA VIDYĀBHŪṢAṆA,
M.A., PH.D.

This paper gives a short account of the Tibetan versions of 27 works on the Mādhyamika philosophy, the Sanskrit originals of which, with one exception, appear to have long been lost. The Tibetan versions are included in the well-known collection called the Tangyur, which the writer of the paper examined while residing at the monastery of Labrang in Sikkim in June 1907. They include the works of Ārya Nāgārjuna, Ārya Deva and Buddha Pālita, besides those of teacher Bhavya, who criticised his contemporaneous systems of Hindu philosophy, viz., the Yoga, Sāṅkhya, Vaiśeṣika, Vedānta and Mīmāṃsā. These works, which have not been noticed elsewhere, are very important as they will throw a good deal of light on the history of Indian philosophy.

1. प्रज्ञानाम मूलमध्यमक कारिका¹ (Tib. དབྱུང་མཁའ་བའི་ཚིག་
འཕྲུང་གྲས་པ་ཤེས་རབ་ཅེས་གྲུབ) — Memorial verses
on the fundamental Mādhyamika philosophy
named *Prajñā* (wisdom).

This work extends over folios 1—20 of the Tangyur, Mdo, Tsa. The text was composed by Ārya Nāgārjuna. It was translated into Tibetan under orders of the great king Dpal-lha-btsan, by the great Indian Mahāyāna sage Jñāna-garbha and the Tibetan interpreter-monk of Shu-chen named Cog-ro-kluhi-rgyal-mtshan. The translation was subsequently revised in the central monastery of the unparalleled city of Kāśmīra by the Kāśmīrian sage Ha-su-mati and the Tibetan interpreter Pa-tshab-ñi-ma-grags. The Tibetan version begins with a salutation to Mañju-śrī-kumāra-bhūta. The original text begins thus :—

གང་གིས་དེེན་ཅིང་འབྲེལ་བར་འབྲུང་ ॥

འགག་པ་མེད་པ་སྐྱེ་མེད་པ་ ॥

¹ This is the same as the Sanskrit Mādhyamika Sūtra which has been recovered from Nepal and printed in the Bibliotheca Buddhica series of St. Petersburg as well as in the text series of the Calcutta Buddhist Text Society. The Sanskrit originals of the remaining works in the present list appear to have been lost.

ཚད་པ་མེད་པ་དྲག་མེད་པ།
 རོང་བ་མེད་པ་འགྲོ་མེད་པ།
 ཐད་ད་དོན་མེད་དོན་གཅིག་མེད།
 སྲོམ་པ་ཉིད་ཞི་ཞི་བརྟན་པ།
 ཇམས་པའི་སངས་རྒྱས་སྣོད་ལྟེང་གི།
 དམ་པ་དེ་ལ་ཕྱག་འཚལ་ལོ། ३ །

"I adore the fully enlightened Buddha, the foremost of the eloquent, who taught us the doctrine of Pratitya-samutpāda, according to which things are neither destroyed nor produced, neither transient nor eternal, neither different nor same, neither do come forth nor pass away,—the knowledge of which confers blessings by putting an end to all illusions."

It consists of 27 chapters, *viz.*, (1) རྟོག་བདེག་, བམམ་པ་ལཱ་ཤེས་པའི་ཇམས་པའི་སངས་རྒྱས་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of conditions or relations; (2) རོང་བ་མེད་པ་འགྲོ་མེད་པ་, བསྐྱེད་པ་མེད་པ་འཕྲོ་མེད་པ་, གནང་བ་མེད་པ་འཕྲོ་མེད་པ་, examination of going and coming; (3) དབང་བ་མེད་པ་, མིའི་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of sense-organs; (4) སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of five aggregates; (5) བསྐྱེད་པ་མེད་པ་འཕྲོ་མེད་པ་, མིའི་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of elements; (6) རྟོག་བདེག་པའི་སངས་རྒྱས་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, འདྲུན་པའི་སངས་རྒྱས་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of attachment and the attached; (7) སྲོམ་པ་ཉིད་ཞི་ཞི་བརྟན་པ་, སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, མིའི་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of origination, continuance and destruction; (8) རྟོག་བདེག་པའི་སངས་རྒྱས་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, རྟོག་བདེག་པའི་སངས་རྒྱས་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of act and agent; (9) སྲོམ་པ་ཉིད་ཞི་ཞི་བརྟན་པ་, སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, མིའི་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།, examination of priority; (10) མེད་པ་མེད་པ་འགྲོ་མེད་པ་, མིའི་སྣོད་ལྟེང་གི་དྲུག་པའི་ཕྱག་འཚལ་ལོ།,

examination of fire and fuel; (11) སློན་དང་ཕྱི་མའི་མཐའ་བདུག་, *samsara-parīcchā*, examination of priority and posteriority in relation to transmigration; (12) སྤྱུག་བསྐྱེད་བདུག་, ལུ་མ་པར་ལྡོག་པའི་ཕར་ལྡོག་, *duḥkha-parīcchā*, examination of suffering; (13) འདྲ་ཕྱིད་བདུག་, རྣམ་ཐོག་པར་ལྡོག་, *samskāra-parīcchā*, examination of reminiscences; (14) སྤྱད་པ་བདུག་, མཚམས་པར་ལྡོག་, *samsarg-parīcchā*, examination of contact; (15) རང་བཞིན་བདུག་, མཚམས་པར་ལྡོག་, *svabhāva-parīcchā*, examination of essential character; (16) བཅོམས་པ་དང་ཐང་པ་བདུག་, བཅོམས་པ་དང་ཐང་པ་བདུག་, *bandha-mokṣa-parīcchā*, examination of bondage and liberation; (17) ལས་དང་འབྲས་ལུ་བདུག་, ལས་ལས་པར་ལྡོག་, *karmā-kala-parīcchā*, examination of action and fruit; (18) བདག་བདུག་, རྣམ་པར་ལྡོག་, *ātma-parīcchā*, examination of the soul; (19) དུས་བདུག་, རྣམ་པར་ལྡོག་, *kāla-parīcchā*, examination of time; (20) ཚོགས་པ་བདུག་, མཚམས་པར་ལྡོག་, *saṃgraha-parīcchā*, examination of wholeness; (21) འབྱུང་བ་དང་འཇིག་པ་བདུག་, འབྱུང་བ་དང་འཇིག་པ་བདུག་, *sambhava-vibhava-parīcchā*, examination of origination and destruction; (22) དེ་བཞིན་གཤེགས་པ་བདུག་, འཇིག་པར་ལྡོག་, *tathāgata-parīcchā*, examination of Tathāgata; (23) ཕྱི་ཕོ་ལོག་བདུག་, ཕྱི་ཕོ་ལོག་བདུག་, *viparyāsa-parīcchā*, examination of perversion; (24) འཕགས་པའི་བདེན་པ་བདུག་, འཕགས་པའི་བདེན་པ་བདུག་, *āryasatya-parīcchā*, examination of the noble truths; (25) ལྷ་འདོད་པ་བདུག་, ལྷ་འདོད་པ་བདུག་, *nirvāṇa-parīcchā*, examination of Nirvāṇa; (26) སྤྱིད་པའི་ཡན་ལག་བརྒྱུ་མཉམས་བདུག་, སྤྱིད་པའི་ཡན་ལག་བརྒྱུ་མཉམས་བདུག་, *ḥḍādaśāḥ-parīcchā*, examination of the twelve parts of Pratitya-samutpāda; and (27) ལྟ་བུ་བདུག་, ལྟ་བུ་བདུག་, *dṛṣṭi-parīcchā*, examination of views.

2. युक्ति षष्टिका कारिका (Tib. རིགས་པ་དུག་ཅུ་པའི་ཚོག་
ལའུར་བྱས་པ) — Sixty memorial verses on reasoning.

This work consists of folios 20—22 of the Tangyur, Mdo, Tsa, and was composed by Ārya Nāgārjuna. It begins thus:—

གང་གིས་སྐྱེ་དང་འཇིག་པ་དག།
ཚུལ་འདི་ཡིས་ནི་སྤངས་གུར་པ།
དེམ་ཅིང་འབྱུང་བ་གསུང་པ་ཡི།
ཐུབ་དབང་དེ་ལ་ཕྱག་འཚལ་ལོ།

“Who is free from the courses of birth and destruction, and who preached the doctrine of Pratitya-samutpāda, to that lord of sages I bow down.”

The work was translated into Tibetan by the Indian sage Mutita-śrī and the Tibetan interpreter Pa-tshab-ñi-ma-grags. The translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

3. वेदल्यहृत्त्र-नाम (Tib. ཞིབ་མོ་རྣམ་པར་འཐག་པ་ཞེས་བྱ་བའི་
མདོ) — A comprehensive analysis called Vedalya
Sūtra.

This work consists of folios 22—24 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, begins thus:—

རྗོག་གི་ཤེས་པའི་ང་རྒྱལ་གྱིས།
གང་ཞིག་རྩོད་པར་མངམ་འདོད་པ།
དེ་ཡིས་ང་རྒྱལ་སྤང་བའི་ཕྱིར།
ཞིབ་མོ་རྣམ་འཐག་བཤད་པར་བྱ།

“Whoever, through pride of reasoning and knowledge, wishes disputation, for the sake of quelling his pride, the Vedalya is expounded.”

The text was translated into Tibetan by the Kāśmīrian Paṇḍita Ananta and the Tibetan interpreter-monk Grags-hbyor-śes-rab. The translation begins with a salutation to teacher Ārya Nāgārjuna.

4. *शून्यता-सप्तति-कारिका* (Tib. མྱེང་པ་ཉིད་བདུན་ཅུ་པ་རི་ཚིག་གཉེན་བྱས་པ) — Seventy memorial verses on the void.

This work consists of folios 24—26 of the Tangyur, Mdo, Tsa. The text was composed by Ārya Nāgārjuna and was translated into Tibetan by Gshon-nu-mchog and Gñu-dha-rma-grags. The translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

5. *विग्रहव्यवर्तनी-कारिका* (Tib. ཚིང་པ་བརྗོད་པ་རི་ཚིག་གཉེན་བྱས་པ) — Memorial verses on quelling disputes.

This work consists of folios 26--29 of the Tangyur, Mdo, Tsa. The text was composed by Ārya Nāgārjuna, and translated into Tibetan by the Indian sage Jñāna-garbha and the Tibetan interpreter Ka-wa-dpal-brtsegs. Subsequently the translation was recast by the Kāśmīrian Paṇḍita Jayānanta and the interpreter Khu-mdo-sde-dpal.

6. *मूलमध्यमकवृत्ति अकुतोभय* (Tib. དབྱམ་ཅུ་བའི་འགྲེལ་པ་གཤམ་འཇིགས་མེད) — A dauntless commentary on the original Mādhyamika philosophy.

This work extends over folios 29—104 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, begins thus:—

གང་གིས་སྤྱིས་དང་འཇིག་པ་དག།
 འདི་ཡི་ཚུལ་གྱིས་རབ་སྐྱེས་པ།།
 དེའི་ཚིང་འབྲུང་བ་གསུངས་པ་ཡི།།
 ཐུབ་དབང་དེ་ལ་ཐུག་འཚལ་ལོ།།

"I bow down to that lord of sages, who preached Pratitya-samutpāda which is devoid of the essence of origination and destruction."

The text was translated into Tibetan under orders of the great king Dpal-lha-b san-po by the Indian Mahāyāna sage Jñāna-garbha and the Tibetan interpreter of Shu-chen named Kluhi-rgyal-mtshan. The translation begins with a salutation to the Three Gems, Mañju-śrī-kumāra-bhūta and Ārya Nāgārjuna.

The translation closes by mentioning eight expounders of the Mādhyamika philosophy, viz., (1) Ārya Nāgārjuna; (2) Sthavira Buddha Pālita; (3) Candra Kīrti; (4) Deva Sarmā; (5) Guṇa-śrī; (6) Guṇa-mati; (7) Sthira-mati; and (8) Bhavya (འཇགས་ལྷན་བྱེད་).

7. *वैदल्यं नाम प्रकरणम्* (Tib. *ཞིབ་མོ་རྣམ་པར་འཕགས་པའི་རབ་དུ་བྱེད་པ།*)—A treatise named Vaidalya (a comprehensive analysis).

This work extends over folios 104—116 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, begins thus:—

དོག་གི་ཤེས་པའི་ང་རྒྱལ་གྱིས།
གང་ཞིག་ཚོད་པར་མངོན་འདོད་པ།
དེ་ཡི་ང་རྒྱལ་སྐྱོང་པའི་སྤྱིར།
ཞིབ་མོ་རྣམ་འཕགས་བཤད་པར་བྱ།

“Whoever, through pride of reasoning and knowledge, wishes disputation, for the sake of quelling his pride the Vaidya is expounded.”

The text was translated into Tibetan under orders of Kal-yāna-mitra Guṇa-kīrti (ཡོན་ཏན་གྲགས་པ།) by the Kāśmīrian Paṇḍita Jayānanta and the great Tibetan interpreter Sākya-bhikṣu Kbu-mdo-lha-wa. The translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

8. *सून्यता-सप्तति-वृत्ति* (Tib. *སྐྱོང་པ་ཉིད་བདུན་ཅུ་པའི་འགྲེལ་པ།*)—A commentary on the *Sūnyatā-saptati*.

This work extends over folios 116—128 of the Tangyur, Mdo, Tsa. The text was composed by Ārya Nāgārjuna. The Tibetan translation begins with a salutation to Mañju-śrī-jūāna-sattva (འཇགས་དཔལ་ཡོ་ཤེས་སེམས་པ།)

9. *विग्रहव्यवर्तनी-वृत्ति* (Tib. *ཚོད་པ་བརྗོད་པའི་འགྲེལ་པ།*)—A commentary on the *Vigrahavyavartanī*.

This work extends over folios 128—146 of the Tangyur, Mdo, Tsa. The original of it was composed by Ārya Nāgārjuna. The

Tibetan translation was prepared by the Indian sage Jñāna-gar-bha and the Tibetan interpreter Vande Vana-rakṣita. It begins with a salutation to Mañju-śri-kumāra-bhūta.

10. महायान विम्वतिका (Tib. བློ་བཟང་མེད་པོ་ཉི་ལུ་པ) — Twenty verses on the Mahāyāna.

This work consists of folios 146—147 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, begins thus:—

ཆགས་མེད་ཐུགས་སུ་རྒྱུད་སངས་རྒྱལ་།
རྗོད་བྱེད་བརྗོད་པར་བྱ་བ་མེན་།
ཐུགས་རྗེས་རྒྱལ་བ་སྣང་གུར་པ།
སྤྱོད་བསམ་མི་བྱེད་ཐུག་འཚམ་ལོ།

“I salute Buddha who has no attachment and yet who enters the heart, who is a speaker but of whom nothing can be spoken, who is the king of mercy and personification of light, who is possessed of inconceivable power and is all-pervading.”

The text was translated into Tibetan by the Indian sage Candrakumāra and the Tibetan interpreter-monk Śākya-hod. The translation begins with a salutation to Mañju-śri-kumāra-bhūta.

11. अक्षरशतक (Tib. ཨི་གོ་བརྒྱ་པ) — A treatise of one hundred letters.

This work consists of folio 147 of the Tangyur, Mdo, Tsa. The text was composed by Ārya Nāgārjuna. The Tibetan translation begins with a salutation to Mañju-śri-vajra.

12. अक्षरशतक-नाम-वृत्ति (Tib. ཨི་གོ་བརྒྱ་པ་ཞེས་བྱ་བའི་འགྲེལ་པ) — A commentary on the Akṣara-śataka.

This work extends over folios 147—156 of the Tangyur, Mdo, Tsa. The text was translated into Tibetan in the unparalleled city of Kāśmīra by Vande Gshon-nu-śes-rab (Kumāra-prajña). The translation was subsequently revised by Paṇḍita Ananta, and the Tibetan interpreter Grags-hbyor-śes-rab. The translation begins with a salutation to Mañjuvajra.

13. प्रतीत्य-समुत्पाद-हृदय-कारिका (Tib. རྗོད་ཅིང་འབྲེལ་པར་འབྲུང་བའི་སྣོད་པོ་འི་ཚིག་པེུར་བྱས་པ) — Memorial verses on the essence of *Pratītya-samutpāda*.

This work consists of folio 156 of the Tangyur, Mdo, Tsa. The text was composed by Ārya Nāgārjuna. The Tibetan translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

14. प्रतीत्य-समुत्पाद-हृदय-व्याख्यान, དྲིན་ཅིང་འབྲེལ་པར་འབྲུང་
བའི་སྒྲིང་པོ་འི་རྣམ་པར་བཤད་པ། —Explanation of the
Pratītya-samutpāda-hṛdaya.

This work extends over folios 156—159 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, was translated into Tibetan by the Indian sage Jina-mitra, Dhana-śrīla, Śilendra-bodhi, Vande Ye-śes-gde and others. The Tibetan version begins with a salutation to Mañju-śrī-kumāra-bhūta.

15. अबुध-बोधक-नाम-प्रकरणम्, མ་རྟོགས་པ་རྟོགས་པར་བྱེད་པ་
ཞེས་བྱ་བའི་རབ་དུ་བྱེད་པ། —A treatise instructing the
unintelligent.

This work extends over folios 159—160 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, was translated into Tibetan by Paṇḍita Ananta and the Tibetan interpreter Grags-hbyor-śes-rab. The translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

16. रत्नसुकोष-नाम, སྒྲི་མེད་རིན་པོ་ཆའི་མཛོད་ཅེས་བྱ་བ། —A good
treasury of gems.

The work consists of folios 160—161 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, was translated into Tibetan by the Indian sage Kanaka Varma and the Tibetan interpreter Sūryakīrti.

17. भवसंक्रान्ति, སྤོད་པ་འཕོ་བ། —Worldly migration.

This work consists of folios 161—162 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, is divided into five chapters, *viz.*, (1) ཆོས་ཉིད, essential character; (2) སྤང་བོ་ལྔ་སྒྲིང་
པ་ཉིད་དུ་བསྟན་པ, instruction on the five aggregates, and the void; (3) ཤེས་རབ་བསྟན་པ, instruction on wisdom; (4) ཐབས་བསྟན་པ, instruction on resources; and (5) བདེན་པ་གཉིས་བསྟན་པ, instruction on the two truths.

The Tibetan translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

18. भवसंक्रान्ति टीका, *མྱེད་པའི་འཕོ་བའི་རྒྱ་ཀློང་།*—A commentary on the Bhavasamkrānti.

This work extends over folios 162—169 of the Tangyur, Mdo, Tsa. The text, which was composed by Paṇḍita Maitreya Nātha (*བྱམས་པ་མགོན་པོ་འཕྲུལ་པ་*) was translated into Tibetan by Paṇḍita Zla-wa-gshon-nu-la-gru-ṣton-chud. The translation begins with a salutation to Sarvajña.

19. बुद्धपालित-मूलमध्यम-वृत्ति, *དབུ་མ་ཙུ་བའི་འགྲེལ་པ་བུ་ལུ་པ་*
ལཱི་ཏུ་།—Buddha Pālita's commentary on the original Mādhyamika philosophy.

This work extends over folios 169—310 of the Tangyur, Mdo, Tsa. The text, which was composed by the great Mahāyāna teacher Buddha Pālita, was translated into Tibetan by the Indian sage Jñāna-garbha and the Tibetan interpreter of Shu-chen named Cog-klo-kluhi-rgyal-mtshan. The translation begins with a salutation to the Three Gems, Mañju-śrī-kumāra-bhūta, Ārya Nāgārjuna and Acārya Buddha Pālita.

20. स्वभावत्रय-प्रवेश-सिद्धि, *རང་བཞིན་གསུམ་ལ་འཇུག་པའི་*
སྒྲུབ་པ་།—Proof of entrance into the threefold character.

This work extends over folios 310—312 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Nāgārjuna, was translated into Tibetan by the Kāśmīrian Paṇḍita Bhikṣu Candrakīrti (*ལྷོ་བ་གྲགས་པ་*). The Tibetan version begins with a salutation to Buddha.

21. हस्तबलनाम-प्रकरण, *ཚ་ཤས་ཀྱི་ཡན་ལག་ཅེས་བྱ་བའི་རབ་*
དུ་བྱེད་པ་།—A treatise named *Hastabala*.

This work consists of folios 312—313 of the Tangyur, Mdo, Tsa. The text, which was composed by teacher Ārya Deva, was translated into Tibetan by the Indian sage Śraddhākara Varma and the Tibetan interpreter Rin-chen-bzañ-po. The translation begins with a salutation to the power of Bhagavān (*བཙུན་པོ་འཇུག་*

འདས་དག་གི་དབང་པོ་ལ་བྱུག་འཚལ་ལོ།།)

22. **हस्तबलनाम-प्रकरणवृत्ति, कः-पेसा-ग्री-यङ्-यवा-उसा-गु-वदि-**
स्व-दु-त्रेद-वदि-द-वो-स—A commentary on the
 treatise named *Hastabala*.

This work consists of folios 313—315 of the Tangyur, Mdo, Tsa. The text, which was composed by Ārya Deva, was translated into Tibetan by the Indian sage Sraddhākara Varma and the Tibetan interpreter Rin-chen-ḥḥaṅ-po. The translation begins

with a salutation to Mañju-śrī-jñāna-sattva (**འཇམ་དབལ་ཡི་ཤེས་**
སེམས་དབང་།) |

23. **मध्यम-हृदय-कारिका, द-गु-सदि-स्त्रि-द-दि-के-सा-ले-दु-स-गु-सा-**
स—Memorial verses on the essence of the
 Mādhyamika philosophy.

This work extends over folios 1—40 of the Tangyur, Mdo, Dsa. The text, which was composed by teacher Bhavya (**ལེགས་ལྡན་བྱེད་**), was translated into Tibetan by the Tibetan interpreter Tshul-khrims-rgyal-wa in the presence of the Indian sage Dīpaṅkara-śrī-jñāna in the monastery of Ra-sa-ḥphrul-gnañ¹ in Lhasa. The translation begins with a salutation to Mañju-śrī-kumāra-bhūta.

The text begins thus :—

གང་གིས་དེ་ཉིད་རབ་བརྟུན་མིན།
 རྣམ་ཤེས་བྱ་མིན་གཞི་མ་ཡིན།
 མཚོན་མིན་བརྟུན་མིན་རིག་བྱ་མིན།
 སྐྱི་འཇིགས་མེད་ཅིང་བདེ་བ་དང་།
 རྣམ་བརྟུན་མ་ཡིན་སྣང་བ་དང་།

¹ Ra-sa-ḥphrul-gnañ (**ར་ས་འཕྲུལ་སྣང་**) is the miraculous temple of Ra-sa at Lhasa, now called the Chokhang or Kinkhording (**དགུལ་འཁོར་**
མྱིང་), which was built by king Srong-tsan-gam-po at the request of his Nepalese wife.

མཚན་མ་མེད་ཅིང་གསལ་བྱེད་མེད།།

གཉིས་མིན་གཉིས་མེད་མ་ཡིན་དང་།།

ཞི་དང་ལྷོ་འཇུག་སྤངས་པ་དང་།།

ཡི་གེ་མེད་པ་ཡི་གེ་ཡིས།།

ཐུགས་རྗེ་ཉིད་ཀྱིས་བསྟན་མཛད་པ།།

སྟོན་པ་མ་ཞེས་ཉིད་གསུང་བ།།

དེ་ལ་གསལ་བར་བྱས་འཚལ་ལོ།།

The book is divided into 11 chapters as follows: (1) བྱང་ཆུབ་སེམས་མི་བདང་བ, uninterrupted spiritual enlightenment (*bodhicitta*); (2) ཐུབ་པའི་བདུལ་ཞུགས་ལ་ཡང་དག་པར་བསྟན་པ, full practice of the ascetic penances (*muni-vrata*); (3) དེ་ཁོ་ན་ཉིད་ཀྱི་ཤེས་པ་འཚོལ་བ, search for knowledge of the truths (*tattvas*); (4) ཉན་ཐོས་ཀྱི་དེ་ཁོ་ན་ཉིད་ལ་འཇུག་པ, introduction to the truths of the *śrāvakas* (*śrāvaka-tattva*); (5) རྣལ་འབྱེད་སྤྲིད་པའི་དེ་ཁོ་ན་ཉིད་གཏན་ལ་དབབ་པ་ལ་འཇུག་པ, introduction to the system of vows of a contemplative ascetic (*yogin*); (6) བྱངས་ཅན་ཀྱི་དེ་ཁོ་ན་ཉིད་ལ་འཇུག་པ, introduction to the truths of the *Sāṃkhyas*; (7) བྱེ་བྲག་པའི་དེ་ཁོ་ན་ཉིད་ལ་འཇུག་པ, introduction to the truths of the *Vaiśeṣikas*; (8) རིག་བྱེད་ཀྱི་མཐའ་བྱུང་སྐྱེ་བའི་དེ་ཁོ་ན་ཉིད་ལ་འཇུག་པ, introduction to the truths of the *Vedānta-vādin*; (9) དབྱེད་པའི་དེ་ཁོ་ན་ཉིད་གཏན་ལ་དབབ་པ་ལ་འཇུག་པ, introduction to the system of the *Mīmāṃsakas*; (10) ཐམས་ཅད་མཁྱེན་པ་ཉིད་ཏུ་བྱུབ་པར་བསྟན་པ, instruction on the attainment of omniscience;

and (11) བསྟོན་པ་དང་མཚན་བསྟན་པ, hymn and instruction on *lakṣaṇa*, sign.

24. མཐམ་མཁ-ལྡང་ལ-འཇིག་རྟེན་ལྷན་པའི་འབྲེལ་པ་

བརྟེན་གྱི་འབར་བ--A flame of discussions in the commentary on the essence of the Mādhyamika philosophy.

The work extends over folios 40—360 of the Tanyur, Mdo, Dsa. The text, which was composed by teacher Bhavya, was translated into Tibetan by the Indian sage Dipaṅkara-śrī-jñāna and the Tibetan interpreter-monk Tshul-khrims-rgya-wa in the monastery of Ra-sa-hphrul-gnañ in Lhasa. The translation begins with a salutation to the Omniscient One.

25. མཐམ་པོ་ལྷན་སྐྱེས་པའི་འབྲེལ་པ་འབྲུང་

བརྟེན་གྱི་བ--Pratitya-samutpāda of the Mādhyamika philosophy.

This work consists of folio 360 of the Tanyur, Mdo, Dsa. The text was composed by Kṛṣṇa (ནག་པོ་པ). The Tibetan version begins with a salutation to the Three Gems.

26. མཐམ་མཁ་ལྡང་ལ-འབྲེལ་པའི་འབྲེལ་པ--A summary of the objects of the Mādhyamika philosophy.

This work consists of folios 360—361 of the Tanyur, Mdo, Dsa. The text, which was composed by teacher Bhavya, begins thus:—

གང་དག་སྐྱེ་མེད་རྟོགས་པ་ཉིད་ཡིན་ཡང་གསྟོང་པོ་གང་སྟོང་ཇེས་
འཁོར་བ་མ་སྟོང་བར། རྒྱལ་བ་རྣམས་ཀྱི་འཇིག་རྟེན་བདེ་བར་བསྐྱབ་པའི་
ཕྱིར། འདི་ཅུ་ཞུགས་ཀྱང་རྟོགས་ལྡོག་པར་ལྡོག། དེ་དག་རྣམས་ལ་དག་པུ་
བདག་ཕྱག་འཚལ།

It was translated into Tibetan by Tshul-khrims-rgyal-wa. The Tibetan version begins with a salutation to Bhagavan Samantabhadra.

27. माध्यमिकावतारस्य-टीका-नाम, द्रुम'ल'दहुमा'पदि'दग्रे'ल'

བཤད་ཅེས་བྱ་བ—A commentary on the
 Mādhyamikāvatāra.

This work extends over folios 1—124 of the Tangyur, Mdo. Ra. The text, which was composed by the Kāśmīrian Paṇḍita Jayānanta, begins thus:—

སངས་རྒྱལ་སྤྱི་བ་པ་གཉིས་སྤངས་པའི།།

ཐམས་ཅད་མཁྱིལ་ལ་རབ་དུ་བདུན་ནས།།

དབྱུང་ལ་ནི་འདུག་པའི་དོན།།

བདག་གིས་གསལ་བར་བཤད་པར་བྱ།།

“Bowling down reverentially to Buddha who has abandoned two defilements and who is omniscient, I explain clearly the meaning of the Mādhyamikāvatāra.”

It was translated into Tibetan by Jayānanta himself and the Tibetan interpreter Vande Kun-dgah-grags. The Tibetan version begins with a salutation to Mañju-śrī-kumāra-bhūta.

¹ སྤྱི་བ་པ་གཉིས་, ལྷན་པོ་གཉིས་, two obscurations or defilements, viz.,

- (1) ཉོན་མོངས་པའི་སྤྱི་བ་པ་, ལྷན་པོ་གཉིས་, defilement of misery caused by habits, etc., and (2) རྟོག་པའི་སྤྱི་བ་པ་, ལྷན་པོ་གཉིས་, defilement produced from the objects of knowledge.

41. Some Songs of Chitral.

By E. B. HOWELL, I.C.S.

The four songs which follow were recorded for me by Munshi Kuli Khan, the Native Political Assistant in Chitral, and the Khowār text has been revised by Khan Sahib Abdul Hakim Khan, who is perhaps better acquainted with Khowār than any other living educated man. Without the aid of these two gentlemen in translation, it is perhaps needless for me to say, this venture had never been made.

The following is taken from the skeleton grammar of the Khowār language contained in Dr. Grierson's Linguistic Survey:—

PRONUNCIATION.

"(a) *Vowels*, *a*, *ā*, *i*, *ī*, *u*, *ū*, *ē*, *ai*, *ō*, *au* as in Indian languages; *ä* as in English *hat*; *ë* as in *tent* or *met*; *ö* as in English *hot*; *o* like the first *o* in *promote* or the *o* in the French word *votre*, the short sound of *o* in the English word *home*.

(b) *Consonants*, *kh*, *zh*, *gh*, *q* are the Persian and Arabic ق غ ژ and چ respectively. *ḷ* has a lingual sound between *l* and *r* *Th* is pronounced like the 'th' in *this*. *Ph* is pronounced *p-h* not *f*. The letters *ts*, *dz* represent the well-known sounds of Pašto and Kāšmiri."

To this I have only to add that in the refrain of the second song, line 2, appears the half aspirate, represented by the symbol ^h. The Arabic چ where found, is, as usual, represented by the sign —'. It need not be pronounced, fortunately.

Khowār the language of Chitral forms one of the Pisāca group. Its close affinity to Persian and Pašto is obvious at a glance though its verb inflexions are not so much broken down as those of the latter language. It has no alphabet of its own, and for the representation of its sounds the Roman character, with its wealth of vowel symbols, seems to me preferable to the Arabic.

A short explanatory note is prefixed to each song, and no further introduction seems necessary, except to invite attention to the really remarkable degree of excellence, as ballad-poetry, to which these songs, in the original, attain.

I.—A SONG OF WAR IN PRAISE OF MUHAMMAD 'ISA.

In March 1895 two Companies of the XIVth Sikhs under the command of Captain Ross were marching to the relief of Bāshun along the road from Mastāj to Chitral. In Rāshun Lieutenants Fowler and Edwards were being besieged by the

adherents of Sher Afzal, a claimant to the throne of Chitral. The besieging force was under the command of Muhammad 'Isa, Sher Afzal's foster-brother. The relieving force was caught by the Chitralis in the Kalak defile, near Kurāgh village, about 40 miles from Chitral, and forced to take shelter in a cave. In the endeavour to extricate themselves Captain Ross and most of his men were killed; only a handful under Lieutenant Jones, who was himself wounded, succeeded in cutting their way back to Mastūj. After the death of Captain Ross some of the native ranks returned to the cave, where they were besieged for seven days. Being then reduced to utter exhaustion, they consented to surrender on condition that their lives were spared. The agreement was not kept by the Chitralis, who are said to have put their prisoners to death by torture.

(1) Kāfir, jang bitī shēr
 Kalakār Gidāra pat,
 Mehtarō chhir brār ki hai,
 Ta doi doi Langara pat.
 'Ajab, Kāfir, di tu tan,
 Ta sūrat dodōro tan,
 Ta kapal ghal'belo tan,¹
 Ta marak ḡaq awa tan,
 Woi "Korōs kura Landan."

(2) Robatson² no ghori dōl
 Fath Ali Shō gani;
 Thē di bōko zhayim,
 Muhammad 'Isa³ gani.
 'Ajab, Kāfir, etc.

(3) Gudām⁴ rēni? Kyā gudām?
 Isha-sum chōki mudām.
 Hamu sharam no bōyan?
 Johjū nas hoi mu hadām.
 'Ajab, Kāfir, etc.

¹ Why the infidel's head is likened to a sieve is not clear. A fanciful observer might perhaps see some likeness between the shape of a sola top's brim and a **فربال** the common sieve in use in Afghānistan and the neighbouring countries. Amongst Pathans the **فربال** is known as ghal-bel, presumably by a popular etymology from ghalla = grain, bel = separate.

² Sir G. Robertson, then Political Agent in Chitral, who was at the time in Chitral fort, also besieged.

³ Muhammad 'Isa the hero of the song, referred to in line 3 of the first verse as the Mehter's foster-brother. 'Muhammad' here and in verse 4 below must be pronounced Mu'mad or Mahmad, as commonly in Pashto. The conjunction of Muhammad and 'Isa is curious in this song, in which the slaughter of 'Isais, and their followers, is so highly praised.

⁴ Gudām = 'godown,' i.e., the Commissariat Department, store-house supply, or treasure.

I. LITERAL TRANSLATION.

(1) Infidel, battle is being *fought* from Kaḷak to Gudār. When the Mehtar's foster-brother comes, he will beat thee to Langar.

Refrain.—Strange, infidel, indeed art thou. Thy form is wolf-like; thy head is as a sieve. I am the lad to slay thee. Thou shalt cry. "Ah me! for London, where is it?"

(2) Robertson, with Fath Ali Shah, is pent in the fort: then with Muhammad Isa's *aid* shall I steal his wife.

Strange, infidel, etc.

(3) He boasteth of his store-houses—but what **are** they, *that* of us they *are* ever in need. Cometh not shame to him? His body is *cut* in twelve pieces.

Strange, infidel, . . .

- (4) Muhammad 'Isa Khān giti
Lyot Kāfiro nast arēr.
Mu tē Mastūj kya darir ?
Maimano¹ lashṭ arēr.
'Ajab, Kāfir, etc.
- (5) Sher Afzal Khān giti
Chitraḷa dār tūp arēr.
Tupēn i di no pēṭṣhī ;
Gurīn Gōlen² lūp arēr.
'Ajab, Kafir, . . .
- (6) Kaḷako zoma bakhār,
Chhuti ta saro ghoḥhār,
* * * *
Lei bashiran ta aḥhār.
'Ajab, Kāfir, . . .
- (7) Roi-nimāl bakhō zhangī
Hai bakhṭo ta kyā dangi ?
Kāfirō, bēri nisēh !
Ta marinyan ta changi.
'Ajab, Kāfir, . . .
- (8) Kāfirō, bēri nisēh !
Bēri ta dik bitī shēr ;
Kāfiro kōlan sora
Lōw rēniān brik bitī shēr.
'Ajab, Kāfir, . . .
- (9) Kāfirō, bēri nisēh !
Sharana ito dōsi,
Ta poyan tasma³ ōzi
Posh-nēm phi to dōsi.
'Ajab, Kafir, . . .
- (10) Kāfiro piti thowek
Pēṭṣhiko usāro prau ;
Awa ta shōran diko,
Tu ma i Masāro prau.
'Ajab, Kāfir, . . .
- (11) Bārān ma krēm to diti
Tu Gōrki ma tē "Chalo" koi,⁴
Mehtarō chhir brār ki hai,
Phat zomo phat chāro koi.
'Ajab, Kāfir, . . .

¹ Maimana, said to be a plain in Afghanistan. What the exploit here referred to was, is not known. [valley.

² Gurīn Gōl is the name of a valley leading westwards from the Chitral

³ In the East, it must be remembered, the spade is an implement wielded by two men. The second man by pulling a string fastened just above the blade, helps the digger to lift the clod.

⁴ Before 1895 there were no roads passable to animal transport in all Chitral, and as in neighbouring countries of similar conformation 'begār' on the roads has at many times been a burning question.

[N.S.]

(4) Muhammad Isa Khan came, and played a great trick upon the infidel. Before him what *stand* shall Mastūj make? He, *it was who* levelled Maimana's plain.

Strange, infidel, . . .

(5) Sher Afzal Khān came and made a wooden guu at Chitral. From that guu he did not fire even a single shot, but slank away by the Gurin gōl.

Strange, infidel, . . .

(6) From the cave in the cliffs of Kalak, earth pours over thy head; * * * it is raining blood behind thee.

Strange, infidel, . . .

(7) The cave is as high as a man *is tall*. What help for thee therein? Infidel, come out! By guile they slay thee!

Strange, infidel, . . .

(8) Infidel, come forth! Outside thy slaughter is a-doing. Over the infidels' bones dogs and foxes are fighting.

Strange, infidel, . . .

(9) Infidel, come forth! In the court-yard let us fight together. We will pull out thy sinews and fasten them to a wooden dung-shovel.

Strange, infidel, . . .

(10) The infidel's rifles are of Martini pattern. You fired and hit the walls. Of thee I have slain hundreds, and of me thou smotest only Masār.

Strange, infidel, . . .

(11) Burdens to my back thy Gurkhas gave, saying "Forward." When the Mehtar's foster-brother comes, down from cliff and down from shale-slope shall he fling them.

Strange, infidel, . . .

- (12) Kāfirē, bēri nisēh !
 Bēri peḥ shughura nishēh !
 Kāghazānroi awani,
 Tu tan dughura niwishēh !
 'Ajab, Kāfir, . . .

II.—LOVE SONGS.

2. A LOVE SONG.

The singer compares his beloved to a ruby, a pearl, a houri of paradise, and a crystal mirror; himself to the dust of the earth. 'Dayūs' (cuckold) refers to the beloved's husband, and 'Jalād waw' to an old woman, probably employed as a go-between in the earlier stages of the love affair.

'Balkho ziārat' means the famous shrine at Mazār-i-Sharif, at which according to K. S. Abdul Hakīm offerings are left by the distressed "on condition of their prayers being granted." The singer very prettily represents his life as devoted there for the success of his love.

- (1) Rōsh̄ti ma tē goyan, laghal bhathana sh̄ēr,
 Durdāno pholok d̄ yūso phāna sh̄ēr.
 Ma mirzāē ālam, tu hur biti asus,
 Ma bilaur harēn tu khūr biti asus ?
 Jalād wawo lyna tu khūr biti asus.
- (2) Daq zamina chhuti, khoshroi tu durdāna :
 Balkho ziārata ma jān ta shukrāna.
 Ma mirzāē ālam, . . .
- (3) Ta sharāna zhang nakh lolan ma giko bash.
 Ādmio dang jān, muni briko bash,
 Ma mirzāē ālam, . . .

3. A LOVE SONG.

3. The lover belongs to Rēshun and his beloved to the village of Shugrām, almost opposite Rēshun, across the river. The *motif* of the song needs no explanation. In the fourth verse occurs a very picturesque expression, ishqo Qalandār = 'a roving friar of the order of Love.' 'Alghāna in the fifth verse means Dir and Swāt and the other Pathān countries to the south of Chitrāl. The second line of verse 5 may be conceived as addressed to a flock of crows whose cawing has interrupted the meditations of the devout lover.

The refrain seems to embody a general reflection, not to tell the praise of the particular beloved. The point of the antithesis seems to be that there is no monotony in the charms of a woman, unlike those of scenery, although she may turn a deaf ear to the lover.

[N.S.]

(12) Infidel, come forth *and* sit without upon the warm sand. The people have taken away thy papers; write upon thy nails.

Strange, infidel, . . .

LITERAL TRANSLATION.

(1) *My* light to me cometh, *she* is as a ruby in the land; as a pearl in the hand of a cuckold is *she*. My charm of the world, a houri art thou. My crystal glass, art thou darkened? At the word of a peevish hag art thou estranged.

(2) I *am as* dust upon the earth, thou, beautiful, art a pearl. At the shrine of Balkh do I pledge my life for thee.
My charm of the world,

(3) Fain would I come to see the lofty balcony in thy courtyard. Man's heart is tough, else fain would I have died.
My charm of the world,

- (1) Zomo sorēn loli ko Rēshuno kuru bron shiyuni.
 Kya kuru bron kya jumla drusti drust yaksan
 shiyūni ?
 Kumōro shun don namakin,
 Kumōro har lyu namakin,
- (2) Awa ki ta laliman, tu ma pētshi khūri lalis,
 Ma jān ta sora nazar dushmano kanduri lalis ?
 Kumōro . . .
- (3) Jū bas Shugrami biti, Rēshuno tē ki gōs, kyani
 boi ?
 Zerbaliyan bolok biti shēr, buchuhahir ān dōs, kyani
 boi ?
 Kumōro . . .
- (4) Roi ma bashār koronyau “Ē diwāna, kuri bisan” ?
 Awa ’ishqo Qalandār, bulbulo mashkan kasiman.
 Kumōro . . .
- (5) Gāhē Alghāna asum, gāhē Badakhshāna asum.
 Chaghliyē, chagh mo korēh, khushroyo armāna asum.
 Kumōro . . .

4. A LOVE SONG.

4. The lover compares himself to a hawk—a white hawk—which like the Homeric *κικρός* is the *ἄκιστος πετεινῶν* and the king of birds, while he likens his mistress' husband to a hill-partridge.

- (1) Awa taighūn sayūrj ; ta moqh ma haqa kolue,
 Khyo korom ta sifatan ? No surnai shēr no bolue.
 Chhui anusdaq keliman, ma ashruān mo mazhūrēh,
 ’Alā mirzā komōru, Kābula Amīro zhūrē,
 Ta thau nāzak badan, mirzā, ta ghon no azhūre.

LITERAL TRANSLATION.

(1) From on the cliff to view Rēshun's fields *and* homesteads fair appear. Why *oh* why are the fields and homesteads in their fair aspect all alike?

A maiden's lips and teeth are lovely, lovely her every word.

(2) When I look to thee, thou piercest me and *then* lookest another way. My life upon thee, how long wilt thou look upon mine enemy?

A maiden's lips . . .

(3) After (lit. having been) two days in *Shugrām*, if thou comest to Rēshun, what harm? The yellow roses are in bud; put a chaplet of *them* on thy head, what harm is there?

A maiden's lips . . .

(4) The folk ask of me, "Madman, whither goest thou?" I *am* a roving friar of *the order* of love, *and* wander in search of *my* nightingale.

A maiden's lips . . .

(5) Now in *Afghān* parts am I, and now in *Badakshān*. Caw not, *ye* cawing crows! In quest of *my* beloved am I.

A maiden's lips . . .

LITERAL TRANSLATION.

(1) I *am* a white hawk; thy man to me a partridge. How can I tell thy praises? Nor pipe have I nor lute.

Day and night, *poor* lad, I weep; ask not my woes. *Dainty*, graceful darling, daughter of the king of *Cābul* art thou; very delicate is thy body, *my* darling, there can be none like thee.





JULY 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 1st July, 1908, at 9-15 P.M. *

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L., D.Sc., President in the chair.

The following members were present :—

Dr. Upendra Nath Brahmachari, Mr. J. C. Brown, Mr. P. J. Brühl, Mr. I. H. Burkill, Mr. J. A. Chapman, Mr. L. L. Fermor, Mr. H. G. Graves, Mr. K. A. K. Hollowes, Lieut.-Colonel G. F. A. Harris, I.M.S., Mr. D. Hooper, Mr. H. C. Jones, Mr. T. H. D. LaTouche, Dr. Girinrda Nath Mukerjee, Dr. D. Quinlan, Major L. Rogers, I.M.S., Dr. E. D. Ross, Babu Umapati Datta Sharma, Hon. Mr. Justice H. L. Stephen, Dr. Satish Chandra Vidyabhusana, Mr. E. Vredenburg, and Mr. H. Walker.

Visitor :—Babu Hem Chandra Das Gupta and Mr. B. A. Gupte.

The minutes of the last meeting were read and confirmed.

Twenty-four presentations were announced.

The President announced :—

(1) That the Society has received notice that the Third International Botanical Congress will meet at Brussels on May 14th, 1910, and sit until May 22nd, under the presidentship of M. le Baron D. Moreau, formerly minister of Agriculture, Belgium, and M. Th. Durand, Director of the State Botanic Garden at Brussels. Membership may be had on payment of fifteen francs (Rs. 9/) to M. Vandervaeren, Treasurer of the Committee, Uccle, Belgium. Members will receive all the publications of the Congress. The General Secretary is M. E. De Wildeman of the Botanic Garden at Brussels. A new section of the Congress will be instituted for economic botany. The Committees appointed at the Vienna Congress of 1905, to discuss the nomenclature of cryptogams and fossil plants, will report, and the Congress will proceed to formulate rules.

(2) That Mahamahopadhyaya Haraprasad Shastri has been re-elected a member of the Finance Committee during the year.

Lieut.-Colonel Henry Haversham Godwin-Austin, F.R.S., F.Z.S., F.R.G.S., Prof. Melchoir Treub, Prof. Herman Oldenberg, and Mr. William Irvine, I.C.S. (retired), were balloted for and elected Honorary Members.

Babu Dines Chandra Sen, Mahamahopadhyaya Sudhakara Drivedi, and Revd. Father J. Hoffmann, S.J., were balloted for and elected Associate Members.

The following five gentlemen were ballotted for as Ordinary Members :—

The Hon. Mr. Justice H. Holmwood, I.C.S., Judge, High Court, 22, Theatre Road, proposed by the Hon. Mr. Justice Asutosh Mukhopadhyaya, seconded by Mr. T. H. D. LaTouche; *Mr. D. H. W. Ritchie* of Messrs. Mackinnon, Mackenzie & Co., proposed by Mr. W. K. Dods, seconded by Mr. T. H. D. LaTouche; *Pandit S. P. V. Ranganathaswami*, Aryavaraguru, Court Pundit of Maharaja Sree G. N. Gajapati Row, Vizagapatam, proposed by Dr. Satis Chandra Vidyabhusana, seconded by Mr. T. H. D. LaTouche; *Dr. J. Stuart Brooke*, Chief Medical Officer, E.I.R., Allahabad, proposed by Lieut.-Colonel F. J. Drury, I.M.S., seconded by Major L. Rogers, I.M.S.; and *Babu Brajendra Nath Seal*, M.A., Principal, Victoria College, Cooch Bihar, proposed by the Hon. Mr. Justice Asutosh Mukhopadhyaya, seconded by Dr. Satis Chandra Vidyabhusana.

Mr. B. A. Gupte exhibited an interesting *Khillāt*, 200 years old, and read the following note on it.

His Highness the Mahārāja of Bikāner has contributed to the Victoria Memorial Exhibition a unique silk-brocade-coat presented as *Khillāt* or dress of honour to his ancestor Mahārāja Sūr Singaji of Bikaner in 1612 A.D., on his accession to the *Masnad* of the state. As a robe of honour it has been much valued by the Mahārāja and preserved as an heir-loom. As a specimen of art, it deserves special notice for its clever workmanship. There are two panels in the design each encircled by foliage and linear decorations, one of which contains the bust of a king with the ensignia of royalty in the shape of a *Kalyi* or spray of pearls and jewels; and the other that of a queen or lady of position fully bejewelled. Her curly hair and slightly different lips might seem intended to indicate a different nationality. The artisan who produced this fabric possibly meant to portray an Indian Princess. Below the bust of the king is a Persian legend which reads :—

Goi in surat sarāpā jān shudā, which means, "These are beautiful features which please my heart"; and below the figure of the lady is another legend, the second half of a couplet. It runs :—

Pardādār-e-Khusrave Irān shudā, purporting to mean that she has become a *parda* or *zanana* lady of His Majesty of Persia. The wonderful details of the design, the delineations of the distinct features of the Iranian and Hindu faces on the loom, and the clear lettering of Persian verse invoke admiration.

There are seven shades of dyes represented. The lemon-yellow seems to have been produced by the known process of steeping silk in a hot solution of *isparek* or *Dephinium Zulil* and pistachio galls mixed with impure carbonate of soda. This solution gives to silk a yellow that does not fade by exposure to the sun. The orange or tawny yellow looks to be the product of *Kapila* or *Mallotus phillipinensis* and alum, mixed with carbonate of soda.

This is the most lasting of Indian yellow dyes. The blue represents one of the shades produced from indigo, and the orange red by lac. The pink is possibly a mixture of the *mangistha* with yellow, and the ash can be accounted for by a mixture of the infusion of myrobolans and iron; but it is difficult to account for the beautiful green in the fabric. Indian greens are dull. But this shade is a peculiar one not found in original Indian work.

The inner lining of the coat consist of a thin cotton gauze possibly dyed with madder or *Rubia tinctoria*. It is a very old specimen of what is known as knot dyeing. For the Persian origin of the pistachio galls *buz-ganj*, and *ispārek*, or delphinum, see my note on page 384 of Vol. xiii, Part i, of the *Bombay Gazetteer*, Thana District.

Rupees 614 is shown as the price paid. It represents about Rs. 100 a yard! There are two indistinct seals of the Mogul period on the silk or border lining, and a few of the Darbār scribblings in Hindi and Nāgari scripts.

A photograph, which will be found at page cvi, has been taken of this coat to illustrate its design.

The following papers were read :—

1. *Mathura Inscriptions in the Indian Museum.*—By RAKHAL DASS BANERJEE.

2. *Proposal for a Standard Temperature for use in Tropical Countries.*—By PAUL J. BRÜHL.

These papers will be published in a subsequent number of the *Journal*.

3. *Contributions to the History of Hindu Jurisprudence. Part I. On the Vyavahara-Matrika or Nyaya Matrika of Jimutavahana.*—By the HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L.

This paper will be published in the *Memoirs*.

4. *Recent Plant Immigrants.*—By PAUL J. BRÜHL.

This paper will be published in a subsequent number of the *Journal*.

5. *Geological Notes on Hill Tipperah (including the Lalmai Range in Comillah District).*—By HEM CHANDRA DAS GUPTA. Communicated by MR. E. VREDENBURG.

This paper has been published in the *Journal* for June, 1908.

6. *Drosometric Experiments and Observations.*—By PAUL J. BRÜHL and BEPIN BEHARI DAS.

This paper will be published in a subsequent number of the *Journal*.

7. *The Surgical Instruments of the Hindus, with a comparative study of Surgical Instruments of the Greek, Roman, Arab, and*

Modern European Surgeons. Part II, Blunt Instruments.—By DR. GIRINDRA NATH MUKERJEE.

8. *Observations on the Intensity of Day Illumination in Lower Bengal.*—By PAUL J. BRÜHL and BEPIN BEHARI DAS.

This paper will be published in a subsequent number of the *Journal*.

9. *Reduction of Fehling's Solution to Metallic Copper—a Method of Depositing a Shining, Mirror-like Film of Copper on Glass Vessels.*—By PANCHANAN NEOGI, M.A. Communicated by the *Natural History Secretary*.

This paper has been published in the *Journal* for June, 1908.

Professor Brühl suggested that a committee be appointed to consider the question raised in his paper entitled, "Proposal for a standard temperature for use in tropical countries." The meeting agreed that the Council should appoint a committee to discuss the matter.



The Adjourned Meeting of the Medical Section was held at the Society's Rooms, on Wednesday, July 8th, 1908, at 9-15 P.M.

LIEUT.-COLONEL G. F. A. HARRIS, I.M.S., in the chair.

The following members were present:—

Assistant Surgeon Rai Hira Lal Bose, Bahadur; Assistant Surgeon Upendranath Brahmachari; Lieut.-Colonel W. J. Buchanan, I.M.S.; Capt. F. P. Connor, I.M.S.; Dr. H. M. Crake, Lieut.-Colonel F. J. Drury, I.M.S.; Dr. H. Finck, Dr. Birendranath Ghosh, Lieut.-Colonel C. P. Lukis, I.M.S.; Capt. M. Mackelvie, I.M.S.; Dr. M. M. Masoom, Capt. D. McCay, I.M.S.; Dr. D. Quinlan, Major L. Rogers, I.M.S., Honorary Secretary.

Visitor:—Dr. J. Mitra.

The minutes of the last meeting were read and confirmed.

Clinical cases were exhibited by Lieut.-Colonel Harris, and some X-ray negatives illustrating foreign bodies were shown by Capt. Connor.

Major Rogers, on behalf of Assistant Surgeon A. A. E. Baptist, read a paper and showed radiograms illustrating cases of special interest.

With the permission of the Council, the following Resolution was brought up for discussion:—

"That in view of the continued multiplication of unauthorised and self-constituted bodies granting licenses and certificates to practice medicine, to the serious detriment of the medical

graduates of the Indian Universities, the Medical Section of the Asiatic Society of Bengal is of the opinion that the time fully has come for the passing of a Medical Registration Act for India. Baidis or Kabirajas and Hakims not being interfered with."

The Resolution was proposed by the Medical Secretary, and seconded by Rai Hira Lal Bose, Bahadur, and supported by Dr. Upendranath Brahmachari, Dr. B. Ghosh, and Lieut.-Colonel C. P. Lukis, I.M.S., and carried unanimously.



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

- Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained by application to the Honorary Secretary, 57, Park Street, Calcutta.

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- (a) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.
- (b) To propose and second candidates for Ordinary Membership.
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- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
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- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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OF THE

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“Proceedings” for July 1908, page cvi.

Insert under the block—

“KHILLĀT 200 YEARS OLD.”

(See page cii.)

42. Geometrical Theory of a Plane Non-Cyclic Arc, Finite as well as Infinitesimal.

By Prof. SYAMADAS MUKHOPADHYAYA.

INTRODUCTION.

There is an important distinction, not usually noticed, between a geometrical and an analytical curve. A geometrical curve is one which can be drawn on a plane, or in space, in any manner. An analytical curve is one which is represented by an analytical equation. In an analytical curve, the curvature and its rates of variation, $\frac{dR}{ds}$, $\frac{d^2R}{ds^2}$, etc., of all possible orders,

are necessarily finite and continuous, except at a certain limited number of points. In a geometrical curve, no such restriction necessarily holds. We may, however, study such geometrical curves by supposing that the curvature and its rates of variation, up to a given order and no further, are finite and continuous.

The following paper is an attempt to study geometrically a plane arc, under the supposition that the radius of curvature only is finite and continuous, or that the radius of curvature, as well as its first rate of variation, is finite and continuous. No complete geometry, however, has been attempted. Only certain methods have been suggested, and a number of interesting theorems deduced, to illustrate those methods.

In the first place, consecutive points, on a curve, have been defined as the intersection of the curve with a line of given species X , these consecutive points being only the position of ultimate coincidence, of a number of real distinct points, which must have originally existed in every case, separated by finite distances. The conception is a simple and natural one. In counting consecutive points, the analyst, not infrequently, confounds real points with imaginary ones. The point of undulation is an instance.

In many cases, where a line of given species X meets a curve in ' r ' distinct points, of course all real, for imaginary points are inconceivable geometrically, it is possible to bring the ' r ' distinct points into coincidence, by varying the form and position of X . The method is a useful one and has been illustrated in Theorem I.

The introduction of the conception of *partial* rate of variation of curvature is an innovation. It is a simple conception and is really more fundamental than the complete rate of variation, only it does not come so naturally in the analytical way.

Every endeavour has been made to make the demonstrations rigorous and genuinely geometrical. Condensation has been attempted by introducing a large number of corollaries many of which might stand independently.

SECTION I.—FINITE ARC.

Definitions.—A point O , moving continuously on a plane, from a position P to a position Q , describes the line PQ .

If a number of *distinct* points be taken on the line PQ , as the intersection of PQ with another line X , of *given species*, and their positions varied by varying X , so that they ultimately coincide, at a certain point O , on the line PQ , in a certain order, then in their final position they are called so many *consecutive* points at O , lying on the line X of given species, and the line X is said to pass through so many consecutive points on PQ .

Thus if X pass through ' r ' consecutive points at O , then in the neighbourhood of O , ' r ' distinct points must always be obtainable on PQ , at finite distances from each other, through which the line X of given species passes.

The straight line passing through two consecutive points on PQ at O , is the tangent at O .

If a straight line pass through three consecutive points on PQ at O , then O is called a point of *inflexion*. Thus in the neighbourhood of a point of inflexion, three distinct points must always be obtainable, through which a straight line passes.

The circle passing through three consecutive points on PQ at O is called the circle of curvature at O .

If a circle pass through four consecutive points on PQ at O , then O will be called a *cyclic* point.

If the radius of the circle of curvature at a cyclic point be infinitely large, it is called a point of *undulation*.

It is hardly justifiable to define a point of undulation as one where the tangent meets the curve at four consecutive points. In the neighbourhood of a point of undulation a straight line can meet the curve at only two real points, and therefore by the variation of such a straight line we can ultimately get only two consecutive points. Therefore, of the four points at which the tangent is said to meet the curve, at a point of undulation, only two can be strictly called consecutive, the other two being only conjugate points.

The rational way, therefore, to define a point of undulation, is to call it a cyclic point of an infinite radius of curvature. In the neighbourhood of a point of undulation, it is possible to get four concyclic points on the curve, and by varying the circle, the points will ultimately coincide, the radius of the circle growing at the same time infinitely large.

If the direction of the tangent at O vary continuously as O moves from P to Q , along line PQ , then the line PQ is called a continuous curve. On a continuous curve, therefore, we cannot have a sudden change of the direction of the tangent anywhere. Thus we cannot have a node or a cusp anywhere.

A continuous curve PQ is called a *convex* arc, or simply an arc, if no straight line cut it at more than two points. The straight line PQ is called its chord. Any other chord $P'Q'$ is

called a *minor* chord, and the corresponding arc $P'Q'$ a *minor* arc, P' being always supposed nearer P , and Q' nearer Q .

A convex arc, evidently, cannot have a point of inflexion on it, although it may have a point of undulation. Here again the incongruity of the ordinary conception of a point of undulation is brought out.

A convex arc will be called *cyclic* or *non-cyclic*, according as there is or there is not a cyclic point on it.

Theorem I.—No circle can meet a non-cyclic convex arc at more than three points.

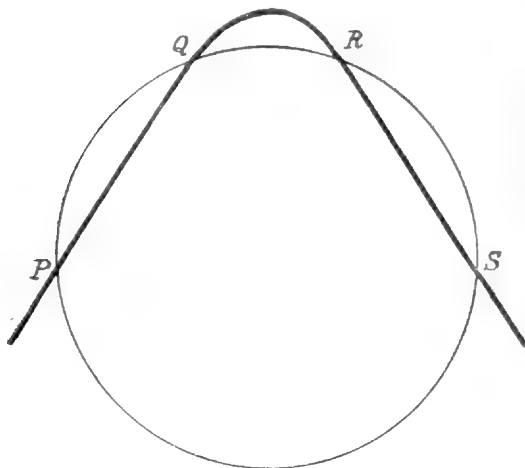


Fig. 1.

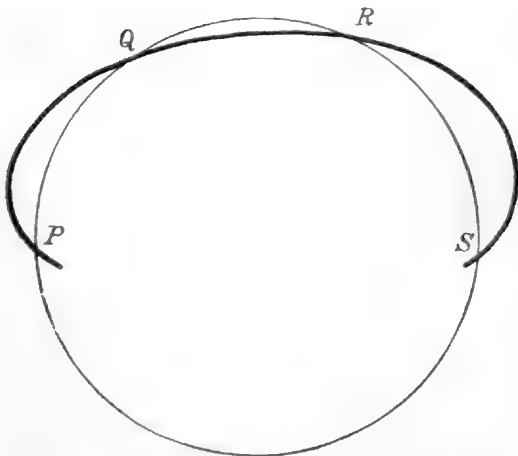


Fig. 2.

If possible let a circle meet a non-cyclic convex arc at four distinct points P, Q, R, S , (Figs. 1 and 2). Then by keeping P and S fixed, and continuously varying the radius of the circle, we can make Q and R come as close together as we choose. Again by keeping Q and R fixed and continuously changing the radius of the circle we can make P and S approach Q and R . It may happen that as P approaches Q and ultimately coincides with Q , S does not approach quite near to R , or it may happen, that as P approaches Q , S approaches R , crosses it and moves towards Q , or even crosses Q and moves towards P .

By repeating the above operations a sufficient number of times, it is evident we can make P, Q, R, S come as close together as we like and ultimately coincide at some point O , lying between the original positions of P, Q, R, S , but not coinciding with P or S at their original positions.

Thus there will be a cyclic point on the given arc, which is contrary to hypothesis.

Cor. A.—If a circle meet a convex arc at four distinct points P, Q, R, S , then there exists a cyclic point between P and S .

Cor. B.—Every closed convex curve, that is a curve of which every arc is convex, has at least two cyclic points on it.

For, a circle, through any three points of the figure, will meet the figure again, at a fourth point, dividing the figure into at least four convex arcs. Then there will be a *cyclic* point in every three consecutive arcs. Thus there will be at least two cyclic points on the figure.

Cor. C.—If a closed curve has a node or cusp, the remainder being convex, then there will be at least one cyclic point in the remainder.

Cor. D.—A non-cyclic curve must be necessarily spiral in form. This suggests an obvious general geometrical definition of spirals. It evidently follows from Corollaries *B* and *C*.

Theorem II.—If POQ be a non-cyclic arc, then angle POQ will continuously increase or decrease as O moves along the arc from P to Q .

If not, then two positions O_1 and O_2 can be found for O , between P and Q , such that angle PO_1Q is equal to angle PO_2Q . Therefore, P, O_1, O_2, Q are concyclic and there is a cyclic point between P and Q , which is against hypothesis.

Cor. A.—If the tangents PT and QT at P and Q are equal, then there must exist a cyclic point on the arc POQ . For, the angles TPQ and TQP , being the limiting values of the supplement of the angle POQ , when O coincides with P and Q , respectively, cannot be equal in a non-cyclic arc.

Cor. B.—If the angle POQ continuously increase as O moves from P to Q , then the circle POQ will fall below the arc from P to O and above the arc from O to Q .

Def.—An arc POQ will be called positive, if the angle POQ continuously increase, as O moves from P to Q along the arc; and it will be called negative if the angle POQ continuously decrease, as O moves from P to Q . If the arc POQ be positive then evidently the arc QOP is negative and *vice versa*.

Cor. C.—If the tangents at P and Q to a positive non-cyclic arc PQ , meet above the arc, then QT is greater than PT .

Theorem III.—If O be any point on a non-cyclic arc POQ , then the circle POO , passing through P and two consecutive points at O , will fall entirely below or above the given arc, according as the arc POQ is positive or negative.

In the first place, it is evident that the circle POO will lie

entirely below or above the given arc, as it cannot intersect the arc at a fourth point.

Suppose the arc POQ is positive. Then the circle POO will fall entirely below the given arc.

If not let it lie entirely above, as represented by the dotted line (Fig. 3).

Take any point B on the given arc between P and O . Join QR and produce QR to meet the circle POO at S . Join PS , PR , PO and QO . Then evidently angle SPO is less than angle

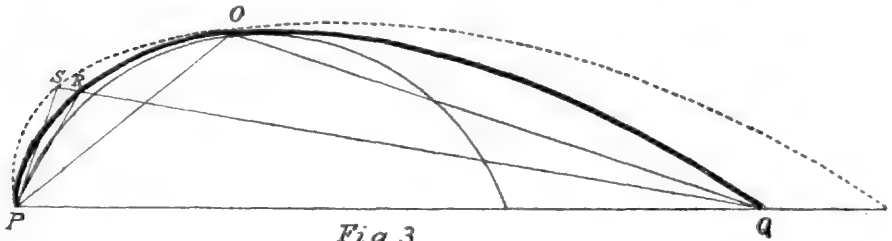


Fig. 3.

SQO , as Q falls inside the circle. Therefore angle PSQ is greater than angle POQ . Much more is the angle PRQ greater than angle POQ , which is contrary to hypothesis.

Similarly, if the arc POQ be negative, then the circle POO will lie entirely outside the given arc.

The converse theorem is also evidently true, namely, the arc POQ will be positive or negative according as the circle POO falls continually entirely inside or outside the given arc, as O moves from P to Q .

Cor. A.—If POQ be a non-cyclic arc, then it will fall between the circles POO and QOO .

Cor. B.—If POQ be a non-cyclic arc, then the circle of curvature at P falls entirely within the circle of curvature at Q . Thus the radius of curvature at P is less than the radius of curvature at Q .

Theorem IV.—If POQ be a positive non-cyclic arc and S be any point in it, then the minor arcs PS and SQ will be also positive, *i.e.*, the angle POS will continuously increase as O moves from P to S , and the angle QOS will continuously increase as O moves from S to Q .

Join PS . Then since angle POQ continuously increases as O moves from P to Q , the circle POO continuously falls below the given arc. Hence as O moves from P to S , the circle POO falls below the arc PS , and hence the angle POS continuously increases as O moves from P to S .

Similarly, if O be taken in arc SQ , it can be proved that the angle SOQ continuously decreases as O moves from Q to S , *i.e.*, the angle QOS is negative. Therefore arc SQ is positive.

Cor. A.—If PQ be any positive non-cyclic arc, then any minor

arc $P'Q'$ is also positive. For, PQ' is positive, therefore, $P'Q'$ is also positive.

Cor. B.—If in an arc POQ there be a cyclic point, then angle POQ cannot continuously increase or decrease as O moves from P to Q .

For, if there be a cyclic point S , on arc PQ , then in the neighbourhood of S , four distinct points, say, P', R', S', Q' , must exist lying on a circle. Hence in the arc $P'Q'$, the angle $P'OQ'$ cannot continuously increase or decrease as O moves from P' to Q' . Hence in the arc POQ the angle POQ cannot continuously increase or decrease as O moves from P to Q , for then, by the method of the above theorem, the angle $P'OQ'$ would continuously increase or decrease as O moved from P' to Q' .

Cor. C.—If in an arc POQ there be a cyclic point S , then a minor arc $P'SQ'$ can always be found such that the tangents $P'T', Q'T'$ at P', Q' are equal.

For, in the neighbourhood of S , four distinct points P', R', S', Q' , are obtainable lying on a circle. The point S will be between P' and Q' . Keep $R'S'$ fixed and vary the circle till $P'R'$ or $S'Q'$ coincide. Then keep these latter coincident points fixed, and vary the circle till the other two points coincide.

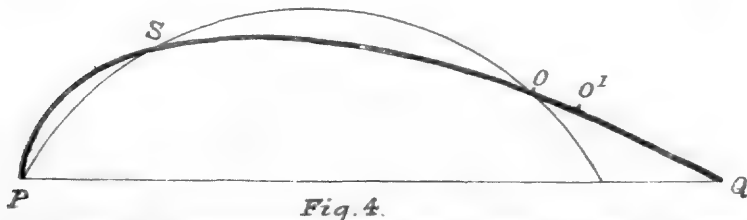
Cor. D.—If POQ be a positive non-cyclic arc, then the radius of curvature at O continuously increases as O moves from P to Q .

Cor. E.—If in an arc POQ there be a cyclic point S , then the radius of curvature has a maximum or minimum value at S .

For, the circle of curvature at S as it passes through four consecutive points at S falls entirely above or below the arc at S . Thus if arc PS be positive, arc SQ will be negative and *vice versa*. The circles of curvature at P and Q will, therefore, both be less or both be greater than the circle of curvature at S .

Theorem V.—If POQ be a non-cyclic positive arc, and S any fixed point on it, then angle POS will continuously decrease as O moves from S to Q , and the angle QOS will continuously decrease as O moves from P to S .

If O be taken between S and Q , then the circle PSO will evidently fall below the given arc from P to S , and above the given arc from S to O , and again below the given arc from O to Q (Fig. 4).



Now if O' be another position of O nearer Q , then evidently angle $PO'S$ is less than angle POS . Hence angle POS continuously diminishes as O moves from S to Q .

Similarly the angle QOS continuously diminishes as O moves from P to S .

Cor. A.—If PQ be any positive non-cyclic arc, and $P'Q'$ any minor arc, then angle POQ' will continuously diminish as O moves P to P' or Q to Q' , and the supplement of angle $P'OQ'$ will continuously diminish as O moves from P' to Q' . This follows from above theorem and *Cor. A* of Theorem IV.

Cor. B.—If POQ be any positive non cyclic arc, in which angle POQ is always obtuse and $P'Q'$ any minor arc, then the radius of the circle $P'OQ'$ continuously increases as O moves from P to Q . For, the diameter of the circle $P'OQ'$ is $P'Q'/\sin POQ'$.

Cor. C.—If any three points O_1, O_2, O_3 be taken on a positive non-cyclic arc POQ , in which the angle POQ is always obtuse, then the radius of the circle $O_1O_2O_3$ is always increased if any of the three points be moved towards Q .

Theorem VI.—If $P'Q'$ be a minor chord of the arc POQ , parallel to the base PQ . R and R' the midpoints of PQ and $P'Q'$, and δ the complement of the angle between RR' and PQ , then the distance between the centres of the circles $PP'Q'$ and $P'Q'Q$ is equal to $PQ \tan \delta$.

Join PP', QQ' and RR' and produce them to meet in T . Let L

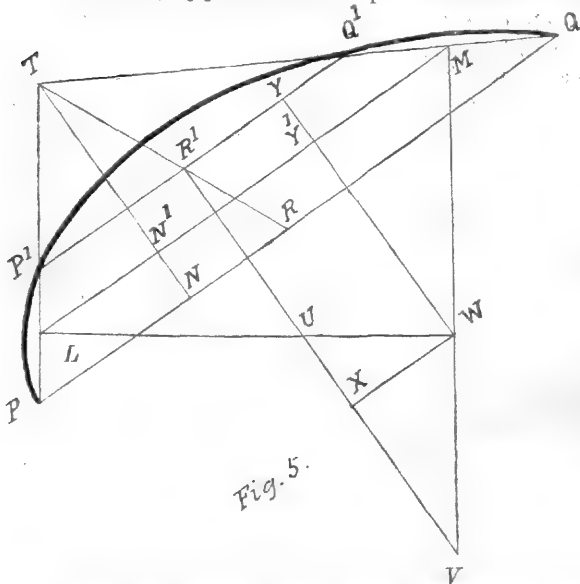


Fig. 5.

and M be the midpoints of PP' and QQ' and let perpendiculars to PP', QQ' and $P'Q'$ at L, M and R' respectively intersect to form the triangle UVW , similar to TLM . From T draw TN perpendicular to PQ , and from W draw WX and WY perpendicular to $B'UV$ and $P'Q'$ respectively.

Then it follows easily from elementary geometry (Fig. 5) that $WX = R'Y = NR$, since WY and TN cut off equal intercepts MY' and LN' from LM .

Therefore, $\tan \delta = \frac{NR}{TN} = \frac{WX}{TN} = \frac{UV}{PQ}$ or $PQ \tan \delta = UV = \text{distance}$
between the centres of the circles $PP'Q'$ and $P'Q'Q$.

Cor. A.—The distance between the centres of the circles $PP'Q$ and $PQ'Q$ is $P'Q \tan \delta$. This is proved in the same way as the above proposition.

Cor. B.—If O be the summit of the arc POQ , and R the midpoint of chord PQ , and δ the complement of the angle between OR and PQ , then the difference between the radii of the circles POO and QOO is $PQ \tan \delta$.

Cor. C.—If T be the intersection of the tangents at P and Q to an arc PQ , R the midpoint of chord PQ , and δ the complement of the angle between TR and PQ , then the distance between the centres of the circles PQQ and PPQ is $PQ \tan \delta$.

SECTION II.—INFINITESIMAL ARC.

Definitions.—If a number of continuously varying quantities vanish simultaneously, they are called infinitesimals at the moment of vanishing. One infinitesimal is of the same order n s, or of a higher or lower order than, another, according as the ultimate ratio between the first and the second is finite, zero or infinite. Any infinitesimal x may be taken as the standard and called an infinitesimal of order one. Any other infinitesimal y is then called of order n , if the ultimate ratio of y/x^n is finite, that is, neither zero nor infinite. In all that follows, the chord PQ , of the infinitesimal arc POQ , will be considered as of the first order.

If $PRSQ$ be an infinitesimal arc, the ultimate ratio, of the difference of the radii of the circles RSQ and PRS , to the distance PQ , will be called the *partial* rate of variation of the radius of the circle of curvature at P .

If POQ be an infinitesimal arc, the ultimate ratio, of the difference of the radii of the circles of curvature at Q and P , to the distance PQ , will be called the *complete* rate of variation, or simply, rate of variation, of the radius of the circle of curvature at P .

In a convex arc, the only supposition we will make is that the radius of the circle of curvature is finite and varies continuously.

In a non-cyclic arc, we will make the additional supposition, that the *partial* rate of variation of the radius of curvature is finite and continuous.

If $PRSQ$ be an infinitesimal arc RS , any minor chord parallel to PQ , and M, N the midpoints of PQ, RS , then the line through M, N , in its ultimate position, is called the *deviation*¹ axis at P .

¹ Transon introduced the term '*deviation axis*,' for which Salmon substituted '*aberrancy axis*.' Transon called $\tan \delta$ the rate of deviation from circular form, an exceedingly suggestive expression, which Salmon cut down to '*aberrancy*.' Both the terms have been retained, by the present writer, with a slight distinction in use.

(See Liouville, Vol. vi, and Salmon's Higher Plane Curves, page 368, 3rd edition.) It may be pointed out, that the definition of deviation axis given here, is more general in form than that given by Transon.

The angle between the normal and deviation axis at P , both drawn outwards, is called the angle of *aberrancy* at P .

Theorem VII.—In any convex infinitesimal arc POQ , the supplement θ , of the angle POQ , and the angles α , β , which the tangents at P , Q make with PQ , are infinitesimals of the first order and ultimately equal.

For, if R , R_1 , R_2 be the radii of the circles POQ , PPQ , PQQ respectively, then R , R_1 , R_2 are finite and ultimately equal to the radius of curvature at P .

But, $PQ = 2R \sin \theta = 2R_1 \sin \alpha = 2R_2 \sin \beta$. Therefore, θ , α , β are ultimately equal infinitesimals of the first order.

Cor. A.—If PT and QT be tangents at P and Q , then PT and QT are ultimately equal, and the radius r of the circle PQT is ultimately equal to half the radius of the circle of curvature at P .

Cor. B.—The difference between the arc PQ and chord PQ is less than a quantity which is an infinitesimal of the third order.

For, the convex arc PQ , falling inside the triangle PTQ , has length between $PT + TQ$ and PQ . Hence the difference between the arc and chord is less than $PT + TQ - PQ$ or $8r \sin \frac{\alpha}{2}$

$\sin \frac{\beta}{2} \sin \frac{\alpha + \beta}{2}$ which is again less than $ra\beta (\alpha + \beta)$.

Cor. C.—The difference between θ and $\sin \theta$ is less than a quantity which is an infinitesimal of the third order, θ being of the first order.

Theorem VIII.—The angle of aberrancy, at a cyclic point on a convex arc, vanishes.

Let O be a cyclic point. Take any infinitesimal arc POQ . Then, from *Cor. C*, *Theorem IV*, a smaller arc $P'OQ'$ can be always found, such that the tangents $P'T$ and $Q'T$ at P' and Q' are equal. Therefore, if R be the middle point of $P'Q'$, TR is at right angles to $P'Q'$. Now, TR becomes the deviation axis at O , ultimately. Therefore, the deviation axis at O coincides with the normal at O , and the angle of aberrancy vanishes.

Theorem IX.—The partial rate of variation of the radius of curvature, at any point P of a non-cyclic arc, is $\tan \delta$, where δ is the angle of aberrancy at P .

Take an infinitesimal arc $PRSQ$, where RS is parallel to PQ . Then, from *Theorem VI*, we have $\tan \delta = \frac{UV}{PQ}$, where UV is the distance between the centres of the circles RSQ and PRS . Now, it is easily seen that UV is ultimately equal to the difference of the radii of the circles RSQ and PRS . Hence, $\tan \delta$ is equal to the partial rate of variation of the radius of curvature at P .

Cor. A.—If PQ be an infinitesimal non-cyclic arc, then the difference between the radii of the circles PQQ and PPQ is $PQ \tan \delta$, for the circle PPQ is transformed into the circle PQQ by a single change of P into Q .

Cor. B.—The complete rate of variation of the radius of curvature at any point P , of a convex arc, is $3 \tan \delta$, where δ is the angle of aberrancy at P (Trançon's Theorem).

For the complete variation of the circle of curvature PPP into QQQ , may be effected by three equal partial variations, *viz.*, that of P into Q three times repeated.¹

Theorem X.—If PT , TQ be tangents at P and Q to a positive non-cyclic infinitesimal arc PQ , the difference of PT and TQ is ultimately equal to $2R\alpha^2 \tan \delta$, where δ is the angle of aberrancy and R the radius of curvature, at P , and α the angle TPQ .

For, if β be the angle PQT , then

$$\frac{PT}{TQ} = \frac{\sin \beta}{\sin \alpha} = \frac{\frac{PQ}{2 \sin \alpha}}{\frac{PQ}{2 \sin \beta}} = \frac{\text{radius of circle } PPP}{\text{radius of circle } PQQ}$$

Therefore,

$$\frac{TQ - PT}{TQ + PT} = \frac{\text{radius of } PQQ - \text{radius of circle } PPP}{\text{radius of } PQQ + \text{radius of circle } PPP}$$

or,
$$\frac{TQ - PT}{PQ} = \frac{PQ \tan \delta}{2R}, \text{ ultimately}$$

or,
$$TQ - PT = 2R\alpha^2 \tan \delta.$$

Cor. A. — $\alpha - \beta = 2\alpha^2 \tan \delta.$

Theorem XI.—If O_1, O_2, O_3 be any three points on the positive non-cyclic infinitesimal arc POQ , then the radius of the circle $O_1O_2O_3$ is equal to $R\{1 + 2(\alpha_1 + \alpha_2 + \alpha_3) \tan \delta\}$, where $\alpha_1, \alpha_2, \alpha_3$ are the angles which PO_1, PO_2, PO_3 make with the tangent at P , δ the angle of aberrancy and R the radius of curvature at P .

For, the radius of circle $O_1O_2O_3$ is evidently

$$R + (PO_1 + PO_2 + PO_3) \tan \delta = R + 2R (\alpha_1 + \alpha_2 + \alpha_3) \tan \delta$$

since
$$2R = \frac{PO_1}{\alpha_1} = \frac{PO_2}{\alpha_2} = \frac{PO_3}{\alpha_3} \text{ in the limit.}$$

Theorem XII.—If s and l be the lengths of the arc and chord of any positive non-cyclic infinitesimal arc PQ , then $s - l = 2R (\alpha + 2\alpha^2 \tan \delta)$, where δ is the angle of aberrancy and R the radius of curvature at P , and α the angle which the tangent at P makes with PQ .

¹ The above simple and general demonstration of Trançon's Theorem is based on the conception of partial rate of variation of curvature. Trançon himself deduced his theorem from properties of conics (Lionville, Vol. vi). Some elegant demonstrations have been given by Dr. Asutosh Mukhopadhyaya in his paper *On the Differential Equation of all Parabolas.* (Journal of the Asiatic Society of Bengal, Vol. lvii, Part ii).

For, if R' be the radius of the circle PPQ , then, by Theorem XI,

$$R' = R(1 + 2a \tan \delta).$$

Therefore chord $PQ = 2R' \sin \alpha = 2R'a = 2R(\alpha + 2\alpha^2 \tan \delta)$.

But the arc PQ differs from chord PQ by an infinitesimal of the third order.

Therefore $s = l = 2R(\alpha + 2\alpha^2 \tan \delta)$.

Theorem XIII—If O_1, O_2, O_3 be any three points on the non-cyclic infinitesimal arc $PO_1O_2O_3Q$, the angle $O_1O_2O_3$ is equal to $(1 - 2\alpha_3 \tan \delta)(\alpha_2 - \alpha_1)$, where $\alpha_1, \alpha_2, \alpha_3$ are the angles which PO_1, PO_2, PO_3 make with PT .

Let angle $O_1O_2O_3 = x$.

Then $\sin x = \frac{O_1O_2}{2R_{123}}$ and $\sin(\alpha_2 - \alpha_1) = \frac{O_1O_2}{2R_{12}}$, where R_{123} and R_{12} mean the radii of the circles $O_1O_2O_3$ and PO_1O_2 respectively.

$$\text{Then, } \frac{\sin x}{\sin(\alpha_2 - \alpha_1)} = \frac{R_{12}}{R_{123}} = \frac{R\{1 + 2(\alpha_1 + \alpha_3) \tan \delta\}}{R\{1 + 2(\alpha_1 + \alpha_2 + \alpha_3) \tan \delta\}}$$

$$= 1 - 2\alpha_3 \tan \delta.$$

Therefore $x = (\alpha_2 - \alpha_1)(1 - 2\alpha_3 \tan \delta)$.

Cor. A.—Angle $PO_2O_1 = \alpha_1(1 - 2\alpha_2 \tan \delta)$.

Theorem XIV.—In any non-cyclic infinitesimal arc PO_1O_2Q , chord $O_1O_2 = (PO_2 - PO_1) + R\alpha_1\alpha_2(\alpha_2 - \alpha_1)$, neglecting infinitesimal of fifth order, where α_1, α_2 are the angles which PO_1, PO_2 make with the tangent at P , and R is the radius of curvature at P .

We have, by trigonometry,

$$O_1O_2 + PO_1 - PO_2 = 8R_{12} \sin \frac{O_1PO_2}{2} \sin \frac{O_1O_2P}{2} \sin \frac{O_1PO_2 + O_1O_2P}{2}.$$

But

$$R_{12} = R\{1 + 2(\alpha_1 + \alpha_2) \tan \delta\}$$

$$\sin \frac{O_1PO_2}{2} = \sin \frac{\alpha_2 - \alpha_1}{2} = \frac{\alpha_2 - \alpha_1}{2}$$

$$\sin \frac{O_1O_2P}{2} = \frac{\alpha_1}{2}(1 - 2\alpha_2 \tan \delta)$$

$$\sin \frac{O_1PO_2 + O_1O_2P}{2} = \frac{\alpha_2 - \alpha_1}{2} + \frac{\alpha_1}{2}(1 - 2\alpha_2 \tan \delta)$$

$$= \frac{\alpha_2}{2}(1 - 2\alpha_1 \tan \delta).$$

Therefore,

$$\begin{aligned} O_1O_2 + PO_1 - PO_2 &= R(\alpha_2 - \alpha_1) \alpha_1 \alpha_2 (1 + 0 \tan \delta) \\ &= R(\alpha_2 - \alpha_1) \alpha_1 \alpha_2. \end{aligned}$$

Theorem XV.—The difference $s-l$ between the lengths of arc and chord of an infinitesimal non-cyclic arc PQ is $\frac{1}{3}Ra^3$, neglecting infinitesimal of fifth order, where R is the radius of curvature at P , and a is the angle between chord PQ and the tangent at P .

Divide angle a into an infinite number of small parts (say n equal parts where n is large), by the lines PO_1, PO_2, PO_3 , etc., where O_1, O_2, O_3 , etc., are points on the arc PQ .

Then $s = \sum_1^n O_{r-1} O_r$, in the limit when $n = \infty$

$$l = \sum_1^n (PO_r - PO_{r-1})$$

Therefore, $s-l = Lt \sum_1^n (O_{r-1} O_r + PO_{r-1} - PO_r)$

$$= Lt \sum_1^n R (a_r - a_{r-1}) a_{r-1} a_r$$

$$= \frac{1}{3} R Lt \sum_1^n \{a_r^3 - a_{r-1}^3 - (a_r - a_{r-1})^3\}$$

$$= \frac{1}{3} R a^3 - \frac{1}{3} R Lt \sum_1^n (a_r - a_{r-1})^3$$

$$= \frac{1}{3} R a^3.$$

Since $Lt \sum_1^n (a_r - a_{r-1})^3 = Lt \sum_1^n \left(\frac{ra}{n} - \frac{(r-1)a}{n} \right)^3 = Lt \frac{a^3}{n^3} = 0$.

Cor. A.—The difference $s-l$ is independent of δ , if we neglect infinitesimals of fifth order, R and a being given.

Cor. B.— $\sin \theta = \theta - \frac{\theta^3}{6}$, neglecting infinitesimal of fifth order.

Cor. C.—Area of segment, bounded by s and l ,

$$= 2R^2 \sum \{ (a_r - a_{r-1}) a_r a_{r-1} + 2a_r a_{r-1} (a_r^2 - a_{r-1}^2) \tan \delta \} \text{ (by Theorem XII)}$$

$$= 2R^2 \left\{ \frac{1}{3} a^3 + a^4 \tan \delta \right\}$$

For, $\sum (a_r - a_{r-1}) a_r a_{r-1} = \frac{1}{3} a^3$

and $\sum 2(a_r^2 - a_{r-1}^2) a_r a_{r-1} = \sum \{ a_r^4 - a_{r-1}^4 - (a_r - a_{r-1})^3 (a_r + a_{r-1}) \} = a^4$

N.B.—If only the radius of curvature be finite and continuous and not also its partial rate of variation, then it is more easily shewn, by omitting $\tan \delta$, that $s-l$ is equal to $\frac{1}{3} Ra^3$, where we neglect infinitesimals of the fourth order not fifth. The writer is not aware of these rigorous geometrical determinations having been made before. Text-book writers content themselves generally by stating that the difference is of the third order.



43. Fresh Light on the Word "Scarlet."

By DR. E. D. ROSS.

I have recently come across a form of the much-discussed word scarlet in a Chinese-Persian Vocabulary, one of a series of ten vocabularies contained in a MS., dated 1549, belonging to the Library of University College, London.

In the Chinese-Persian list, under the section dealing with clothing, stuffs, silks, etc., we find phonetically written, in the Chinese, the word Sa-ha-la, which, in the Persian transcription, becomes Sa-ka-la-t.

The position of the word in the list between two words, both signifying silks of different kinds, seems to throw a little new light on its original meaning.

There are several forms of the word to be found in Persian and Arabic Dictionaries, the commonest being: Sakallât, Sıklât, Saklâtûn, and Saklatâ.

Dozy in his *Supplément aux Dictionnaires Arabes* defines the word *Saklâtûn* as follows:— "Sorte d'étoffe de soie brochée-d'or¹; celle qu'on fabriquait à Bagdad jouissait d'une grande réputation. Au moyen âge ce mot avait cours dans toute l'Europe"

The following passage from Edrisi seems to support this:— "Almeiva (Almaria) was a Mussulman city at the time of the Moravidae. It was then a place of great industry, and reckoned among others, 800 *silk* looms, where they manufactured costly robes, brocades, the stuffs known as *saklutun* . . . and several other *silk* tissues."

An earlier allusion to the word occurs in Baihaki (1040) (Elliot, ii, 148): "The robes were brought in, consisting of valuable frocks of *saklâtûn* of various colours."

In Chinese literature there are several allusions to the word Sa-ha-la.

Bretschneider in the second volume of his "Mediaeval Researches from Western Asiatic Sources" has two interesting examples of the word. Quoting from the Ming History, he says: "In 1387, in the reign of *Hung Wa* (the first Ming Emperor), a Mahomedan by name of Man-la-ha-fei-sz arrived at the Chinese capital as envoy from Tie-mu-er. He offered as tribute fifteen horses and camels, and was well received. *Sa-ma-rh-han* (Samarkand) then sent horses and camels as tribute every year, and in 1392 that country offered as tribute six pieces of velvet, nine pieces of green *sa-ha-la* . . . etc."

¹ The word immediately preceding Sa-ha-la in the Chinese-Persian list is *Chin-hsin*, meaning silk embroidered (with gold or silver).

A later passage has: "In 1544 and 1548 again embassies from Lu-mi¹ arrived. They presented as tribute corals, diamonds, curtains made of *sa-ha-la*" The inclusion of *sa-ha-la* among costly articles of tribute seems to imply that the material, whether silk or cloth, was a valuable and highly-prized one. In a note Bretschneider says: "The Ming Geography mentions the *sa-ha-'a* as a manufacture of Bang-kó-la (Bengal) and states that this stuff is woven from wool, and that it is downy. There are two kinds, a red and a green. Probably by *sa-ha-la* the Persian shal (shawl) is intended."

This last suggestion seems to be completely disproved, however, by the Persian transcription—*Sa-ka-la-t* in the Chinese-Persian list: unless indeed the word shawl is identical in origin with the word scarlet!

According to *Hobson-Jobson*, in the Punjaub and N. India generally the word Saklat was given to a stuff imported from the borders of China, and in the Punjaub Trade Returns of 1862 we find mention of Sooklat, a blanket cloth used for the outside of the sheep skin coats worn by travellers.

So far there seems to be a consensus of opinion that the word scarlet or sakarlat means broad cloth, fine cloth, or cloth of superior quality, and this certainly came to be the general signification of the word in Europe during the Middle Ages.

The origin of the word seems to be wrapped in mystery, and there seems to be little in favour of the argument that the word can be traced to Arabic or Persian sources. I cannot do better in conclusion than quote what Littré has to say on the subject: "On a indiqué comme origine l'arabe ou persan *escarlat. sekelat*, mais ces mots sont modernes et paraissent venir l'un du Français ou l'espagnol, l'autre de l'Anglais. C'est écarté reste le latin *galaticus*, la Galatie, province d'Asie, où dans l'antiquité on recueillait beaucoup de kermès; *galaticus rubor* a signifié en effet écarlatte. Cette conjecture est très plausible; elle serait tout à fait sûre si l'on trouvait quelque forme intermédiaire entre *galaticus* et écarlatte. Au XV^e siècle écarlatte paraît signifier étoffe en général."

¹ i.e., Rûm or Asia Minor.

44. On the retardation and acceleration in the dissolution of Mercury in Nitric Acid in the presence of minute traces of Ferric Nitrate and Manganous Nitrate.

By P. C. RAY, D.Sc.

Since the communication of my first paper on mercurous nitrite to this Society (vide *Journal*, Asiatic Society of Bengal, 1896, Vol. lxxv, Part ii, No. 1) I have often had occasion to prepare this compound in quantity for studying its many reactions. I have often been struck with the remarkable fact that samples of nitric acid have now and then failed to yield mercurous nitrite. Of late I have been busy investigating into the causes of this curious anomaly. It has now transpired that mere traces of iron and manganese salts, the latter probably derived from the bottles themselves, have a marked influence in the dissolution of mercury and presumably of copper and other metals in nitric acid.

With a view to throw light on this point, several experiments have already been taken in hand. The *modus operandi* is as follows: Three beakers of about 55 c.c. capacity are arranged side by side. Ten c.c. of freshly distilled nitric acid of 1.40 sp. gr. are introduced into each, and 2 c.c. of ferric nitrate solution (1 c.c. = 0.0912 g. Fe_2O_3) added to one, and 1 c.c. of manganous nitrate solution (1 c.c. = 0.0954 g. Mn_2O_4) to another, while the third beaker contained uncontaminated acid for comparison. The acid was then diluted with 40 c.c. of water, and 10 grams of mercury poured into each beaker.

The details of one experiment are given below. The reaction in each beaker was allowed to proceed for three hours, and its progress watched carefully. In the blank experiment crystals of mercurous nitrite were noticed after $1\frac{3}{4}$ hours, whereas the one "seeded" with the iron solution gave indications of crystals after 2 hours and 50 minutes only; but none appeared at all in the one "seeded" with manganous nitrate. The quantities of mercury dissolved were 2.14 g., 1.72 g., 2.50 g., respectively.¹

It has, however, been noticed that if, instead of the nitrates, the sulphates of the respective metals be substituted even in more diluted conditions, the dissolution of mercury, as also the formation of mercurous nitrite, are considerably accelerated.

I am engaged in further investigation of this new and promising subject.

¹ Cf. The interaction of copper and nitric acid in presence of metallic nitrates ("Journ. Chem. Soc. Transactions," June 1908, p. 1162).

45. An Alphabetical List of Jaina MSS. belonging to Government in the Oriental Library of the Asiatic Society of Bengal.

In response to the request of a certain gentleman of Bombay, Pandit Kunja Vihari Nyayabhusana prepared an alphabetical list of Jaina manuscripts incorporated in the collection of the Asiatic Society of Bengal. By order of the Council of the Society, the same list is printed and published.

The manuscripts included in the list, with the exception of those designated as 'Society's collection,' were purchased at the expenses of the Government of Bengal out of the fund granted to the Society for the Search of Sanskrit Manuscripts. Dr. Rajendra Lal Mitra, C.I.E., was in charge of the search from 1871 to 1891 A.D., during which 185 volumes of Jaina manuscripts were purchased. On his death, in the latter year, the fund for the search of Sanskrit Manuscripts was placed at the disposal of Mahāmahopādhyāya Hara Prasad Sastri, M.A., who, up to the year 1904, succeeded in purchasing 44 Jaina manuscripts. In 1905, under the supervision of the Mahāmahopādhyāya, a Jaina library at Benares, consisting of 1,114 Jaina manuscripts, was purchased at a cost of Rs. 5,000 specially granted for the purpose by the Government of Bengal. So, in the library of the Asiatic Society of Bengal, there are altogether 1,343 Jaina manuscripts purchased at the cost of Government besides the Society's own collection in which are included 12 manuscripts connected with Jainism.

The manuscripts collected by Dr. Rajendra Lal Mitra are numbered 1—3156, while those collected by Mahāmahopādhyāya Hara Prasad Sastri bear Nos. 3157—6613. All the manuscripts bearing Nos. 6614-7727 belonged to the Jaina library already referred to.

Dr. Rājendra Lal's collection comprises some of the Jaina canonical scriptures in Prakrit such as Ācārāṅga-sūtra, Uttarādhyayana-sūtra, Upāsaka-daśaṅga-sūtra, Daśavaikālika-sūtra, Praśnavyākaraṇa, Bhagavati-sūtra, etc., besides many of the philological, historical and philosophical works in Prakrit or Sanskrit such as Adipurāṇa, Āptamīmāṃsita, Uttara-purāṇa, Paṇḍava-purāṇa, Prameya-kamala-mārtaṇḍa, Mūhipāla-caritra, Rāja-vārtika, Śloka-vārtika, Siddha-Hema Śabdānuśāsana-vṛtti, Subhāsita-ratna-sandoha, Syādvada-mañjarī, etc.

The manuscripts which had belonged to the Jaina library, and were purchased at Benares, are generally very small: several

of them cover only 2 or 3 leaves, while some are duplicates or triplicates of what were already collected; at the same time they count among their numbers many interesting and important treatises which will prove of great use to scholars engaged in researches on Jainism.

SATIS CHANDRA VIDYABHUSANA,
Jt. Philological Secretary.

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No.	Name.	No.	Name.
7544	अक्षयवतीयाख्या	7042	अध्यात्मप्रबोध स्वाध्याय
6867	„ „ व्याख्यानादिः	7155	अनन्तचतुर्दशो कथा
6961 } 7182 }	अङ्गसुग्गाविचारः	6813	अमन्तनाथस्तवः
7039	अजितजिनस्तवः	7153	अनाथी ऋषि
1507	अजितनाथ पुराणम् by अरुणमणि	6786 } 7799 }	अग्निट्कारिका (सटीका)
7698	अजितशान्तिजिन स्तवनम्	748	अनेकाद्यसंग्रहः by हेमचन्द्र
6654	„ „ „ स्तवटीका	2540 } 7582 }	अनन्तगङ्गाशङ्करसूत्रम्
6735	अज्जयणकुञ्जौवया (?)	7196	अन्तरास्तवनम्
7200 } 7516 }	अठारे नातरा सिद्धाय	6614 } 7224 }	अभिधानचिन्तामणिः
7404	अट्टाइ दीपविचार	7458 }	(सटीकः) by हेमचन्द्र
7155	अट्टाइ रास	7165	अभिनन्दन जिनस्तवः
4160 } 7612 }	अमन्तरोववाइसूत्रम्	6671	„ स्तवः
7318	अतिचारसूत्रम्	7385	अमरकुमार सुरसुन्दरी चउपइ
7636	अध्ययनसूत्रम्	3044	अम्बडकधानकम् by सुन्दरक सूरि
7150	अध्यात्मप्रबोध गीत		

No.	Name.
6808	अयोध्याजीस्तवन
7095 } 7725 }	अरणकमुनिस्वाध्यायः
7353	अरिहन्तगुणादिः
7474	" युई
7129	" वाणो (सटीक)
6870	अर्धदानविधिः
7176	अद्वैकथानकम् by वाराणसी दास
7311	अर्हन्तस्तवादि
6958 } 7531 }	अल्पवज्रत्वदार
6720	अल्पवज्रत्वविचारगर्भित- श्रीमहावीरदेवस्य स्तवनं
6992	अशोचाधिकारः
7081	अष्टकम्
6778	अष्टपदः
6960 } 7017 } 763 } 7701 } 7724 }	अष्टप्रकारोपूजा
7291	अष्टपहाप्रतीहार्थादिः
7019	अष्टविधजिनपूजा
6722	अष्टविवर्गसंवादन by कवि अमृतविजयगणि

No.	Name.
1525	अष्टसाहस्री or (समूला) आप्तमीमांसावृत्तिः by विद्यानन्दः
6862	अष्टस्त्रीवर्णनसम्बोधन by कवि अमृतविजय
7100	अष्टादशदोषपारणा
7591	अष्टादशनातरा
7288	अष्टाविंशतिमहोत्सव (असम्पूर्ण)
7534	अष्टाविंशति लब्धित्तवः
6668	अष्टोत्तरी स्नात्रविधिः
6761	अहर्गणसारिणी

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6911	आउरपचकवाणम्
7155	आकाशपञ्चमो कथा
7608	आगमः (Incomplete)
6899	,, वर्षालक्षणम्
6959	आगमसारः (असम्पूर्णः)
6617 } 7543 }	आगमसारोद्धारवालाव- बोधः by देवचन्द्रजी
7378	आगमोक्त साधुवन्दना
7164 } 7560 }	आगारसंख्यागाथा
6167 } 7665 }	आचाराङ्कसूत्रम्
6891	,, ,, (टब्बासहितम्)

No.	Name.	No.	Name.
2519	आचाराङ्गसूत्रवृत्तिः by श्रीलाङ्ग	7026 } 7606 }	आरम्भसिद्धिः by उदयप्रभदेव
7167	आचारोपदेशः by चारित्र्यसिंह	7501	आराधना
7353	आचार्यगुणः	6926	,, स्तवः
7299 } 7632 }	आठकर्म आठावन प्रकृति विचार	6962	आलोचनास्तव
7581	आत्मसिञ्चाय	6866 } 7091 }	आलोचनाविधि
1500	आत्मख्यातिः (समयसार ख्या)	6624	आवश्यकसूत्रवृत्तिः (शिष्यहिता) by हरिभद्रसूरि
6747	आत्मनिन्दा	2555	आवश्यकसूत्रवृत्तिः
3045	आत्मप्रबोधः by जिनबालसूरि	7390	आषाढभूत आचार्यचौडाली
7150	आत्मप्रबोध गीत	6798	आसवाधिकारः
6920 } 7217 }	आत्महिनोपदेश- साध्यायः		इ ।
1170	आत्मानुशासनम्	1467	इन्द्रध्वजपूजा by विश्वभूषणभट्टारक
7704	आदिजिनस्तवादिः	6972	इषकारौसन्धि
7050	आदिनाथस्तवः		ई ।
1498	आदिपुराणम्	2532	ईश्वरप्रत्यभिज्ञाहृदयम् by क्षेमराज
7096 } 7093 } 7294 }	आदीश्वरोस्तवः		उ ।
1525	आप्तमीमांसितम् by अकलङ्कदेवः (विद्या- नन्दकृत-अष्टसाह- स्रीत्यपराख्य-अलङ्कृति- नामक वृत्तिसहितम्)	6644	उत्तमचरितकथा
		7555	उत्तमराजचरितकथा

No.	Name.
1499	उत्तरपुराणम्
2563 } 2581 } 4159 }	उत्तराध्ययनकथा by विजयसेन
2542	उत्तराध्ययनवृत्तिः by नेमिचन्द्र
6641 } 7197 }	उत्तराध्ययनसूत्रम्
2608 } 4318 }	„ „ (सटीकम्)
2566 } 6634 }	उत्तराध्ययनसूत्र टीका (सुखबोधा) by देवेन्द्रगणि
2591	उत्तराध्ययनसूत्रार्थदीपिका by लक्ष्मीवल्लभगणि
7188	उपदेशः
7179	उपदेशमालाप्रकरणम्
6644	„ „ सूत्रम् (धर्मदासकृतविवृति- सहितम्)
2602	उपदेशमालाविवरणम् by सिद्धायनाचार्य
7625	उपधानस्तोत्रम्
2522 } 2556 } 2562 }	उपमितभवप्रपञ्चा कथा by सिद्धर्षि
6952	उपश्रुतिप्रकृतम्

No.	Name.
7707 } 7417 }	उपसर्गहरस्तोत्रादिः
7440	„ „ स्तोत्रविवृतिः
7353	उपाध्यायगुणः
7447	„ पदोपस्थापनम्
7169	उपासकदशाङ्गसूत्रम्
7142	उपासकदशाध्ययनम् (सटीकम्)
6619 } 6646 }	उपासकाचारः by सकलकीर्ति
1474	उपासकाध्ययनम्
1533	„ „ टीका by प्रभाचन्द्र
6749	उवाइयसूत्रम् (अभयदेव सूत्रिकृतवृत्तिसहितम्)
4168	उवाइ उवाङ्गसूत्रम्
7628	„ „ (सटीकम्)
4314	उवाङ्गसूत्रम्
6710	उपकार
	कृ ।
6725	ऋषभजिनस्तवनम्
6705	ऋषभजिनस्तवन and पद
7259	ऋषभदेवगीतम्
7117 } 7265 }	„ „ स्तवनम्
7579	ऋषिचौडालिया
7532	ऋषिमण्डलप्रकरणम् (१ पञ्चाभावः)

No.	Name.	No.	Name.	
2598	ऋषिमण्डल सूत्रवृत्तिः by शुभवर्द्धन गणि	7450	कर्ममय्यपञ्चमकल्पः by देवेन्द्रसूरि	
4824 } 7084 } 7680 }	ऋषिमण्डल स्तोत्रम्	7437	कर्मबन्धभेदः	
7469		“ “ “ टौका by पद्ममन्दिरगणि	7191	कर्मभूम्यादिस्तवनम्
			6922	कर्मवत्तीश्री
	ए ।	6687 } 7128 }	कर्मविपाकः	
7668	एकत्रिंशत्सम्बिस्तवनम्	6816		“ “ गौता
6868	एकादशी युद्ध	7638	“ “ वितृतिः (असम्पूर्णा)	
6953	एकादशी विधिः	7611	कर्मविपाकसूत्रम्	
7688	एकादशीयज्ञविधिः	7611	कर्मस्तवसूत्रम्	
6836	एकादशीवृद्धस्तवनम्	7379	कलङ्कजन्मपत्री	
7501	एकेन्द्रियादिषट्कायगाथा	2549	कल्पकिरणावली (समूला) by धर्मसागर गणि	
	औ ।	1252 } 6626 }	कल्पतरुकोषः by केशव	
2594	औपपातिकवृत्तिः by अभयदेवसूरि	5234		कल्पसागरः
	क ।	7627	कल्पसूत्रम् (सटीकम्)	
1456 } 6623 }	कथाकोषः गद्यबन्धः	2553 } 4883 }	“ “ टौका	
6620		“ “ (खण्डितः)		6795 } 7058 }	( कल्पद्रुकलिका )
7588	कनकलता	6969	कल्पसूत्रवाचना	
1513	कर्णामृतपुराणम् by केशवसेन ऋषाजिष्ठा	4158	कल्पाध्ययनम् वा दशानुतखान्दः	
6621	कर्पूरप्रकरणावालावबोधः by जिनसागरसूरि	4325 } 6768 }	कल्याणमन्दिरस्तवः by कुसुदचन्द्रा चार्थ	

No.	Name.	No.	Name.
7434	} कल्याणमन्दिरस्तवः (गुणरत्नसुरिकृत- टीका सहितः)	7008	कुलचिन्तामणिवतीश्री
7549		7700	केरलभाषा
2610	कल्याणमन्दिरटीका	6681	केवलज्ञानस्तवन and चवनस्तवन
6664	„ „ लोत्रटीका by हर्षकीर्त्तिसूरि	7343	केवलस्तवनम्
7330	} कल्याणमन्दिरभाषा	8003	क्रियाकलापः by जिनदेवसूरि
7690		1580	क्षपणासारः
7694		7286 } क्षमावतीश्री 7415 }	
7679	„ „ वृत्तिः	7546	क्षेत्रविचारः
7232	„ „ सूत्रार्थः	2605 } क्षेत्रसमासप्रकरणम् 4309 }	
6730	कष्टावली	2541	„ „ टीका by मलयगिरि
6804	कागपरौक्षा	6692 } क्षेत्रसमासवार्त्तिकम् 6640 }	
7297	कानड चौपड		
7705	कापडा वतीश्री		
7053	कामकन्दना (असम्पूर्ण)		
7710	कामिनीसवैया		
6777	कायात्मसाध्याय		
6672	कार्तिकसौभाग्यपञ्चमी- माहात्म्यम्	7014	गजसिंहराय चौपड
7507 } कालकाचार्यसम्बन्धः 7583 }		6877	गणधरवाद दृष्टान्तः (किञ्चित्)
6693	कालदण्ड चौपड	7498	गणोविद्यापञ्चतिः
7445	काथ (सटीक)	6616	गद्यबन्धः by पद्मविजय- गणि (मुनिसुन्दरसूरि विरचित पद्यबन्धात् जयानन्दराजविचरि- त्रात् उद्धृतः)
7496	कुङ्कुमपद		
6715	कुमारपालरास by जिनहर्ष		

No.	Name.	No.	Name.
7554	गर्भरक्षायन्त्र (हिन्दी)	7201	गृहशोधनमन्त्रभाषा
6781	गाथासहितम् (अवचूरि- सहितम्)	1447	गोमट्टसारवृत्तिः by नेमिचन्द्र
7001 } 7184 }	गीतपदसंग्रहः	6829	गौड़ीजीको स्तवन
6653 } 7154 }	गीतसंग्रहः	7049 } 7463 }	गौड़ीपार्थस्तवनम्
7689 } 7692 }	गीतस्तवादिसंग्रहः	6875 } 7601 }	गौड़ीस्तुतिः
7716	गुटिकाविधिः	6981	गौतमकुलकम्
7276	गुणठागास्वाध्यायः	7639	„ „ (सटीकम्)
7444	गुणमालाप्रकरणम् (सटीकं)	2514 } 5572 }	गौतमकुलकवृत्तिः by देवराज
2611 } 3047 } 3048 }	गुणमाला व्याख्या by रामविजय	6640 } 7109 }	गौतमपृच्छा
6675 } 6861 } 7468 }	गुणस्थानक्रमारोहः (सवृत्तिः) by रत्न- शेखरसूरि	7708	„ „ (टव्वासहिता)
3051	गुणस्थानप्रकरणम् (सटीकं) by रत्नेश्वरसूरि	2603	„ „ सुगमावृत्तिः by मतिवर्द्धन
2613	गुरुगुणघटत्रिंशिकासूत्रम् (सटीकं)	7303 } 7428 }	गौतमस्वामिरास
7526	गुरुपूजा by जिनकुशल- सूरि	7699 }	„ „ सिञ्जाय
7295	गुरुभास	7101	„ „ सिञ्जाय
7425	गुरुस्तुतिः	7215	ग्रहवाटिका घ ।
		7070	घण्टाकर्णवृद्धकल्पः च ।
		7295	चउसरण
		1475	चक्रधरपुराणम्

No.	Name.	No.	Name.
7222	चक्रेश्वरीस्तोत्रम्	7482	चतुर्विंशतिशासनम्
6688	चतुःप्रत्येकबुधप्रबन्धः by समथमुन्दरगणिक	7527 } 7678 }	चन्दनमलयगिरि चौपड
6652	चतुःशरणप्रकीर्णकाव- चूरिः	6910 } 7705 }	" " वार्त्ता
7173	चतुःशरणस्तोत्रम् (सटीकम्)	7028	चन्दनराजकी कथा
6988	चतुर्थकर्म्मग्रन्थः (असम्पूर्णाः)	6876	चन्दलेहा चौपड
7180	चतुर्थवरणसमस्यापूर्तिः	6690	चन्दाप्रभुजीस्तवन
6823	चतुर्भुगविचारः	7411	चन्द्रकुमारवार्त्ता
6841 } 7389 }	चतुर्विंशतिका by जिनप्रभसूरि	1484	चन्द्रप्रभचरितम् by दामोदर
7561	चतुर्विंशतिजिननमस्कारः by हेमचन्द्र	6801 } 7315 } 7462 }	चन्द्रप्रभुस्तवनम्
6828	चतुर्विंशतिजिननमस्कारः (सटीकः) (शेषपत्रमात्रम्) by हेमचन्द्रसूरि	1516	चरित्रसारः by चासुण्ड- महाराज
4312 } 6741 } 7306 }	चतुर्विंशतिजिनस्तुतिः	7218	चवदै पूरणस्तव
6853	" जिनान्तरकाल- गर्भितस्तवनम्	6670	" पूरवस्तवन
7707	चतुर्विंशतितीर्थङ्करवर्णनम्	6706	चातुर्मास्यत्रयी
6768	" " स्तुतिः	7709	चिडीपखेह व्याह
7551	" दण्डकम्	6677	चिन्तामणिकामधेनुः (?)
7061	" " स्तवः	7008 } 7246 }	" पार्श्वजिनस्तोत्रम्
		7518	" मन्त्राज्ञायः
		7504	चूलिकापेशाचिकम्
		7486	चेतस्मन्तारककाव्यम् by जिनवल्लभसूरि

No.	Name.	No.	Name.
6821 } 7088 } 7643 } 7706 }	चैत्यवन्दनम्	6348 } 7620 }	जन्मपत्रपद्धतिः
7648		7478		जन्ममङ्गलस्तवनम्
6932		7230	जपमाला
6728		7644	जम्बू अञ्जयनम्
7645	6640 } 7511 }	जम्बू चरित्रम्	जम्बू द्वीपप्रज्ञप्तिः
7064	4162	4334	जम्बू द्वीपप्रज्ञप्तिः
7405	4385	4385	जम्बू द्वीपप्रज्ञप्तिः
7577	2552	2552	जम्बू द्वीपप्रज्ञप्तिः
7325			(समूला) by पुण्यसागर
6847		6807 } 7648 }	जम्बू द्वीपसंग्रहणी by हरिभद्रसूरी
7015		6873	जम्बू द्वीप सूत्रम् (वृत्तिसहितम्)
7595		1461	जयकुमारचरित्रम् by ब्रह्मकामराज
7556		7386	जयतिज्जगगाथा
6856		7190	जयपताकायन्त्रकल्पः
7698		7334	जितकल्पः
7422		6853	जितायुर्गर्भितस्तवनम्
7705		7278	जिनकल्याणकादि
		6662	जिनकुशलकन्द
		7526	जिनकुशलसूरी गुरुपञ्चा
		6989	जिनजाप्यम्
	छ ।		
6975	छन्दः		
7661	छन्दजातभ्रमरवेली		
	ज ।		
7178 } 7198 }	जगज्जीवनसूरीगामयकम्		

No.	Name.	No.	Name.	
6701	जिनपचीशीसवैया by वनारसीदास	6846	जीवविचारः	
7669	जिनपञ्जरस्तोत्रम्	6848		
6999		7.51		
7192		7313		
6822	जिनपालका चौठालिया	7326		" " प्रकरणम् (टव्वासहितम्) by शान्तिसूरि
7835		7491		
1448	जिनपूजाविधिः	7688		
6943	जिनप्रतिमा दृढीकरणम्	2718	जीवविचारप्रकरणवृत्तिः by क्षमाकल्याण	
7198	" " वन्दनम्	6700		
1488	जिनप्रतिष्ठासामग्री	6811	जीवविचारप्रकरणवृत्तिः by रत्नसूरि	
7637	जिनमहिम्नः स्तोत्रम्	7594		
1476	जिनयज्ञकल्पः by व्याघ्राधर	8052	जीवविचारप्रकरणवृत्तिः by मेघनन्दन	
6957	जिनरस by वेणीराम	6640		
7336	जिनवरणम्	7216	जीवविचारस्तवः	
7328	जिनप्रतकम् (सटीकां)	7125		
7485		7391	जीवाजीवसप्तदशभेदाः	
7078	जिनसम्प्रभावस्तोत्रम्	7587		जीवाराधना
7121		2718	जीवाजीवपुण्यपापादि- विचारः	
1531	जिनसंहिता by एक- सन्धि भट्टारक	2543		जीवाभिगमसूत्रम् (सटी- कम्) by मलयगिरि
6782	जिनस्तवः	2590		
6768	जिनस्तुतिः	6687	जैनकर्म्मविपाकः	
2717	जिनस्तोत्रं चैत्यवन्दनादि	7128		
6941	जीवभेदः	1545	जैनचित्रावली	
7600		7717	जैनतन्त्रसारः (?)	
		1544	जैनतीर्थङ्कर (२४ चित्राणि)	

No.	Name.	No.	Name.
1541	जैनपूजाविधिः	6915	ज्योतिषसारसंग्रहः
7060	जैनमङ्गलघोड़श्री	6636	ज्योतिषसंग्रहादिः
6713	जैनमण्डनम्		भा ।
6793	जैनरक्षास्तोत्रम्	6882	भाभासिञ्जाय
1471	जैनविवाहपद्धतिः		ट ।
7251	जैनस्वरोदयः	7479	टीपनाकी पाटी (२ य ३ य पत्रयोरभावः)
4170)	ज्ञाताधर्मकथा	7219	टूकश्लोकाः
7048)			ठ ।
7202)		7314	ठह्नीवाचना (?) (असम्पूर्णा)
6680)	ज्ञानपञ्चमी		ढ ।
7097)		6883	ढण्डगामुनिसिञ्जाय
7131)		7589	ढालकावली
7646)		6938	ढालस्तुति इत्यादि
6771	„ „ विधिः	7618	ढालसागर
1536	ज्ञानसूर्योदय नाटकम् by वादिचन्द्र		त ।
6947	ज्ञानस्वरोदय (१-४ पत्राभावः) by चरणदान जी	6974	तत्त्वार्थः (किञ्चित्)
6615	ज्ञानार्णवः by मुभचन्द्रदेव	7447	तत्त्वार्थाधिगमसूत्रम्
7069	ज्ञानावरणभेदादिसूची	6674	तवनसंग्रह and तपप्रमाण
7514)	ज्योतिषम् (?)	7621	ताजकसारः (असम्पूर्णाः)
7842)		7056	तारादेवी ढाल
7923)		7670	तिथ्यादिस्यष्टीकरणम्
7926)			
7938)			
7559	ज्योतिष करण्ड टीका by मलयगिरि		
7068	ज्योतिष संज्ञा		
7466	„ सारः (असम्पूर्णाः)		

No.	Name.	No.	Name.
6686	तीर्थमालासमेत शिखर- स्तवनम्	7387	दशदृष्टान्तः
6930	तीर्थमालास्तवनम्	7473	दशपञ्चक्वाण
6784 } 7530 }	तीर्थाधिराजस्तोत्रम्	7154	दशपञ्चक्वाणतपविचार
7150	तीर्थाबली गीतम्	7033	दशपञ्चक्वाणसिञ्चायादि
7135 } 7565 }	तेरका वीया सिञ्चाय	7361	दशमौ कालसूत्रम् (असम्पूर्णा)
6789	त्रैलोक्यदोषिकासंग्रहणी (डब्बार्थसहिता)	7155	दशलक्षणाकथा
1512	त्रैलोक्यसारटीका by माधवत्रैवेद्य	6857 } 7568 }	दशवैकालिकचूलिका
		4163 } 6780 }	दशवैकालिकसूत्रम्
		7465 } 7686 }	(सटीकं)
		2574	दशवैकालिकसूत्रटीका by समधसुन्दर
		6918	दशवैकालिकश्रुतस्कन्धः
		2588	दशवैयालियसूत्रकन्दो (सटीकः)
		1504	दशसूत्रटीका by श्रुत- सागर
		1505	दशसूत्रटीका बालबोधः by जयन्तपण्डित
4811 } 7280 }	दण्डकम्	2570	दशानां चूर्णी
6973 } 7061 }	दण्डकतवन	7150 } 7510 }	दशावरणभद्र
6931 } 7002 }	दण्डकप्रकरणम्	7675	दशावतार परिशिष्टम्
6640 } 7667 }	दण्डकविचारषट्त्रिंशिका (अथचूरिसहिता)	6918	दशाश्रुतस्कन्धः
7535	दण्डकसूत्रम्	4158 } 7350 }	दशाश्रुतस्कन्धसूत्रम्
7654	दण्डकस्तवः (टिप्पनीसहितः)	7464 }	by भद्रवाज्जस्वामी
2714	दम्भकचउविसद्धारः (सटीकः)		
6760	दयावेली		

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No.	Name.	No.	Name.
7520	दानकल्पद्रुमः by जिन- कौर्त्तिस्मृति	7037 } 7126 }	देवप्रतिक्रमणविध्यादि
7175	दानश्रीलतपभावना	6879 } 7578 }	देववन्दनविधिः
7712	दानश्रीलचौडाली	7565	,, ,, भाष्यम्
6640	दानादिचतुःकुणकम् (लाभकुशलगणित वृत्तिमहिम्) by देवेन्द्राचार्य	7408	देवरचना
6968	दानाधिकारे सिंहलसुत- शौषड इत्यादि	1538	देवागमनवृत्तिः by वसुनन्दौ
6783	दानेकयवना कथा	7500	देविन्दुत्तपथद्वं
7170 } 7930 }	दिनचर्या (५ पत्राणि)	6759	देवीप्रतिष्ठाविधिः (आचारदिनकरौयः)
7453	दीक्षाकल्याणकम्	6756	देशज्ञानवा
7024	दीक्षादानविधिः	6966 } 7274 } 7698 }	देशावकाशिकविधिः
1479	दीक्षापटलम्	6879	दोषगाथा
7005	दीपमालिका (अक्षम्पूर्णा)	7423	दोषदृष्ट्या
2582	दीपमालिकापर्वथाख्या	7557	दोषावली
6711	दीपोत्सवकल्पः (सटीकः) by जिनप्रभस्मृति	7690	द्यानतविलास
6964	दुर्घटसूत्रं	6967	द्रव्यपरीक्षा (१ पत्रं)
7524	दृष्ट्या	6640	द्रव्यसंग्रहः (रामचन्द्र- कृतटीकासहितः) by नेमिचन्द्र
7155	देवपूजा	6881 } 7651 }	द्रव्यसंग्रहः (टिप्पणी- सहितः) by नेमिचन्द्र
6696	देवपूजा दिग्दर्शनफल- कम्	1508	द्रव्यसंग्रहाभिधानटीका by ब्रह्मदेव
7011 } 7400 } 7493 }	देवप्रतिक्रमणविधिः	7122	द्वार्त्रिंशका by दिवाकर

No.	Name.	No.	Name.
7235	द्वादशभावना गीतम्	6627	नन्दीश्वरपद
7289	द्वादशव्रतम्	2516	नन्द्यध्ययनवृत्तिः by मलयगिरि
	ध ।	6640	नयचक्रम् by देवसेन- पण्डित
7128	धनञ्जयनिघण्टुः by धनञ्जय	7641	नयस्वाध्याय
7823 } 7460 }	धनाज्ञीसिञ्ज्हाय	7538	नलदमयन्ती चौपइ
7043	धनामुनिस्सिञ्ज्हाय	6682 } 7690 }	नवकार भाषा
6780	धनास्वाध्याय, काया- स्वाध्याय, कष्टावली च	7697	,, मन्वस्तवनम्
6808	धर्मजिनस्तुतिः	7502	,, मन्त्रादि
7370	धर्मदत्तधनवती चौपइ	7409	,, विधिः
7150	धर्मनाथस्तवनम्	7108 } 7354 }	नवग्रहस्तोत्रम्
7447	धर्मरत्नप्रकरणम्	6912	नवग्रहार्चितपार्श्वस्तुतिः, etc.
7682	धर्मलक्षणम्	2600 } 3059 }	नवतत्त्वप्रकरणम् (सटीकं)
3054	धर्मविलुप्तप्रकरणम् by मुनिचन्द्रसूरिः	4166 } 4315 } 4323 }	
7860	धर्मसौ वाचनी	6787 } 6978 }	नवतत्त्वप्रकरणम्
2593	धर्मोपदेशमालावृत्तिः by जयसिंहसूरि	7333 } 7398 } 7488 }	
7352	ध्वजारोपणकलसस्थापन- विधिः		
	न ।		
7296	नक्षत्रसङ्कटशान्तिः	6885	नवतत्त्ववालावबोधः
2515	नन्दिसूत्रम्	6640	नवतत्त्ववृत्ति (हिन्दीभाषा)
7045	नन्दिसेनमुनिस्वाध्याय	6724	नवतत्त्वावचूरिः (समूला)
7567	नन्दीश्वरहीपूजा		

No.	Name.	No.	Name.
6830 } 7596 }	नवपद	6785 } 6977 }	निरयावलिका श्रुतखन्ध- विवरणम् (समूलम्) by श्रीचन्द्रसूरि
7522	नवपद क्षमाश्रवणं (पञ्चदश्याभावः)	4829	निरयावलिकासूत्रम्
6656 } 7509 }	नवपद चैत्यवन्दन	7618	” ” (असम्पूर्णं)
7255	नवपदजी की पूजा	6684	निर्व्याणकल्याणकस्तवनम्
6791	नवपदजी स्तवन	7194	निर्व्याणस्तवनम्
6721 } 6821 } 7089 } 7199 }	नवपद स्तुतिः	6705	निसानी (?)
7368 } 7515 } 7607 }		7517	नीतियज्ञः
7288	नवरत्नादिसंग्रहः	1539	नीतिसारः by इन्द्रगन्दी
7115	नव्यक्षेत्रसमासः by सोमतिलकसूरि	7062	नीलरेखाविचारः
7116	नष्टपत्रिकादिविचारः	7066	नेमनाथजी की लावनी
7145	नागलासिञ्जाय	6869	नेमनाथघुड
7701 } 7703 }	नानाविधस्तवादिसंग्रहः	7052 } 7899 }	नेमनाथवारहमासा
1738 } 7224 } 7458 }	नाममाला by हेमचन्द्र	7248	नेमराजमतीस्तवः
6625 } 6896 } 7010 }	नारचन्द्र ज्योतिषम्	7066 } 7301 }	” ” लावणौ
7123	निघण्टुसमयः by धनञ्जय	6927	नेमिजिनगीत
6784	निदानम् by लक्ष्मीधर	6902	” ” पद
1481	नियमसारटीका by पद्म- प्रभमलधौरिदेव	7574	नेमिजिनस्तवः
		6792	नेमिनाथस्तवः
		6907	नेमिनाथराजमथोर्दादेश- मासप्रबन्धः
		6905 } 7052 } 7140 }	नेमि राजमती बारह- मासा

No.	Name.	No.	Name.
7185 } 7523 }	नेमिराजमतीखाध्याय	6666	पञ्चपरमेष्ठिस्तोत्रम्
7094	नेमिराजखाध्याय	6909	पञ्चप्रतिक्रमणविधियुक्त सुमतिनाथस्तवनम् and सामयिक ३२ दोष सिञ्जाय
7525 } 7678 }	नेमिराजुलस्तवः	7161	पञ्चमकल्याणकौ पूजागीत
7677	„ „ स्तुतिपद	7020	पञ्चमज्ञानपूजा
2565	न्यायमञ्जूषा by हेमहंस- गण्डि	2520	पञ्चमसंयहटीका
प ।		7528	पञ्चमाङ्गभास
7040	पञ्चक्खानतप	7688	पञ्चमीयहणविधिः
6872	पञ्चक्खानविधिः	6814 } 7278 }	„ पारणविधिः
7152 } 7452 }	पञ्चकल्याणकम्	6812 } 7144 }	„ लघुस्तवनम्
7690	„ „ मङ्गलम्	6986	„ स्तवनम्
7598	पञ्चतीर्थचैत्यवन्दनम्	7250	„ स्तवादि
6985 } 6925 }	„ „ स्तवनम्	7609	पञ्चविंशति उपसर्गः
6753	पञ्चतीर्थी	7054	पञ्चसमवायस्तवनम्
7475	पञ्चनमस्कारचूर्णी	1463	पञ्चस्तवनावचूरिः
7312	पञ्चनिर्गम्यसंयहणीसूत्रम् (सटीकं)	7029	पञ्चाङ्गप्रकरणसूचौ
6772	पञ्चपरमेष्ठिहृन्द	6631	पञ्चाङ्गप्रकरण टीका by हरिभद्रसूरि
7713	„ „ प्रभावः	2592	पञ्चाङ्गक सूत्र टीका by हरिभद्रसूरि
4808 } 7076 }	„ „ नमस्कारः	7298	पङ्क्तिमण्य सिञ्जाय
7697	„ „ सन्वगुणस्तवनम्	7545	„ „ सूक्तम्
7214	„ „ वन्दनम्		

No.	Name.	No.	Name.	
2554	पद्मवनाशी सूत्रम्	2712	पर्येषणाकल्पसूत्रम् सटीकं	
4819	पद्मतिः	6779	” व्याख्या (असम्पूर्णा)	
7562	पत्तनकला	2715	} पाक्षिकसूत्रम्	
7656	पत्नी १ पत्रम्	4827		
6888	} पदसंग्रहः	7369		
6984		7482		
7105		7615		
7220		6948	पाक्षिकादिप्रतिक्रमण-	
7254			सूत्रम्	
7455			7513	पाण्डवचौपद
7693			1800	} ” पुराणम्
7159	पदाष्टक	1509	by श्रीभूषणसूरि	
1449	पद्मपुराणम् by जिनदास	6797	पापतत्त्वम् (१ पत्राभावः)	
1510	” ” (दृष्टत्) by रविसेनाचार्य	6844	पार्श्वजित चारतौ	
1523	पद्मानन्दीपचवी by कुन्दाचार्य	7044	पार्श्वजिन पद्मावतीस्तोत्रम्	
6799	पद्मावती	7633	” मन्त्रगर्भितस्तुतिः	
1518	” चरित्रम् by पद्मसेन	7878	} ” स्तवनम्	
7244	पद्मावती मन्त्रः	7488		
7427	पद्मावतीसहस्रनाम	7616		
7085	} ” स्तोत्रम्	7684		
7824		7726		
7139	परदेशी स्वप्नसाध्याय	6745	} पार्श्वजिनादिस्तुतिः	
7091	परमेश्वरस्तवन	6991		
7076	परमेष्ठिनमस्तार	7063		
6914	परमात्मवतीश्री	7065		
		7188		
		7141		
		7408		
		1527	पार्श्वनाथ चरितम् by सकलकीर्ति	

No.	Name.	No.	Name.
2586	पार्श्वनाथचरितम् by भावदेवसूत्रि	1532	पुरुषार्थानुशासनम्
2587		6933	पुष्पाञ्जलिस्तोत्रम्
3040		7162	पूजायुक्तम्
7650		7126	पृथिवीचन्द्रकुमाररास
6618	पार्श्वनाथचरितम् by ?	7539	पृथ्वीराजवेली
6657	पार्श्वनाथकृन्द	7603	
7484	पार्श्वनाथजी चैत्यवन्दनम्	7129	पैतृशिवोल
7102	पार्श्वनाथदेशान्तरीकृन्द	7239	
7489		7079	6665	पोसहप्रतिक्रमणविध्यादि
7079	„ यमकवन्द्यस्तुतिः	7163	पोसहविधिलेखनपरवारी
6728	„ लघुस्तोत्रम्	7316	पौषदशमी कथा
6768	„ स्तुतिः	2521	प्रज्ञापनाटीका (समूला)
7004		6858		by मलयगिरि
7477		6839	प्रतिक्रमणसिञ्जाय
6796		1472	प्रतिमाप्रमाणम्
6817	पार्श्वस्तुतिः	7417	प्रतिमाप्रतिष्ठा विधिः
6820		7499	प्रतिष्ठामहोत्सव विधिः
6965		6703	प्रतिष्ठाविधिः (असम्पूर्णः)
7158		7433	प्रत्याख्यानसूत्रम्
6971	पार्श्वदिस्तुतिः (सावचूरिः)	6805	„ भाष्यम्
6946	पाप्राज्ञेवली	7287	
7690		7248	प्रत्याख्यानोक्तविधिः
3046	पिण्डनियुक्तिविवृतिः by मलयगिरि	7611	प्रथमकर्म्मविपाकसूत्रम्
6803	पिण्डविशुद्धिदीपिका	7240	प्रथमादिहादशव्रत समालोचना
7712	पुण्यवतीश्री	1464	प्रद्युम्नचरितम् by सोमकौर्त्ति
6914	पुद्गलगीता by कविकर्परचन्द्रजी	6629	
7059	पुद्गलभङ्गविवृतिः by नयविजयगणि	6678	

No.	Name.	No.	Name.
6669 } 7495 }	प्रबोधचिन्तामणिः by जयशेखरसूरि	6914	प्रश्नोत्तरमाला by कविकर्पूरचन्द्रजी
7242 } 7690 }	प्रबोधवारणो	6982 } 7213 }	प्रश्नोत्तररत्नमाला
7154 } 7258 }	प्रभातसामयिक भजन	1299	„ „ वृत्तिः by देवेन्द्रमुनीश्वर
7320	„ „ विधिः	6878	प्रश्नोत्तरसार्द्धशतकम् by क्षमाकल्याणगणि
6984	प्रभावती चौपड़	6758	प्रश्नोत्तरी
1543	प्रमेयकमलमार्तण्डः माणिक्यनन्दिकृतस्य (परीक्षामुखसूत्रस्य भाष्यभूतः) (समूलः) by प्रभाचन्द्र	7253	„ by नन्दराममिश्र
6622	प्रवचनसारभाषाटीका (समूला) by पाण्डे हेमराज	6619 } 6646 }	प्रश्नोत्तरोपासकाचारः by सकलकीर्ति
1503	प्रवचनसारटीका	7156	प्राकृतव्याकरणम् (१ पत्रमात्रम्)
7456	„ सारोद्धारः by उदयप्रभसूरि	6647	प्रात नमस्कार
6979	प्रत्रय्याकुलकम्	1473	प्रीतिङ्करमहामुनिचरि- तम् by नेमिदत्त
1521 } 1522 }	प्रशस्ताप्रशस्तिः		फ ।
6639	प्रशस्तिका	7019	फलधर्मेकुटुम्बकथा
6744	प्रश्नमेदः		ब ।
2524 } 4313 }	प्रश्नव्याकरणम्	7611	बन्धसामित्वसूत्रम्
7572 }	by पार्श्वचन्द्र ?	7363	बन्धसामित्वबालावबोधः
6819	प्रश्नावली	7321	बुद्धिरास
7240	प्रश्नोत्तरम्	7269	बृहस्पतिवर्षितम्
		2536	बृहत्सामिन्ना
		1479	बृहद्दीक्षापटलम्

No.	Name.	No.	Name.
7570	दृष्टवृत्तचूरिः by हरिभद्रस्वरि (२ पत्राभावः)	7471	भक्तिपरिष्ठापयस्त्रम्
6768	दृष्टवृत्तकारः by जिनबल्लभस्वरि	2518	भगवतीपञ्चमाङ्कवृत्तिः
1508	ब्रह्मदेव-वृत्तिः (द्रव्य- संग्रहाभिधान टीका) by नेमिदत्त	2560 } 4317 }	भगवतीस्त्रम्
1542	ब्रह्मविलास by भैया- भगोती दास	956 } 2561 }	भगवतीवृत्तिः by अजयदेव
	भ ।	7947	भद्रवाङ्मसंहिता
7690 } 7694 } 7697 }	भक्तामरस्त्रोत्रम्	7547	भयहरस्त्रोत्रम्
4822 } 6768 }		6718 } 7497 }	भरहचरित्तम् (सटीकं)
6775 } 7346 }		7451	भवभावनास्त्रोत्रम् by हेमचन्द्रस्वरि
7366 }		7149	भवानीवायक and जमानारादूँहा
7130 } 7207 }		6855	भवानीवायक
2517	” ” टीका	6739	भवानीस्त्रोत्रम्
6640	” ” वृत्तिः by गुणाकरस्वरि	1524	भव्यकुमुदचन्द्रिका by चाप्राधर
7619	भक्तामरस्त्रोत्रवृत्तिः (समस्यापूर्तिः)	7287	भावनागीत
7865	भक्तामरस्य मन्त्रसङ्ग्रहा- टीका	6942	भावनावेली
7676	भक्तामरादिस्त्रोत्रादि- संग्रहः	6954	भावारिवारणस्त्रोत्रम् (जयसागरकृतवृत्ति- सहितम्) by जिन- बल्लभस्वरि
		7573 } 7653 }	भासयज्ञः
		1844 }	भुवनदीपकं
		4332 }	by पद्मप्रभस्वरि
		68 }	” ” (सटीकं)
		5556 }	” ” (सटीकं)

No.	Name.	No.	Name.
6384	„ „ वृत्तिः by सिंहतिलक	7080	महाविष्णुश्रीय
6501	भुवनदीपकटीका by सिंहतिलक	7602	महापञ्चक्वाणपद्मम्
4380	भुवनभानुकेरली	1491	महापुराणटीप्यणकम् by प्रभाचन्द्रपण्डित
7816	भैचिन्तामणि	7540	महाबलमलयसुन्दरी
	म ।	6739	महामायाकन्दः
7241	मङ्गलम्	7948	महालक्ष्मीमाहात्म्यम्
6897	मणिभद्रस्तोत्रम्	7698 } महावीरपारणम्	
7604	मदनस्तवक	7720 }	
7092	मनःपदवीसिञ्ज्याय	6889 } „ स्तवनम्	
7563	मन्त्रसंग्रहः	7519 }	
7580	मन्त्राज्ञायः	7538 }	
7640	मन्त्रावली	7158	„ स्तोत्रम्
6924	मन्दरस्तवनम्	7639	„ „ (सटीकम्)
7585	मरणविभक्तिपद्मम्	7467	मह्वीपालचरित्रम् (सटीकं) by वीरदेवगणि
6766	मल्लिनाथजिनस्तुतिः, etc.	1483	मह्वीपालचरितम् by चारित्रभूषण
1535	मल्लिनाथपुराणम् by सकलकौर्त्ति	7136	माङ्गलिकसिञ्ज्याय
6788 } महादण्डकम्		6996	माताजरोकन्द
7124 }		7441	मानतुङ्गमानवतीचरितम् by मोहनविजय
7550 }		7398	मारगणोद्धारः
7335	महादण्डकबोल	6815 } मार्गशीर्षेकादशी कथा	
7292	महादेवार्थस्तवः	7401 }	
7939	महादेवो उदाहरणम्	7447	मालारोपणविधिः
6698	महादेवोसारिणीविवृतिः by पण्डित तच्चसुन्दर	3487 } मुनिपतिचरितम्	
		7110 }	
		7187 }	

No.	Name.	No.	Name.	
7718	मुनिमालिका	1159	योगचिन्तामणिः by हर्षकौर्त्तिसूरि	
7480	मुनिसुव्रतजिनस्तवः	1728		
1501	मुनिसुव्रतपुराणम् by कृष्णदास	7257		
1521	मूलाचारटीका by मेधावी	7340		
1470	मूलाचारप्रदीपकः by सकलकौर्त्ति	7397		
6750	} मृगीपुत्रसाध्याय	6615	योगप्रदीपाधिकारः or ज्ञानार्थवः by शुभचन्द्रदेव	
7098		} मेघकुमारगीत by जिनप्रभवसूरि	7800	योगसंग्रहः
7415			2601	योगसारः (सटीकः) by योगचन्द्रमुनि
6768	मेघकुमारगीत by जिनप्रभवसूरि	6663	योगारम्भगीत	
7664	मेघमुनि सिञ्चाय		र ।	
7074	मेरुत्रयोदशीव्याख्यानम्	6655	रक्षामन्वादि	
7720	मोक्षनगर सिञ्चाय	7138	रङ्गसागरः	
1517	मोक्षप्राभृतटीका by श्रुतसागर	7155	रत्नत्रयव्रतकथा	
7347	मोतीकपासिया रास	7272	रत्नपाल चौपइ	
6998	मोरादे जीरो सिञ्चाय, etc.	7058	रविवारकथा	
7278	} मौन एकादशी	6886	राइसज्यारा	
7436		7831	} राइ सज्यारा गाथा	
	7137			
	7152			
	य ।	4161	राजप्रश्रीयसूत्रम्	
6801	यतिप्रक्रमणसूत्रम्	4165	„ „ „ (सवार्त्तिकं)	
6702	यवनीपृच्छा	6691	राजमती सिञ्चाय	
6718	युक्तिप्रकाशः or जैन- मण्डनम् (खोपज्ञवृत्ति- सहितं) (२ पत्रमात्रम्)	7083	राजर्षिसाध्याय	
		1515	राजवार्त्तिकम् or तत्त्वार्थवार्त्तिकम्	

No.	Name.	No.	Name.
7894 } 7723 }	राजुलपचीशी	7148	लघुमहादेवी ज्योतिषम्
7208	रात्रिपोसहविधिः	7552	लघुशान्तिः
7494 } 7575 }	रात्रिप्रतिक्रमणविधिः	7090	लघुशान्तिस्तवादिः
6694	रात्रिभोजनपानाधिद्वार- दोष	6695 } 6936 } 7004 }	लघुशान्तिस्तोत्रम्
7599	रामचन्द्रचरितम् by देवविजयगणि	6640	लघुसंग्रहणरत्नम् (सटीकं) by श्रीचन्द्रसूरि
7548	राशिवारघात	7376	लघुसंग्रहणीवृत्तिः (असम्पूर्णा)
6987	रूपदोषपिकुल (असम्पूर्णा)	7036	लघुस्तोत्रम्
7413	रूपसेनचरितम् by जिनसूरि	6699	,, ,, वृत्तिः
6950	रोहिणीचौपद	7037	लब्धिलवः
1456	रोहिणीव्रतकथा by भानुकौर्त्वाचार्य	7668	३१ लब्धिलोत्रं (सटीकं)
6704	रोहिणीस्तवः ल ।	7285	लीलावती चौपद
7158	लक्ष्मीस्तोत्रम्	7512	लोकनालि द्वारिप्रिका (सटीका)
7490	लघुक्षेत्रसमासटीका (आद्यपत्रद्वयाभावः)	2568	लोकप्रकाशः by विनयविजय व ।
1302	लघुक्षेत्रसमासविवरणम्	7372	वत्सीश अतिशयसिञ्ज्जाय
7271	लघुदण्डकम्	6651	वत्सराज हंसराज चरित by जिनोदयसूरि
7392	लघुनाममाला by हर्षकौर्त्तिसूरि	7127	वत्सराज हंसराज चौपद by जिनोदयसूरि
7082	लघुनिश्रीयसूत्रम् (सटीकं)	6818 } 7481 }	वधावो
7804	लघुपदावली		

No.	Name.	No.	Name.	
6731	वधावोभास	6824	वारविचारः	
7634	वनस्पतिसप्ततिका	6752	} वारहमासा	
7687	वन्दे सूत्रम्	7132		
6955	वम्भणवाङ्मौर जिनस्तवः	7231		
		7610		
7006	वम्भणवाणी स्तवः	7177	वाराणसीविलास	
2572	} वर्द्धमानदेशना by राजकीर्तिगणि	7077	वारे देवलोक	
6640			6689	वासद्वेषपूजा
7529	वर्द्धमानसप्तविंशतिभवा- धिकारः	7662	वासविह्वरमाण स्तुतिः	
6722	वर्णनसंवादनम् by अमृतविजय गणि	6786	विक्रम आबोली रास	
2711	वर्षासूत्रम् वा वरेण्यौ- सूत्रम्	6860	विक्रमादित्यचरितम् by रामचन्द्रसूरि	
6881	वलिनरेन्द्रचरितम्	7622	विचारगाथा	
2599	} वलिनरेन्द्राख्यानम्	7223	विचारवतीश्री	
8488			2523	} विचारषट्त्रिंशिका (सावचूरिः)
6630			7281	
7172			7647	
5109	वसुधातुकारिका	2606	विचारषट्त्रिंशिकावचूरिः	
2583	} वसुधारा	7362	विचारसारप्रकरणम्	
6900			7345	विजयकरसिञ्जाय
6676	,, महाविद्या	7461	विजयकरधन्वम्	
4836	,, नाम धारणी- परिसूत्रम्	6995	विजयसेठनीस्वाध्याय	
4840	वसुन्धरोद्देशः	6763	विधिसंयहः (असम्पूर्णः)	
7429	वाक्यप्रकाशमौक्तिकम् by धर्मसूरि	7712	विनयाध्ययनम्	
6827	वादखलम् by जिनपतिसूरि	2595	} विपाकसूत्रम् वृत्तिसहितम्	
		7459		
		7103	विमलजिनस्तवः	
		2580	विमलनाथ चरितम् by ज्ञानसागर	

No.	Name.	No.	Name.	
1528	विमलनाथ पुराणम् by ब्रह्मकृष्णदास	7388	वीसस्यानक स्तवः	
7286	विम्बपरीक्षाप्रकरणम्	7233	वीसविहरमायाजिनस्तव- पूजा	
6898	विम्बप्रवेशविधिः (असम्पूर्णाः)	7851	वृद्धालौठाला	
6970	विवाहपाटी	6835	वृद्धस्तवः	
8050	विविक्तनामसंग्रहः by भानुचन्द्र	7045	वृद्धहोराचक्र (हिन्दी) (आद्यपत्रद्वयाभावः)	
6664	विवेकचिन्तामणि (हिन्दीभाषा)	6708	वृन्दविनोदसतसह by कविवृन्द	
7025	विंशतिपदपूजाविधिः	6990	वृन्दारवृत्तिः	
6628	विंशतिस्थानकाधिकार	6887	वेदभिन्नी चउपी	
7041	विशेषशतकम् by समयसुन्दर	7150	वैराग्यगीत	
7029	विशेषशतकसूची	6683	वैराग्यदीपकसूलभद्रवेलि	
1270	वीतरागस्तोत्रम्	6741 } 6825 } 6851 }	वैराग्यशतकम् सटीकम्	
6764	वीरकाण्ड अज्जगणम्	7168		व्याकरणम् (किञ्चित्)
7022	वीरचरितम् (असम्पूर्णम्)	6643		व्याख्यानसंग्रहः
7337 } 7359 }	वीरजिन भक्तिस्तवादिः	7210	व्याख्याषट्प्रकारी	
6874		वीरद्वित्रिंशिका		श ।
7134	वीरस्तवादि	7348	शक्रस्तवः by सिद्धसेन दिवाकर	
7381	वीरस्तुतिः	6951 } 7307 }	शङ्खेश्वरपार्श्वजिनस्तोत्रम्	
6742	वीरस्तव्यध्ययनम्	7075		„ „ स्तवादिः
7438	वीसस्यानक जैती	2589 } 7611 }	शतकम् (सटीकं)	
7663	„ „ (सटीक)			
7358	„ „ तपोविधिः			

No.	Name.	No.	Name.
2585	शतार्थी by जिनमाणिक्य गणि	6850 } 7722 }	शासनदेवी स्तवः
7027	शतावचूरिः (अक्षम्पूर्णाः)	7007	शाश्वतीप्रतिमाप्रासाद जिनस्तवः
6642	शत्रुञ्जयमहातीर्थमाहा- त्यम् by जिनहर्षसूरि	6988	शिखरगिरिस्तवनम्
7152	शत्रुञ्जयरास	7266 } 7542 } 7652 }	शिखरजीका रास
7697	शनिस्तोत्रम्	6945	श्रीतलजिनस्तुतिः
7082) 7720)	शनैश्चर कृन्द	6746) 7395)	श्रीतलनाथजिनस्तवः
7349	शनैश्चरदेव कथा	7367	श्रीलक्ष्मणप्रकाशः
7262	शान्तिकाधिकारविधिः (आचारदिनकरौयः)	7153	श्रीलक्ष्मणमहा उत्तमरास
2579	शान्तिनाथचरितम् by अजितप्रभसूरि	6868	श्रीलोपदेशमाला
2550) 8041) 6627)	शान्तिनाथचरितम् by भावचन्द्रसूरि	2551	,, ,, or श्रील- तरङ्गिणी
1474	शान्तिनाथपुराणम्	6637	श्रीलोपदेशमाला-बालाव- बोधः by रत्नमूर्ति
6660) 7119) 7150) 7263)	,, स्तवनम्	7031	श्रीलोपरि सिञ्चाय
6849) 7430) 7721)	शान्तिस्तवः	6980	श्रीलोपरे चन्द्रकेवलीरास
7714	शान्तिस्तवटीकादिः	7211	शुक्लदिसप्ततिकाकथा (अक्षम्पूर्णा)
6774	शारदाष्टक	7382	शुभषण्ड
7175	शालभद्र चौपड	7268	शुद्धारवैराग्यतरङ्गिणी by सोमप्रभाचार्य
6892	शाश्वतजिनस्तवः	6732) 7624)	श्रमणसूत्रम्
		6738	शास्त्रप्रतिक्रमणसूत्रवृत्तिः

No.	Name.	No.	Name.
7240	श्राद्धवन्दना	2576	श्रीपालचरितम् (सटीकम्) by जयकीर्ति
7681	श्राद्धविधिः वा श्रावक- विधिः	6635	श्रीपालनरेन्द्रकथा (सटीका)
7718	श्रावककर्म	7229	श्रीपालरास
6997 } 7329 }	श्रावककरणी	7072	श्रीपतिस्तोत्रम्
7057	श्रावकपडिक्रमणसूक्तम्	6901	श्रीसुत्तरत्नावली by क्षमाकल्याण
6956	श्रावकप्रतिक्रमणसूत्रम् (सटीकं)	7472	श्रेणिक चौपड
7181	श्रावकप्रतिक्रमणबालाव- बोधः	3486 } 7038 }	श्रेणिकराज कथा
7234	श्रावकप्रतिक्रमणसूत्रार्थः	1506	श्लोकवार्तिकम् or तत्त्वार्थश्लोकवार्तिकम्
6894 } 7631 }	श्रावकविधिप्रकाशः by क्षमाकल्याण		ष ।
7270	श्रावकसामयिक पारीजड	7047	षट्कायसिन्ध्याय
7140	श्रावकस्त्वंगं	7327	षट्कारकसंग्रहः (शेषपत्रमात्रम्) by अमरचन्द्र
1468	श्रावकाचारः by पद्मनन्दिसुनि	2566 } 6634 }	षट्त्रिंशदध्ययनटीका or उत्तराध्यायनटीका (सुख- बोधा) by देवेन्द्रगणि
7505	श्रावकातिचारः	7504	षट्भाषामयचन्द्रप्रभुगीत
6767	श्रावकाराधना	2589	षट्श्रीतिकाख्यकर्मग्रन्थः सटीकः
7355	” ” बालावबोधः	6659	षट्श्लोकी (विवरण- सहिता)
6923	श्रीचन्द्रचरितम् (अक्षरपूर्णं)	7046	षट्समासाः
7085	श्रीपालचरितम् (अक्षरपूर्णं)		
2577	श्रीपालचरितम् by जयकीर्ति		

No.	Name.
7446 } 7611 }	षडशीतिका
6806	„ „ टीका (अक्षरपूर्णा)
7188	षड्विंशतिप्रश्नोत्तरम्
7720	षडङ्ककी चौडाली
6729	षष्टिशतकव्याख्यानम् by सहजमण्डनगणि
6838	षामणा गीत
6794	षोडशकविवरणम् by यशोभद्रसूरि
स ।	
7690	संग्रहगुटिका
7227	संग्रहणीप्रकरणम् (सटीकं)
7571	संग्रहणीवृत्तिः by देवभद्रसूरि
7407	संग्रहणीव्याख्या by शिवनिधानगणि
6802 } 6906 }	संग्रहणीसूत्रम्
7412	„ „ विवरणम् by दयासिंहगणि
6987	संवत्सरो (अक्षरपूर्णा)
7856	संवेगीरास

No.	Name.
7666	संस्कृतमञ्जरी (अक्षरपूर्णा)
7655	संस्तरप्रकरणम्
7685	संस्तरक पदसम्
7155	सगन्धदशमीकथा
6667	सगरोज्वारः
2596	सङ्घनिर्युक्तिस्त्रयम् by भद्रवाङ्मामौ
7148	सङ्घपट्टकम् (सटीकं)
3060	„ „ प्रकरणम् (सावचूरि)
6906	सङ्घेयीसूत्रम्
6661	सच्चिताचित्त विवरण- सिञ्चाय by कवि नयविमल
7018	सच्चिताचित्तसिञ्चाय
7209	सञ्जनचित्तवक्त्रम्:
6737 } 6855 }	सतरेभेदीपूजा (सटीका)
6648 } 6755 }	सतीसिञ्चाय
7553	सन्तनाथस्तवः
6697	सन्तकुमार सिञ्चाय
7718	सन्तरनिरन्तरद्वार मन्दा- दङ्कम्
6895 } 7584 }	सन्धासामयिकविध्यादिः
4182	सप्ततित्याख्या

No.	Name.	No.	Name.
2578	सप्ततिका टीका by मलयगिरि	2547 } 7842 }	सम्बोधसप्ततिका (सटीका)
7021	सप्तधातूपधातुशोधनम्	7153	सम्भवनाद्यादिगीत
7564	सप्तप्रकारहृन्दः	1462	सम्भेदश्रिखरिमाहात्म्यम्
6678	सभासारनाटक (ई पत्र)	7186	सम्यक्कौमुदी कथा
7841	सभासारनाटकम् by रघुराम	7447	सम्यक्सप्ततिका
6658	समकितके ५ भेद	6826 } 686३ } 7660 }	सरस्वतीहृन्दः
7264	समकितपचीश्रीसूत्र (सटीक)	7614	सरस्वतीदृढस्तोत्रम्
7204	समकितविचारः	6650	सरस्वतीस्तोत्रम्
7504	समग्रजिनस्तुतिः	7364	सरस्वत्यष्टकम् by विद्याविलास
6845	समयसारनाटक	6917 } 7449 }	सर्वजिनमिश्रितस्तोत्रम्
6701 } 7690 }	समयसारनाटक भाषा- कविल by वनारसी- दास	6832	सर्वतपग्रहणकरणाविधिः
6717	Do. incomplete	7657	सर्वार्थिष्ठितस्मरणम्
1500	समयसारव्याख्या (आत्मव्याप्तिः)	1502	सर्वार्थसिद्धिः
7153	सम्भवनाथगीत	7221	सहस्रकूटजिनस्तवः
8048	समरादित्यचरित्रम् by सुमतिवर्द्धनमुनि	7406	साधर्मिककुलक
7457	समवायः	7087	साधारणजिनस्तवः
6685 } 6898 }	समवायाङ्गसूत्रम्	7674	साधुपद
6848	समस्तविंशतिपदस्तुतिः	7381	साधुप्रतिक्रमणसूत्रम्
6910	सम्यक्त्यागिका	7067 } 7309 } 7720 }	साधुवन्दना
		6913	साधुसतसह
		7493	साधुसमाचारौ

No.	Name.	No.	Name.	
6788	सान्तरनिरन्तरद्वारमहा- दण्डकम्	285	सिद्धहेमचन्द्राभिधान- स्वोपज्ञशब्दानुशासन- वृत्तिः (८ माध्यायः)	
7414	सामयिकविधिः	25 1/2		
7151	सामयिकविधिपड़िकमण	7997B.		
7317	„ विधादिः	7997A.	Ditto (१-३ अध्यायस्य २ य पादः)	
1465	सारचौवीशी	2567	Ditto लघुवृत्तिः (१-५ अध्यायाः)	
2716	सारदाकन्दः	2609	Ditto लघुन्यासः (१-७ अध्यायाः)	
6774	सारदाकृत्	6726}	सिद्धाचलस्तवनम्	
6645	सारसतटीका (सावबोधिका)	7009}		
1477	सार्द्धद्वयद्वीपजिनपूजा	68:7	सिद्धान्तवोलविचार	
7691	सावलिङ्गा चौपद, etc.	7420	सिद्धान्तसारसमुच्चयः	
7705	सावलिङ्गावातदूँहा	6763	सिद्धावगतदण्डवीविचार	
6649}	सिञ्जायादिसंग्रह	1519	सिद्धान्तसारः	
6757}			1526	„ „ दीपकम् by सकलकीर्ति
6770}	सिञ्जाय	1511	सिद्धान्तसारसंग्रहः by नरेन्द्रासन	
6842}			7558	सिद्धान्तोक्तदण्डवीविचारः
6916}			1537}	सिन्दूरप्रकरणम्
7375}			4326}	
7487}			6890}	
7623}			7322}	by सोमप्रभाचार्य
7353	सिद्धगण	7267	सिन्दूरप्रकरणम् (सटीकम्)	
7492	सिद्धचक्रवाणी	7506	सिन्दूरप्रकरणटीका by हर्षकीर्तिसूरि	
6994}	सिद्धचक्रस्तुतिः	6640	सिन्दूरप्रकरणवालावबोध (समूलः)	
7481}				
6748	सिद्धचक्राष्टप्रकारौपूजा			
1490	सिद्धचक्राष्टपूजाटीका by अतसागर			

No.	Name.	No.	Name.
7690	सिन्दूरप्रकरणभाषा	7454	सूत्रकृताङ्गम्
6928	सौताचरित्रम् (असम्पूर्णम्)	2578	„ „ वृत्तिः by श्रीलाचार्य
7308	सौतारामचरितम् (असम्पूर्णम्)	6919	सूत्रोक्तसाधुवन्दना
1489	सुखविधानम् by जगन्नाथ	7195	सूयगडाङ्गसूत्रम्
2566	सुखबोधा (उत्तराध्ययन- टीका)	7508	„ „ (सटीकम्)
1762	सुखबोधार्थमाज्ञापद्धतिः by देवसेन	7439	„ „ (प्रथमश्रुतस्तम्भः)
7155 } 7308 }	सुगन्धदशमी कथा	2607	सूयगडस्त्रीवीउसन्धो सटीकः
7111	सुगमाष्टकं	7012	सूरिस्तुतिः
7421	सुपार्श्वनाथगीतादिः	7536	सूर्यस्यष्टौकरणम् (?)
1534 } 6633 }	सुभाषितयज्ञः by सकलकीर्ति	7415	सूर्यजैरोसिलोको
1480	सुभाषितरत्नसन्दोहः by अमितगति	7000 } 7150 }	सेतुञ्जयस्तवनं
8977	सुभाषितावली	7723	सेतुराजरास
6692	सुमतिकुमतिशिञ्जय	7705	सेरठविज्ञावातदृष्टा
7805	सुमतिसम्भवकाव्यम् by सर्व्वविजयसुकवि	6748	सेलसपन
7448	सुसङ्कथा	7051	सेलसतीस्वाध्याय
6764	सूक्तिसुक्तावली	6953	सौभाग्यपञ्चमीविधि, etc.
6762	„ (९ पत्र मात्रम्)	7597	सौभाग्यपञ्चमीस्तवनं
6901	सूक्तरत्नावली by क्षमाकल्याण	6709 } 6979 } 7016 } 7174 } 7189 } 7226 } 7245 }	स्तवसंग्रहः
7768	सूचनिकापत्रम्	7380 } 7695 } 7696 } 7727 }	

No.	Name.	No.	Name.
7018 } 7302 } 7697 } 7698 }	स्तवादिसंग्रहः	7112	स्याद्वादमतसिञ्जाय
7118 } 7249 } 7402 } 7605 }	स्तुतिसंग्रहः	7240	स्याद्वादस्वाध्याय
6840 } 7160 } 7537 }	स्तोत्रविधिः	7766	सस्तिवाचनविधिः
7593 } 7659 }	स्त्रीजन्मकुण्डली	6645	स्वावबोधिका
7166 } 7521 }	स्त्रीजातकम्	7261 } 7443 }	स्वाध्यायः
6854	स्थविरावलीचरितम् by हेमचन्द्र	ह ।	
2544	स्थानाङ्गसूत्रम् वृत्ति- सहितम्	6940	हयालीसिञ्जाय
6904	स्थूलभद्रनवरसगीत	7672	हरिश्चन्द्रतारालोचनी- चरित
6852	स्थूलभद्रसिञ्जाय	7146	हरियालीसिञ्जाय
7104 } 7701 }	स्नाचपूजाविधिः	7357	हस्तसङ्गोवनम् (असम्पूर्णम्)
589 } 7995 }	स्याद्वादमङ्गरी by मन्निषेयाचार्य	7205 } 7590 }	हितोपदेशस्वाध्यायः
		7558	ऋग्विचारः
		7157	हेतूपदेशः
		7998	हेमचन्द्रधातुपाठटीका
		7999	„ अनेकार्थटीका
		8000	„ लिङ्गानुशासन- टीका
		7028	होमविधिः (असम्पूर्णाः)

Society's Collection.

III.	E.	1 } 266 }	गौतमपृष्ठावृत्तिः
"	"		
III.	A.	87	जन्मपत्रोपद्धतिः
I.	B.	75	जिनतत्त्वचन्द्रिका by महादेव भट्टाचार्य
III.	H.	1	जैनकर्मविपाकवृत्तिः
III.	H.	21	ठाणाङ्गवृत्तिः by अभयदेव
III.	F.	144	दमयन्ती कथा by त्रिविक्रम
III.	C.	108	,, ,, वितृतिः by गुणविनय
III.	H.	27	नायधम्म कथा
"	"	25	परमात्मप्रकाशविवरणम्
III.	E.	2	भक्तामरस्तोत्रम् सटीकम्
	B.	58	सूर्यप्रक्षिप्तीका by मलयगिरि

46. NUMISMATIC SUPPLEMENT No. IX.

Note.—The numeration of the article below is continued from p. 592 of the "Journal and Proceedings" for 1907.

Catalogue of the Coins in the Indian Museum, Calcutta, including the Cabinet of the Asiatic Society of Bengal: Vol. III, Mughal Emperors of India, by H. NELSON WRIGHT, I.C.S., pages lxxxiv—360: Oxford, Clarendon Press, 1908.

58.—The List of Coins in the Indian Museum, compiled by the late Mr. C. J. Rodgers, and published at Calcutta in 1894, could not possibly be regarded as in any sense an adequate or final presentment of the contents of the Museum Cabinets. In the preparation of that list Mr. Rodgers laboured under conditions of exceptional difficulty. In a letter in my possession he mentioned: "When I look back upon the work I had to give to this Catalogue I am astonished I ever finished it. Imagine about 7,000 coins, all higgledy-piggledy. They had to be arranged with the original numbers. I was not allowed to number them consecutively. It took me two years of constant work. It had all to be written three times before things came into order." These brave efforts notwithstanding, the final result left much to be desired. The illustrations were few and poorly executed; the method of coin-numbering was a hidden mystery; and the transcription of the legends, while always correct, yet in many cases failed to indicate the arrangement of the constituent words. That the List, despite its defects, has during the past fourteen years proved serviceable, all collectors of Indian Mughal Coins will gratefully testify; but that it was a production worthy of the noble Museum in Calcutta, no one would for a moment maintain.

It thus became in every way desirable, and especially in view of the large additions recently made, that the work of arranging and registering the coins should be undertaken entirely *de novo*, and that a complete and illustrated Catalogue, as distinct from a bare List, should be prepared. By the publication within the past few weeks of Volume III of the "Catalogue of the Coins in the Indian Museum, Calcutta," the volume treating of the Coins of the Mughal Emperors of India, from Bābar to Bahādur II, the Trustees of that Museum have now at length admirably supplied this long-felt want. They were fortunate in securing the services of Mr. H. Nelson Wright, I.C.S., for the compilation of the Catalogue, and did well in having it printed at the Clarendon Press, Oxford. The illustrations, twenty-two large beautiful Plates, and the Map of India, showing the Mint-towns, add immensely to the numismatic value of the work. It is not too

much to say that now for the first time the combined cabinets of the Indian Museum and of the Asiatic Society of Bengal have been made really available to the public. Comparatively few persons can visit Calcutta to explore the Coin Department of its Museum; but, thanks to this admirable Catalogue, the Coins have now been placed virtually in our hand, and admit of inspection whenever we will. For the Mughal Period, say, from 1526 to 1858, no other treatise is at all as definitely helpful to the student of Indian Numismatics; for not only has Mr. Wright with an infinite patience and accuracy marshalled numerous details, but he has grouped and correlated them with singular skill. One scarcely knows which more to admire, the ample stock of minute information or its lucid presentment.

More than 2,500 coins pass under review, and some of the specimens, registered here quite unpretentiously, furnish legends which till now have baffled the ingenuity of numismatists. For example, one has long wished to discover the marginal readings on the rupees early struck by Akbar in the Aḥmadābād Mint. Well! No. 111 in the Catalogue gives these legends in full. It is also a pleasure to note the entry of some of the very recent finds, such as the square Akbarī fulūs from the Ujjain Mint (No. 527). Reference is further made to the Mint-name Ujjainpūr, even though the Museum evidently does not possess a specimen bearing the name in this enlarged form. Two rupees of the Purbandar Mint, Nos. 1503 and 1697 are given on Plates XIII and XIV, and a Narwar rupee, No. 2249 on Plate XIX. An excellent specimen is shown of the Zinatu-l-bilād Aḥmadābād rupee, No. 1816, and the Bandar-i-mubārak Sūrāt rupee, No. 1539, is also figured. Of the reign of Shāh 'Ālam II alone coins of the following rare mints are represented in the Plates XX—XXII: Chhachrauli, ? Khārpūr, Jammūn, Gokulgarh, Barāli Qiṭ'a and Ānwala.

But the most distinctive feature of the volume is the able and luminous Introduction, pages xiii—lxxxii, devoted to notes on the various Mint-towns recorded on the coins in the Indian Museum. In the treatment of each mint a due proportion has been preserved; and the gathered information supplied regarding the coins struck at the more important Imperial Mints is of especial value. Every page of this Introduction evidences wide numismatic research and also an intimate acquaintance with the presently existing coin cabinets. In his Preface Mr. Wright makes mention of the "considerable impetus" that has in recent years been imparted to the study of the coins of the Mughals, and the chief sources of this newly-awakened interest he also indicates. But most assuredly no more inspiring work has been produced, and none more practically helpful, than just this volume itself. It certainly should avail to enthuse many a student in the field of Oriental research, and bring him under the spell of those quaint coins that once passed freely from hand to hand but are now so difficult of acquisition.

If under the impulse of this Catalogue fresh numismatic

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efforts be made, we sincerely hope they will be on the lines Mr. Wright has suggested. Let a series of monographs be prepared, each dealing with the issues from a separate mint. For work of this nature Mr. Wright's Introduction has already paved the way, and by its help quite a number of such monographs might be readily outlined: the filling in alone is now needed. In one of the last letters that I received from Mr. C. J. Rodgers, he expressed a desire identical with that which Mr. Wright now voices. He stated that he would like to see the whole of India—or, at least, all that had at any time been subject to the Mughal sway—parcelled out into a dozen or so different districts, and in each district he would have a competent person set apart for the collecting and cataloguing of its coins. Thus, one after another, the requisite local monographs would be forthcoming, from which could readily be prepared, it might be merely by co-ordination, an authoritative *Corpus Numismatum*. This plan is certainly simple enough, and Mr. Wright's Introduction goes far to encourage the hope that the cherished scheme will yet be realized.

Naturally the chief value of this Catalogue consists in the fullness and accuracy of its details, and it is to these that any serviceable criticism of the book must mainly relate. No one will be more thankful than Mr. Wright himself for any information elicited that will supplement or modify the statements in his volume. In a Review, however, one's attention must be directed not so much to details as to the general principles that have been observed in the compilation of the Catalogue. Mr. Wright having the courage of his convictions, his work has not been carried out just on the lines laid down by earlier writers. He has, indeed, made a distinct forward movement. Yet, along with much that we cordially appreciate and welcome, there are two matters regarding which opinion will surely be divided. First and foremost, why should there have been any need for a "Table showing the method of Transliteration adopted in this Catalogue"? It is a dozen years since the Royal Asiatic Society set its imprimatur on a now well-known system of transliteration, and strongly urged its general employment, in order that "Oriental studies may thereby be facilitated." Several of the coins described by Mr. Wright are the property of the Asiatic Society of Bengal, and accordingly in the Catalogue that registers them one would have expected that the method of transliteration so definitely approved by the Royal Asiatic would have been adopted. It seems a pity that this course has not been pursued. However, for only three letters do the transliteration-equivalents accepted for this Catalogue differ from those in the Asiatic Society's Scheme. In its English dress ث now appears as *ṭ* instead of *th*, ف as *z* instead of *f*, and ذ as *z* instead of *dh*. So, alas! the reader has now to discriminate between four *z*'s, to wit, ز = *z*, ض = *z*, ظ = *z*, and ذ = *z*. It should also be noted that چ and ش are represented by the digraphs *ch* and *sh* without the usual subscribed line; and,

moreover, the long vowels are now distinguished by the slanting stroke (*accent aigu*), a sign that should naturally be reserved to indicate word-stress or an accented syllable. It is true the changes thus introduced are, after all, but few, and, as they concern only letters of infrequent occurrence, any inconvenience occasioned is but slight. None the less one would have preferred a cordial and complete compliance with the urgent recommendations of a Society that has proved itself so true and constant a friend of Oriental scholarship.

Further, when consulting this volume, one must bear in mind that the order in which the mints are arranged is the *English* alphabetical order. In the Preface Mr. Wright expressly states: "I have purposely avoided an arrangement according to the Persian alphabet, in the belief that the majority of those using the volume are likely to be more readily conversant with the former than with the latter." Now in this belief Mr. Wright is quite probably correct; but even so it might still have been well to arrange these mints, written as they were originally in Persian characters, as Persian scholars would arrange them. In high-class work, such as this volume abundantly evidences, the methods adopted need not be determined solely in accordance with the qualifications of the readers. A judicious care must be exercised, lest, in consulting convenience, the presentment of the subject itself be prejudiced. If only this Catalogue had been a less scholarly production, one might have been more content to accept the English order, but, just because it is rich in scholarship and so fine a piece of honest work, one feels that, if only for consistency's sake, the Persian alphabetical order of the mints should have been followed. For here assuredly not utility alone but "*Wissenschaftlichkeit*" too may well press its claims. Could one imagine, for instance, a German "*Gelehrte*" permitting an arrangement, shall I say, so Philistine? But clearly Mr. Wright is willing to be, even in his scholarship, English rather than German. Well! we, as Englishmen, must try not to complain.

Except for the method of transliteration and the alphabetical arrangement—and these, after all, relate merely to the form not to the matter—all else in the Book is of distinctly the highest quality. Though crowded with details and cross-references, its accuracy is beyond all praise. [But *Ūrdū* should not only occasionally but always be written *Ūrdū* with its first vowel short; and on page xv, line 37, the date 1009 should be changed to 1007.] Two features of special excellence merit detailed notice; one is the clear definition supplied of the "obverse" of a coin, and its consistent application; and the other the strict grouping of all the coins (of the same metal) that issued during any one reign from one and the same mint.

Many coin-collectors have, we are sure, felt at times a doubt as to which side of a coin should be called the "obverse" and which the "reverse," but, thanks to Mr. Wright's lucid explanation, no one henceforward need hesitate. It is only necessary to bear in mind that the obverse of a coin is conventionally held to

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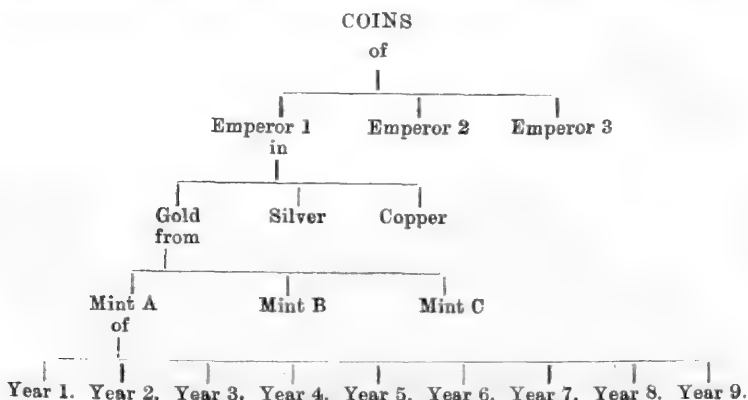
be the side more honourable. Now obviously the sacrosanct Kalima or else its Akbari substitute (الله اكبر جل جلاله), since enshrining the holy name of Allah, is essentially pre-eminent in honour. Next in rank, at least within his own dominion, will come the name of the Emperor, that "shadow of the favour of Allah" (سايه فضل الله); while at a lower grade in the scale of precedence will stand the mint-name. Hence arises the following rule:—

- (a) The "obverse" of a coin is, and absolutely, that side which bears either the Kalima or the Akbari formula.
- (b) Only in the absence of these should the side on which stands the Emperor's name be regarded as the "obverse."
- (c) And, further, where none of the three occurs, neither Kalima, nor formula, nor Emperor's name, the presence of the mint-name suffices to constitute *its* side the "obverse."

Naturally, however, where the legends on the two sides of a coin, read continuously, form a single couplet or quatrain, the "obverse" is reserved for the *first* half, even though it be the second half that carries the distinction of containing the name of the Emperor.

Next with reference to the distinctive method of grouping the coins that are recorded in this volume. In the British Museum and other Catalogues the order in which coins of the same Emperor and the same metal are entered is simply that of chronological sequence; and hence specimens differing widely amongst themselves are yet found placed side by side, owing to the merely fortuitous circumstance that they happened to have issued from their several mints at approximately the same time. The registering of coins by mere rule of thumb—earlier date then earlier entry—is certainly an easy process; but no less certainly such arrangement has only the very slightest scientific value. Recognizing the inutility of this method of grouping, the method hitherto in vogue, Mr. Wright, by boldly adventuring to follow a new principle of classification, has immensely enhanced the usefulness of his book as a practical working catalogue. First the coins are grouped under the different Emperors; next the coins of each Emperor are separated according to their metal, gold or silver or copper; and lastly under each Emperor the coins of each metal are classified according to their mints, the several members of these mint-sub-groups being arranged chronologically. Here, then, we have a distinctly scientific presentation of the coins that issued in different years from each mint during each reign. A couple of years ago at Mr. R. Burn's suggestion I rearranged my own cabinet in accordance with this new method, and can bear personal testimony to the decided advantage that has since accrued. Our hope is that this system of classification will ere

long meet with general adoption. The scheme of division and sub-division is clearly indicated in the following "Tree":—



Every student who even cursorily runs through this Catalogue will perceive that the mere rearrangement as above of the coins sets them before us so naturally and in so orderly a manner as to ensure a more accurate and intelligent acquaintance with them. Slight variations in any one given type, and the passage, whether abrupt or gradual, from one type to another are by the present grouping evidenced each in its own sequence; and this volume now for the first time supplies material duly arranged for tracing any improvement or deterioration that may have taken place in the design of the coins, also any development in their legends. To have rendered this high service is no small achievement, and by his compilation of a Catalogue thus distinguished Mr. Wright has amply earned the grateful thanks of every worker in the fascinating field of Indian Numismatics.

GEO. P. TAYLOR.

Ahmadābād : 1st August, 1908.



AUGUST, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 5th August, 1908, at 9-15 P.M.

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L., D.Sc., President, in the chair.

The following members were present :—

Dr. N. Annandale, Prof. J. A. Cunningham, Mr. B. L. Chaudhuri, Mr. W. A. Christie, Mr. E. P. Harrison, Sir Thomas Holland, Mr. D. Hooper, Mr. C. M. Hutchinson, Mr. H. C. Jones, Mr. T. H. D. La Touche, Dr. Girindranath Mukhopadhyaya, Rev. A. H. Phillips, Major L. Rogers, I.M.S., Dr. E. D. Ross, Rai Ram Brahma Sauryal, Bahadur, Mahamahopadhyaya Haraprasad Shastri, Captain F. H. Stewart, I.M.S., Mr. G. H. Tipper, Dr. Satis Chandra Vidyabhusana, Mr. E. Vredenburg, Mr. D. R. Wallace, Mr. W. C. Wordsworth, Rev. A. W. Young.

Visitors.—Mr. O. A. Dykes, Babu Hem Chandra Das-Gupta, Mr. C. T. Park, and Capt. E. G. R. DeLabilliere.

The minutes of the last meeting were read and confirmed.

Thirty-nine presentations were announced.

The General Secretary reported the death of Dr. M. M. Masoom, an Ordinary Member of the Society.

The General Secretary reported that Mr. E. P. Chapman and Lieutenant-Colonel E. C. Hare, I.M.S., had expressed a wish to withdraw from the Society.

The following two gentlemen were balloted for as Ordinary Members :—

Captain F. A. F. Barnardo, M.B., I.M.S., Eden Hospital, Calcutta, proposed by Major L. Rogers, I.M.S., seconded by Lieut.-Col. W. J. Buchanan, I.M.S.; and *Captain F. F. Owens*, M.B., I.M.S., Chemical Examiner's Department, Government of Bengal, proposed by Major L. Rogers, I.M.S., seconded by Lieut.-Col. W. J. Buchanan, I.M.S.

Sir Thomas Holland exhibited a glaciated boulder from the Blaini conglomerate near Simla.

The President proposed a vote of congratulation to Sir Thomas Holland, which was carried with acclamation.

Sir Thomas Holland replied, thanking the Society.

Mr. H. Cecil Jones exhibited specimens collected from the shales near Rampura (Lat. 24° 28' ; Long. 75° 28'), which belong to the Vindhyan formation, probably to the Upper Vindhyan.

Dr. N. Annandale exhibited a collection of Indian Moth-Flies (Psychodidæ) including specimens of a recent species of the genus *Diplonema*.

Mr. T. Bentham exhibited a series of skins and skulls of the Takin (*Budorcas*) from the Mishmi Hills, Assam, and from Eastern Tibet.

Captain F. H. Stewart, I.M.S., exhibited a collection of fishes made by him at high altitudes in Tibet.

Captain R. E. Lloyd, I.M.S., exhibited some deep-sea fishes recently dredged by the R.I.M.S. "Investigator."

Mr. B. L. Chaudhuri, B.A., B.Sc., exhibited specimens of fish, etc., captured by the steam trawler of the Government of Bengal, and read the following remarks:—

As suggested by Mr. K. G. Gupta in his second report, the Government of Bengal has brought out a small steam trawler (of 183 gross tonnage, 110 ft. long and 21 ft. across beam) for a systematic fishery survey of the Bay for food fishes.

"The main points that have to be determined by the experiment are: (1) to locate the fishing ground; (2) to ascertain by actual catch which of the various appliances with which the vessel has been fitted out (*viz.*, Otter trawl, drift nets, and set lines) would be best for each particular area and for each different kind of fish; and (3) to determine the amount of ice necessary to keep fish caught fresh and sound till brought to market.

The vessel, after some addition and alteration, sailed for her trial trip on the 13th of June and came back on the 23rd of the same month after encountering the first rush of Monsoon in its full force. She went out again on the 6th July and came back on the 14th of the month after cruising right across the Bay near Elephant Point in worst weather condition. She again left on the 30th July for her third cruise.

The collection placed on the table consists of selected specimens of her catches in these trial trips. There are over 30 species of fish of which three are believed to be new to science and many are for the first time reported from the locality. There are also some interesting specimens of Alcyonarians, Echinoderms, with a few crabs and other crustacea. In the catches the well-known Isinglass fish (*Polynemus indicus*) was plentiful, and so also were good sized soles and big skates.

The steam trawler had taken out, each time, 15 to 20 tons of ice, and was successful in landing fish quite fresh and sweet with nearly more than half the quantity of ice left over."

The following papers were read:—

1. *Major James Rennell's Journals, 1764-1767.*—*Edited by T. H. D. LATOUCHE, B.A., F.G.S.*

This paper will be published in a subsequent number of the *Journal*.

2. *Fresh Light on the word "Scarlet."*—By DR. E. DENISON ROSS.

3. *Diagnosis of a Living Species of the Fossil Genus Diplonema* (Psychodid Diptera).—By N. ANNANDALE, D.Sc., C.M.Z.S.

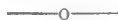
This paper has been published in the *Journal* for June 1908.

4. *The Kosi River, and some lessons to be learnt from it.*—By CAPTAIN F. C. HIRST, I.A.

5. *A General Theory of Osculating Conics.* (Second paper).—By PROF. SYAMADAS MUKHOPADHYAYA, M.A. *Communicated by the President.*

These papers will be published in a subsequent number of the *Journal*.

6. *Memoir on the Surgical Instruments of the Hindus, with a comparative study of the Surgical Instruments of the Greek, Roman, Arab, and the Modern European Surgeons. Part III, The Sharp Instruments.*—By GIRENDRANATH MUKHOPADHYAYA, B.A., M.B.



The Adjourned Meeting of the Medical Section was held at the Society's Rooms on Wednesday, August 12th, 1908, at 9-15 P.M.

LIEUT.-COL. W. J. BUCHANAN, I.M.S., in the chair.

The following members were present :—

Dr. Adrian Caddy, Captain F. P. Connor, I.M.S., Lieut.-Col. F. J. Drury, I.M.S., Dr. O. M. Eakins, Lieut.-Col. C. R. M. Green, I.M.S., Captain D. McCay, I.M.S., Dr. Girindranath Mukhopadhyaya, Major J. Mulvany, I.M.S., Major F. O'Kinealy, I.M.S., Dr. T. F. Pearse, Lieut.-Col. H. W. Pilgrim, I.M.S., Captain F. H. Stewart, I.M.S., Major J. C. Vaughan, I.M.S., Major L. Rogers, I.M.S., Honorary Secretary.

Visitors :—Miss Baumler, M.D., Dr. S. C. Ghosh, Dr. Abinash Chandra Roy, Captain H. E. Smith, I.M.S., Lieut.-Col. W. B. Thomson, R.A.M.C.

The minutes of the last meeting were read and confirmed.

Lieut.-Col. Drury showed cases of Paramyoclonus multiplex and Infantile Hemiplegia with Athetosis.

Major O'Kinealy showed cases of anklyloblepharen and Parinaud's conjunctivitis.

Captain Connor showed cases of bilateral papillema of the tonsil, and a patient from whom the whole clavicle had been removed for myeloid sarcoma, with very little deformity, and a case of multiple tumours in the abdomen.

A note was read on the incidence of Gall-Stones in Calcutta by Major L. Rogers, I.M.S.



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

- Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained by application to the Honorary Secretary, 57, Park Street, Calcutta.

PRIVILEGES OF ORDINARY MEMBERS.

- (a) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.
- (b) To propose and second candidates for Ordinary Membership.
- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
- (e) To take out books, plates and manuscripts from the Library.
- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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List of Officers and Members of Council

OF THE

ASIATIC SOCIETY OF BENGAL

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47. *Dioscorearum novarum Descriptiones quædam*

auctoribus

D. PRAIN et I. H. BURKILL.

Descriptæ sunt :—

- Dioscorea aspersa*, ex China australe,
Dioscorea belophylloides, ex China orientale,
Dioscorea Benthamii, ex China orientale,
Dioscorea bicolor, ex China australe,
Dioscorea Cumingii, ex insulis Philippinensibus,
Dioscorea daunæa, ex Burma inferiore,
Dioscorea Fordii, ex China orientale,
Dioscorea Hemsleyi, ex China australe et collibus Shanorum,
Dioscorea Listeri, ex provincia Assam in India,
Dioscorea melanophyma, ex alpihus himalayicis et China australe,
Dioscorea Morsei, ex China australe,
Dioscorea persimilis, ex China australe et colonia gallica Tonkin,
Dioscorea præcox, ex China australe,
Dioscorea Scortekhimii, ex peninsula Malayana et colonia gallica Tonkin,
Dioscorea vexans, ex insulis Andamanicis,
Dioscorea warburgiana, ex insula Celebes,
Dioscorea Wattii, ex montibus Assamicis Sikkimensibusque.

DIOSCOREA ASPERSA.—*Radix* nobis ignota. *Caules* glabri, obscure triangulares, inermes, dextrorsum volubiles, purpureofusci. *Folia* alterna, membranacea, glabra, nigro-aspersa, late cordata, acuminata, apice mucronulata, sinu basis obtusissimo, margine integro, majora 10 cm. longa 11 cm. lata, 9-nervia, nervis extimis profunde bifidis, nervulis secundariis indistinctis; petiolus glaber, supra canaliculatus, 7 cm. longus. *Spicæ masculæ* simplices, binæ vel ternæ, ad 5 cm. longæ; alabastra ellipsoidea; flores solitarii, sessiles, in rhachi minopere angulato 1—2 mm. remoti; bractæ ovatæ, ad 1 mm. longæ; bracteolæ bracteis latiores, floribus multo breviores. *Perianthii masculi* lacinis exteriores ovate, obtusæ, incrassatæ; interiores exterioribus paululo minores, parum incrassatæ. *Stamina* sex, æqualia, perianthio distincte breviora; antheræ filamentis æquilongæ. *Planta* fœminea ignota.

CHINA AUSTRALIS. In provincia Yunnan, supra Meng-tze in monte "Great Black Mountain" dicto ad 7000-8000 ped. alt., Hancock, 287.

Typus in Herbario Horti Regalis Kewensis conservatus est.

DIOSCOREA BELOPHYILLOIDES. *Radix* nobis ignota. *Caulis* glaber, inermis, teretiusculus, dextrorsum volubilis, livido-viridis. *Folia* alterna vel opposita, chartacea, utrinque glaberrima, basis sinu latissimo, ovato-hastata, acuminata, apice minutissime mucronulata, margine integra, ad 10 cm. longa, ad 4 cm. lata, 7-nervia, nervis extimis profunde bifidis, nervulis secundariis reticulatis infra distinctis; petiolus glaber, tenuis, sulcatus, ad 4 cm. longus. *Spicæ masculæ* nunc ternæ ad axillas foliorum, nunc ad axillas bractearum in racemum brevem conjunctæ; alabastra elongata, obtusa; flores sessiles in rhachi angulato rigidiusculo alternatim 1—2 mm. distantes; bracteæ lanceolatæ, ad 2 mm. longæ; bracteolæ ovato-acuminatæ, naviculari-concavæ, glabræ, floribus multo breviores. *Perianthii masculi* lacinia exterioribus ovato-concavæ, brunneo-lineolatæ, 1—1.25 mm. longæ; interiores exterioribus similes at minora tenuiora. *Stamina* sex, æqualia, filamentis æquilonga; antheræ filamentis duplo longiores. *Spicæ femineæ* solitariae vel binæ, simplices, axillares, ad 4 cm. longæ, ? dependentes; flores 4—8, breviter pedicellati, circiter 5 mm. remoti; bracteæ et bracteolæ adsunt. *Capsulæ* pedicellatæ; alæ maturæ pergamentaceæ, latiores quam semicirculares, fulvæ, punctulis lineolisque horizontalibus notatæ, 17—19 mm. longæ, 14—15 mm. latæ. *Semina* in quoque loculo solitaria (? semper), rotundata, complanata, 12—14 mm. longa, 12—14 mm. lata, ala membranacea loculum fere implente subæqualiter circumcincta.—D. glabra, C. H. Wright, pro parte, in Journ. Linn. Soc. Bot. xxxi (1903), p. 91 (syn. excl.).

CHINA ORIENTALIS. In provincia Kiang-si ad Kinkiang, *Shearer*; et in montibus Lu-shan, *Bullock*.

Typi in Herbario Horti Regalis Kewensis reperiuntur.

DIOSCOREA BENTHAMII. *Radix* nobis ignota. *Caulis* glabri, teretes, inermes, dextrorsum volubiles, rufescentes. *Folia* opposita, glabra, subtus fulvescentia, lanceolato-ovata, basi rotunda, apice acuminata mucronulata, ad 8 cm. longa, ad 3 cm. lata, quinque-nervia, nervis extimis tenuibus apicem versus evanescentibus, nervulis secundariis oblique transversis subtortuosus supra invisibilibus infra distinctis, herbacea, margine nec hyalino; petiolus glaber, canaliculatus, 15 mm. longus. *Spicæ masculæ* singulæ vel binæ vel ternæ in paniculas longas volubiles racemiformes dispositæ, nunc in axillis foliorum parvorum nunc in axillis bractearum, ad 25 mm. longæ, 10—20-floræ; rhachis in modo zigzag conspicuissime flexuosa; alabastra globosa, magna; flores solitarii, sessiles, 2 mm. remoti; bracteæ deltoideo-ovatae, acuminatæ, 1 mm. longæ; bracteolæ iis breviores. *Perianthii masculi* lacinia libera, biseriata, brunneo-lineolatæ; exteriores rotundæ, concavæ, 1.5 mm. longæ; interiores obovatæ, exterioribus crassiores paullulo breviores. *Stamina* sex, æqualia, in basi floribus inserta; antheræ oblongæ, introrsæ, filamentis longiores. *Racemi feminei* singuli vel bini in axillis foliorum, longi, 4—10-flori, deflexi; rhachis glaber, triangularis; bracteæ ovato-acuminatæ;

flores fœminei despicientes; pedicelli 1 mm. longi. *Perianthii fœminei* laciniāe exteriores ovatāe, acutāe, crassāe, 1.25 mm. longæ, brunneo-lineolatāe; interiores crassiores, subclavatāe, 1 mm. longæ. *Capsulāe* dependentes, puberulāe, stipitatāe, apice retrorsāe; alæ pergamentaceāe, latiores quam semicirculares, fulvæ, brunneo-lineolatāe, 12—14 mm. longæ, 11—12 mm. latāe. *Semina* gemina, circumcirca alata.—D. oppositifolia, Bentham, Flora Hongkongensis (1861), p. 367; C. H. Wright, pro parte, in Journ. Linn. Soc. Bot. xxxi (1903), p. 92 (syn. excl.)

CHINA ORIENTALIS. In Colonia britannica Hongkong: Happy Valley, et Little Hongkong, (in Herb. Hongkong); Tytam, *Hance*.

DIOSCOREA BICOLOR. *Rhizoma* nobis ignotum. *Caules* alte scandentes, teretiusculi, glabri, inermes, dextrorsum volubiles, viridi-rufescentes. Folia opposita (omnia?) utrinque glaberrima, fere concoloria, pallide lineolata, subcordata, breviter acuminata, apice minutissime mucronulata, sinu basis lato, margine integro, plurima 5 cm. longa, 5 cm. lata, maxima visa 6 cm. longa 7 cm. lata, 9-nervia, nervis extimis in foliis maximis bifidis, nervulis secundariis subrectis utrinque distinctis; petiolus glaber, sulcatus, ad 5 cm. longus. *Spicāe masculāe* simplices, sæpius ternæ ad axillas foliorum, pedunculo 1 cm. longo incluso ad 12 cm. longæ, 50—70-florāe; flores alternatim sessiles in rhachi trigono densius dispositi; bracteāe lanceolatāe 1—1.5 mm. longæ; bracteolæ perparvæ, ovatāe. *Perianthii masculi* laciniāe biseriatāe; exteriores e basi gibbosa orbiculato-ovatāe, obtusæ, brunneo-maculatāe, fere 2 mm. longæ; interiores clavatāe, vix 1 mm. longæ. *Stamina* sex, æqualia, 0.5 mm. longa; filamenta antheris æquilonga. *Spicāe fœmineæ* axillares, solitariāe, simplices, 10—12-florāe; flores? despicientes; bracteāe ovato-lanceolatāe. *Perianthii fœminei* laciniāe biseriatāe, ovatāe, interiores minores crassāe. *Stamina* imperfecta sex. *Stigmata* conspicua. *Capsulāe* sæpius respicientes, vel ab axi patentem; alæ pergamentaceāe, exacte dimidiato-ellipticāe, apicem et basin versus acutāe, subglanceāe, 22—25 mm. longæ, 8—9 mm. latāe.

CHINA AUSTRALIS. In provincia Yunnan, in dumosis propè Mao-kou-tchong supra Ta-pin-tze ad 6500 ped. alt., *Delavay*, 2397; et sine loco, *Delavay*, 1829.

Typi in Herbario Horti Botanici Parisiani conservati sunt. *Species fructu distinctissima.*

DIOSCOREA CUMINGII. *Radix* nobis ignota. *Caulis* hirtis brevibus dense vestitus, crassiusculus, inermis, sinistrorsum volubilis, rufo-nigrescens. *Folia* alterna, quinata; foliola chartacea, supra ad nervum medium hirsuta, inter nervos pilis minutis sparsim hirtella, infra lanuginosa; foliola media anguste elliptica, basi acuta, apice breviter acuminata, margine integro, ad 10 cm. longa, ad 3 cm. lata, penninervia, nervis

secundariis utrinque sex, nervulis reticulatis supra sat distinctis; foliola intermedia similia; foliola externa inæqualiter anguste ovato-elliptica, 7 cm. longa, 2.5 cm. lata, nervo laterali primo fere medium æquante; petioluli 1 cm. longi. *Racemi masculi* amentiformes in paniculam ad 50 cm. longam axillarem copiose producti, pedicellati, 5—10 mm. longi; flores dense in rhachem villosum aggregati, pedicellati; bractea in pedicello insidens, ovato-acuminata, villosa; bracteolæ similes at minores. *Perianthii masculi* lacinia ovato-lanceolata, ad apicem canaliculata, albo notata, velut si unguem proferentes, exteriores interioribus paulo majores. *Stamina* tres, æqualia; antheræ filamentis æquilongæ; staminodia lata, staminibus paullulo magis conspicua.

INSULÆ PHILIPPINENSES. In insula Luzon, districtu Batangas, *Cuming*, 1469.

Typus in Herbario Horti Regalis Kewensis conservatus est.

DIOSCOREA DAUNEA. *Rhizoma* ? horizontale, carne alba. *Caules* glabri, inermes, purpureo-maculati, teretes, sinistrorsum volubiles. *Folia* glaberrima, alterna, lanceolato-ovato-sagittata, apice acuminata, sinu basi vel profundo id est anguste deltoideo vel in foliis parvis aperto, margine integro, majora ad 16 cm. longa, ad 7 cm. lata, 5—7-nervia, nervis extimis ad medium bifidis, nervis proximis conspicuissime curvatis, nervis secundariis in rete nervulorum decedentibus utrinque distinctis; petiolus glaber, canaliculatus, 5 cm. longus. *Racemi masculi* vel axillares vel in inflorescentiam longam terminalem laxam racemiformem dispositi, ad 5 cm. longi, 8—20 flori, ascendentes, e basi ipsa ramum singulum gerentes dimidio vel ultra breviorum; rhachis glaber, rectus; alabastra globosa, glabra; bracteæ perparvæ, lanceolatae, acuminatae, 0.5 longæ; bracteolæ similes, minores; flores respicientes; pedicelli 1 mm. longi. *Perianthii masculi* lacinia in tubo infundibuliforme connata, subsimiles, lanceolatae, acutæ, brunneo-maculatae, 2 mm. longæ; tubus 1.5 mm. longus. *Stamina* sex, æqualia, in parte inferiori perianthii laciniarum inserta; antheræ oblongæ, didymæ, incurvæ, albæ, introrsæ.

BURMA. In districtu Amherst in cacumine montium Danna inter vicos Kawkareik et Thingan-nyi-naung versus fines siamenses, alt. 3000 ped. alt., *Burkill*, 30296.

Typi in Herbariis hortorum botanicorum ad Kew et Cattam conservati sunt.

DIOSCOREA FORDII. *Radix* nobis ignota. *Caulis* glaber, teretiusculus, inermis, dextrorsum volubilis, viridis. *Folia* opposita, chartacea, glaberrima, ovato-hastata vel ovato-sagittata, acuminata, sinu basi late deltoideo, margine integro, 7—8 cm. longa, 4 cm. lata, 5- vel 7-nervia, nervis subexternis distinctissime arcuatis, nervulis secundariis reticulatis infra distinctis; petiolus

[N.S.]

glaber, sulcatus, 2—3 cm. longus. *Spicæ masculæ* simplices, sæpius 2—4-næ, in racemum 10—16 cm. longum ad nodos 5—15 mm. remotos dispositæ; alabastra globosa; flores sessiles in rhachi tetragono glabro 1 mm. distantes; racemi pedunculus glaber nunc 2 cm. nunc ad 6 cm. longus; bracteæ sub spicis lanceolatæ, 2 mm. longæ; eæ sub floribus ovato-lanceolatæ; bracteolæ ovato-acuminatæ, naviculari-concavæ. *Perianthii masculi* lacinie exteriores majores, subrotundatæ, concavæ, obtusissimæ, 0.75 mm. longæ; interiores minores clavatæ. *Stamina* sex, æqualia, antheræ introrsæ filamentis æquilongæ. *Spicæ feminæ* axillares, solitariæ, simplices, fructu maturo ad 18 cm. longæ, dependentes; flores ad 12. *Capsulæ* sessiles, dependentes; alæ maturæ pergamentacæ, conspicuissime latiores quam semi-circulares, 2 cm. longæ, latæ, fusco-stramineæ. *Semina* in quoque loculo gemina, subrotundata, fere 2 cm. lata, inæqualiter circumcirca alata, rufo-brunnea. D. Batatas, Bentham pro parte, Flora Hongkongensis, (1861) p. 368, C. H. Wright in Journ. Linn. Soc. Bot. xxxi (1903), p. 91; D. glabra, C. H. Wright, pro parte, in Journ. Linn. Soc. Bot. xxxi (1903), p. 91.

CHINA ORIENTALIS. In colonia Hongkong, *Wright*; etiamque in insula adjacente Lantao, *Ford*, 3; prope Wonkæ ejusdem insulæ, *Lamont*, 758, et *mercenarius Fordii*, 659.

Typi in Herbario Regale Kewense conservati sunt.

DIOSCOREA HEMSLEYI. *Radix* ignota. *Caules* pubescentes vel puberuli, ætate glabrescentes, inermes, aliquo modo canaliculati, sinistrorsum volubiles; bulbillæ absunt. *Folia* alterna, late cordata, membranacea, supra puberula, infra dense pubescentia vel ætate parum puberula pallidiora, late cordata, basis sinu rotundata, margine integro, acuminata, apice mucronulata, 8 cm. longa, 8 cm. lata, 9-nervia, nervis extimis sæpius bifurcatis, nervulis secundariis subrectis quam tertiariis parum magis conspicuis, omnibus supra distinctis, majoribus infra solum prominentibus distinctis; petiolus pubescens vel puberulus, inermis, supra late canaliculatus, 5 cm. longus. *Cymæ masculæ* 2—4 mm. longæ, 3—4-floræ vel raræ 1—2-floræ, in racemis amentiformibus ex axillis foliorum divergentibus vel dependentibus ad 10 cm. longis dispositæ; rhachis basi 10—25 mm. longa sterilis, pubescens, trigonus; bracteæ ovato-cordatæ vel lanceolato-cordatæ, puberulæ; bracteolæ absunt. *Perianthii masculi* floris campanulati lacinie in tubo brevi connatæ externe villosæ; tubus 1 mm. longus; lacinie lanceolatæ, obtusæ, brunneo-lineolatæ, exteriores quam interiores paullulo longiores. *Stamina* sex, ad tubi superioram partem affixa, æqualia, perianthio conspicue breviora; antheræ filamentis breviores. *Spicæ feminæ* solitariæ, ex axillis foliorum dependentes, 5—16-floræ, 3—5 cm. longæ; flores solitarii, sessiles, ad 2 mm. remoti; bracteæ lanceolato-cordatæ vel ovato-cordatæ. *Perianthium* *feminei* floris externe pubescens; lacinie ovatæ, brunneo-lineolatæ. *Stamina* infertilia parva adsunt. *Ovarium* dense

pubescens. *Capsulæ* respicientes, parum imbricatæ, glabrescentes, maturitate glabræ, basi aliquomodo retusæ, apice conspicuissime retusæ; alæ semi-oblancoelato-ellipticæ, pergamentacæ, castaneo-fulvæ, ad apicem cristatæ, 25 mm. longæ, 7 mm. latæ. *Semina* gemina, inæqualiter alata.

CHINA AUSTRALIS ETIAMQUE IN MONTIBUS SHANICIS. In provincia Yunnan, prope Meng-tze, inter herbis ad 5000 ped. alt., *Henry*, 10287. In montibus Shanicis principatu Yawng-hwe ad Fort Stedman, *Abdul Khalil*, et ad Indein, alias Ang-teng, *Abdul Khalil*; Pwe-hla, in principatu ejusdem nominis ad 4000 ped. alt., *Collett*, 826.

Typi in Horto Botanico Regali ad Calcuttam conservati sunt. Species hæc ab omnibus asiaticis descriptis fructu distinctissima est; sed ex China media cel. Pottingerius, dux in exploratione geographica specimen unicum imperfectum fructu simillimum attulit, de quo hoc tempore disputatio ulla inutilis erit.

DIOSCOREA LISTERI. *Radix* nobis ignota. *Caules* glabri, 3 mm. diametro, spinosi, rufo-straminei, alte scandentes; bulbilli magnæ, pyriformes, breviter pedicellati, 10 cm. longi, carne siccitate fulva nigro-reticulata. *Folia* alterna, late ovata, pergamentacea, supra glabra, infra basi solum pilis stellatis tecta, apice acuminata, basi cordata vel truncato-cordata, sinu latissimo, margine integro, ad 18 cm. longa, ad 16 cm. lata, 7-nervia, nervis extimis debilibus, nervis subexternis ad medium folii evanescentibus, nervulis secundariis obliquis subrectis; rete nervulorum utrinque distinctum; petiolus pubescens, canaliculatus, 10 cm. longus. *Flores* ignoti. *Spicæ feminæ* 6—8-floræ, fructiferæ ad 12 cm. longæ; rhachis subtriangularis, pubescens. *Capsulæ* magnæ, stipitatæ, apice truncatæ, stipite pilis stellatis dense tecto; alæ coriaceæ, latiores quam semicirculares, flavo-stramineæ, 35 mm. longæ, 30 mm. latæ. *Semina* gemina, castanea, loculo fere implentia, ala membranacea inæqualiter circumcincta.

ASSAM. In montibus Duphlarum, *Lister*; in montibus Nagarum, in valle fluminis Dekho, *Watt*, 11083; in districtu Sibsagar, ad Tengali Bam, *Huq.*

Typi in Herbario Horti Botanici Regalis ad Calcuttam conservati sunt. Teste cel. Wattoo planta bulbillos ita copiose format ut dejecti terram obtigent.

DIOSCOREA MELANOPHYMA. *Tubera* obovoideo-rotundata, dense radiculis oblecta, carne roseo-alba esculente. *Caules* glabri, inermes, teretes, straminei, sinistrorsum volubiles; bulbilli nigri, numerosissimi, ad axillas foliorum producti, 5—7 mm. diametro. *Folia* alterna, quinquefolia vel septemfolia, glaberrima, utrinque viridia; petiolus glaber, canaliculatus, 6 cm. longus; foliola petiolata; medium lanceolatum, basi acutum, apice acuminatum, acumine mirabile attenuato, ad 9 cm. longum, ad 22 mm. latum, penninervium, nervis

lateralibus utrinque sex supra inconspicuis infra parum conspicuis, rete nervulorum invisibile; foliola externa lanceolato-elliptica, medii dimidio aequilonga vel minora; petioli ad 6 mm. longi; necnon in cauliculis filamentosis folia triphylla vel simplicia perparva ad-sunt; hae simplicia ovata abrupte in acu apicali ineuntia. *Racemi masculi* amentiformes, singuli vel per paria producti in axillis foliorum parvorum vel bractearum, ad 7 cm. longi, 20—40-flori; rhachis albo-pubescentis, basi ad 10 mm. sterilis, supra flores solitarios 1 mm. distantes gerens, teres, nec tortus; alabastra globosa; bracteae rotundato-ovatae, acuminatae, in pedicello insidentes, pubescentes; bracteolae absunt. *Perianthii masculi* laciniae biseriatae; exteriores rotundato-ovatae, acutae, pubescentes, 1 mm. longae; interiores ovatae, breviores, crassiores. *Stamina* sex, difformia, tres ante perianthii lacinias exteriores fere didymae introrsae, tres altera parva forsitan sterilia, omnia aequilonga, dimidio laciniae breviora. *Spicae femineae* solitariae, in axillis foliorum superiorum, 3—4 cm. longae, 8—20-florae; rhachis tenuis, in 15 mm. basalibus sterilis, pubescentis; bracteae ovatae, acuminatae, 1 mm. longae; bracteolae parvae, pubescentes, margine ciliatae, lanceolatae. *Perianthii feminei* laciniae biseriatae, pubescentes, exteriores ovato-lanceolatae acute, interiores oblanceolatae minores. *Ovarium* pubescens. *Capsulae* respicientes, fulvae, herbaceo-pergamentacea, apice truncatae, basi rotundatae; alae semi-ovatae, concolores, 12—14 mm. longae, 5 mm. latae. *Semina* ignota. *Dioscorea melanophryma* (sphalm.) Duthie in Strachey, Catalogue of the plants of Kumaon, 1906, p. 186. *Vitis* No. 9032, Wall. Cat.

MONTES INDIE BOREALIS ET CHINE AUSTRO-OCIDENTALIS. Montes Himalayicæ sine loco, *T. Thomson* in Herb. Ind. or. Hook. f. & Thomson: in principatu Kashmir ad Basoli, 4500 ped. alt., *C. B. Clarke*, 31548; in principatus Chamba valle Sao, 4000—6000 ped. alt., *Lace*, 1201: in regione Kulu, *Trevor* in Mus. R. E. P. 27893: in principatibus Simlensibus prope Simla, *T. Thomson*, *Edgeworth*, 83; ad Jowai, 6000 ped. alt., *Gamble*, 4921: infra Sipi, *Collett*, 819; in districtu Almora ad urbem Almora, 4000—6000 ped. alt., *Madden*, et 5000—6500 ped. alt. *Strachey*; in districtu Dehra Dun ad Missouri, 5500—6000 ped. alt., *King*, *Mackinnon*, *Gollan*, 22145 in Mus. R. E. P., *Duthie*, 23098; in collibus supra Rajpur, ad 4000 ped. alt., *Gollan*: in Garhwal, *Gopal Dutt Pant*, 19962 in Mus. R. E. P.: in regno Nepalia, probabiliter ex vicinitate urbis Khatmandu, *Scully*, 261: montes Bhutanicæ forsitan, sine loco, *Griffith*, 956 (K. D. 5560). Montes Khasianæ, sine loco, *De Silva* in Wall. Coll., 9032; infra Cherrapunji, *Hooker f. et T. Thomson*; *Soyung* ad 5500 ped. alt., *C. B. Clarke*, 44724. In Chinæ provincia Yunnan, sine loco, *Bons d'Anty*; ad Meng-tze, 5500 ped. alt., *Henry*, 10253; etiamque in sylvis ad 4600 ped. alt. *Henry*, 9495 D; ad Ta-ouang-miao prope Ta-pin-tze, *Delavay*, 3189; ad radices montis Pee-tsoang-long-chan, *Delavay*, 6643.

Typi in Herbariis hortorum regalium ad Kew et Calcuttam conservati sunt. Species hæc cum *D. kamaonensi*, Kunth, facile neglegentia confunditur; at enim distincta est.

DIOSCOREA MORSEI. *Radix* nobis ignota. *Caules* glabri, filiformes, inermes, sinistrorsum volubiles, virides. *Folia* alterna, tenuiter chartacea, supra glaberrima, subtus ad nervos pilis perpusillis simplicibus sparsim hirtella, deltoideo-cordata, acutissima vel acuminato-acutissima, sinu basis latissimo, margine undulata scariosa, 7-nervia, nervis extimis bifidis, nervulis reticulatis infra distinctis, plurima 6 cm. longa, 3.5—4 cm. lata; petiolus glaber, sulcatus, 2—3 cm. longus. *Spicæ masculæ* singulæ, simplices, axillares; flores solitarii vel bini, sessiles, in rhachi trigono sparsim dispositi; bracteæ sub glomerulis florum ovatæ, acuminatæ; bracteolæ obtusæ, sæpe trilobæ. *Perianthii masculi* crateriformis lacinia ovatæ, apice subrotundatæ. *Staminum* filamenta sex, æqualia, fertilia tres, sterilia tres; antheræ didymæ. *Planta* feminea ignota.

CHINA AUSTRALIS. In provincia Kwangsi, ad Kuling, *Morse*, 28.

Typus in Herbario Horti Regalis Kewensis conservatus est. Species hæc foliis *D. panthaicæ*, Prain et Burkill, similis; differt staminibus.

DIOSCOREA PERSIMILIS. *Radix* ignota. *Caules* glabri, subquad-rangulares, inermes, dextrorsum volubiles, rufescentes. *Folia* subopposita vel alterna, chartacea, glaberrima, pellucide lineolata, ovato-hastata, acuminata, apice minutissime mucronulata, sinu basis late deltoideo, margine integro, rufinervia, 8—10 cm. longa, 5—8 cm. lata, septem-nervia, nervis extimis profunde bifidis, nervulis secundariis subrectis subtus distinctis; petiolus glaber, supra canaliculatus, 5—8 cm. longus. *Spicæ masculæ* singulæ vel per paria in racemum 10—16 cm. longum dispositæ, 10—15 mm. longæ 5—20-floræ; flores in rhachi glabro 1 mm. remoti; alabastra subrotunda; bracteæ rufæ, ovatæ, ad 1 mm. longæ; bracteolæ rufæ, late ovatæ, acutæ vel acuminatæ, glabræ, floribus dimidio breviores. *Perianthii masculi* lacinia fere æquilongæ, brunneo-lineolatæ, exteriores naviculari-concavæ subacutæ, interiores obovatæ obtusæ. *Stamina* sex, æqualia; antheræ filamentis longiores. *Spicæ femineæ* axillares, dependentes, simplices, 10—20 cm. longæ; flores 8—15, breviter pedicellati, despicientes, in rhachi angulato circa 1 cm. remoti; bracteæ et bracteolæ adsunt. *Capulæ* despicientes, alæ maturæ pergamentaceæ, paullulo latiores quam semicirculares, rufo-stramineæ, livido notatæ, 20 mm. longæ, 15 mm. latæ. *Semina* in quoque loculo gemina, orbiculata, complanata, ala membranacea testacea fere regulariter circumcincta. *D. glabra* et *D. japonica*, C. H. Wright, pro parte, in Journ. Linn. Soc. Bot. xxxi (1903), pp. 91-92.

CHINA AUSTRALIS ET TONKIN. In provincia Chinensi Kwang-tung in montibus Lo-fan, *Fordii mercenarius*, 330; Kow-lun vel in terra adjacente, *Fordii mercenarius*, 183; in insula Hainan, *Henry*, 8407, 8690. Tonkin, in sylvis montosis prope Quangyen, *Balansa*, 300; ad Moe-ha, *Balansa*, 4454.

[N.S.]

Typi in Herbario Horti Regalis Kewensis conservati sunt.
Species *D. alata*, Linn., maxime affinis est.

DIOSCOREA PRÆCOX. *Tubera* duo, in terram descendentes. *Caulis* singulus, teretiusculus, inermis, hirsuto-glabrescens, sinistrorsum volubilis, 50—100 cm. altus. *Folia* alterna, tenniter chartacea, pilis mollibus supra sparsim infra dense hirsuta, late cordata vel superiora ovato-cordata, breviter acuminata, apice minutissime mucronulata, sinu basis lato, margine integra, 7—9-nervia, nervis extimis sæpe bifidis, nervis secundariis subrectis utrinque distinctis, majora ad 7 cm. longa et 7 cm. lata, plurima 4 cm. longa et 4 cm. lata; petiolus hirsutus, sulcatus, 2—8 cm. longus. *Cymæ masculæ* axillares, 4—8-floræ, 18 mm. longæ; flores subsessiles in rhachi hirsuto; bracteæ lineari lanceolatæ, 3 mm. longæ; bracteolæ lanceolatæ, minores. *Perianthii masculi* laciniaë biseriataë, omnes lanceolatæ, subobtusæ, brunneo-punctatæ, exteriores quam interiores paullulo majores, 1 mm. longæ, nec patentés; infundibulum 1—1.5 mm. longum. *Stamina* sex, in tubi superiore parte affixa; antheræ introrsæ, filamentis longiores. *Cymæ femineæ* 3-floræ; axis 2—4 mm. longus; flores ovario incluso 4 mm. longi. *Perianthii feminei* laciniaë ovataë, subobtusæ. *Antheræ* infertiles sex. *Ovarium* lanosum. *Fructus* ignotus.

CHINA AUSTRALIS. In provincia Yunnan, in clivis calcareis prope Kongti, infra fauces Hi-chan-men, ad 6500 ped., *Delavay*, 3030; Yunnanfu, *Ducloux*, 737.

Typi in herbario Horti Botanici Parisiensis conservati sunt. Species hæc ex affinitate *D. yunnanensis*, Prain et Burkill, et *D. birmanicæ*, Prain et Burkill, est. Inter cognatas statura pusilla distinctissima.

DIOSCOREA SCORTECHINII. *Radix* nobis ignota. *Caulis* pilis rufis hirtello-glabrescentes, spinosi, castanei, ut videtur dextrorsum volubiles. *Folia* alterna, 5—7-folia, glabra. siccitate brunneo-viridia; petiolus glaber, parum canaliculatus, 6—7 cm. longus; foliola petiolulata; foliolium medium oblanceolato-obovatum, basi acutum, ex apice obtuso vel subrotundato abrupte acuminatum, ad 8 cm. longum, ad 4 cm. latum, penninervium, nervis lateralibus utrinque ad 7, supra indistinctis infra distinctis; rete nervulorum indistinctum; petiolulus 5 mm. longus; foliola lateralia medio simillima sed paululo minorâ. *Planta mascula* ignota. *Spicæ femineæ* longissime pedunculatæ, 10—20-floræ, solitariaë, ex axillis foliorum parvorum superiorum vel bractearum pendulæ; pedunculus sterilis pilis rufis hirta, mox glabrescens, ad 10 cm. longus; rhachis fertilis pilis castaneis subsistentibus hirsutus, ad 6 cm. longus; bracteæ ovataë, acutaë, castaneæ, pubescentes, 2 mm. longæ. *Flores* subsessiles. *Perianthii feminei* laciniaë consimiles, late ovataë, acutaë, pilis castaneis dense pubescentes, 1.5 mm. longæ. *Ovarium* dense pilis castaneis pubescens, 4—5 mm. longum. *Cupsulæ* conspicuæ,

expicientes, apice mucronatæ, basi truncato-cordatæ, mox maturitate ad apicem secedentes; alæ subrectangulares, angulis externis duobus rotundatis, glabræ, fusco-castaneæ, 4—5 cm. longæ, 11—12 mm. latæ. *Semina* ignota.

PERAK. Maxwell's hill, *Scortechini*. TONKIN. In monte Bavi, ad 6500 ped. alt., *Balansa*, 4325.

Typi in Herbario Horti Botanici Regalis ad Calcuttam conservati sunt et ad Kew. Species distinctissima.

DIOSCOREA VEXANS. *Tubera* esculenta. *Caules* glabri, teretiusculi, inermes, dextrorsum volubiles, virides vel rubescentes, nec bulbilliferi. *Folia* utrinque glabra, viridia, pellucido-punctata vel lineolata, opposita vel alterna, sæpissime opposita vel subopposita, ovata vel cordato-ovata vel in plantis immaturis ovato-hastata, apice acuminata, basi vel obtusissima vel truncata vel sinu aperto cordata vel hastata, margine integro anguste hyalino, 8—12 cm. longa, 5—8 cm. lata, 3—5-nervia, nervis primariis lateralibus a medio remotioribus, nervulis secundariis supra vix distinctis infra distinctis aliquomodo tortuosis; petiolus glaber, sulcatus, 2—5 cm. longus vel longior. *Spicæ masculæ* nunc 1—4-natæ in inflorescentiis racemiformes 14—25 cm. longas decurvas dispositæ, nunc at raro ad foliorum axillas 4—6-glomeratæ, 8—20 mm. longæ, 9—25-floræ; rhachis paniculæ tenuis; rhaches spicarum in modo zigzag torti, filiformes; alabastra globosa, sessiles; bracteæ ovatæ, acutæ, 0.5 mm. longæ; bracteolæ similes, perparvæ. *Perianthii masculi* lacinie exteriores oblongæ, obtusæ, firmæ, brunneo-lineolatæ, vix 1 mm. longæ; interiores exterioribus minores, oblanceolatæ, crassæ. *Stamina* sex, æqualia, antheris filamenta æquantibus introrsis. *Spicæ femineæ* 1—2-natæ, 15—20 cm. longæ, dependentes, circa 12-floræ; flores feminei stricte sessiles, despicientes, 1—2 cm. remoti, bibracteolati, glabri. *Capsulæ* dependentes, stipitatæ; alæ subcoriaceæ, semicirculares et apice et basi cuneatæ, immaturæ 2 cm. longæ 1 cm. latæ.

INSULE ANDAMANICÆ. Sine locis, *Man*, *Prainii mercenarius*, 25, 97; South Andaman, sine loco, *Heinig*, 314; Port Blair in collibus saxosis, *Kingii mercenarius*, 553, 569; Port Mouat in sylvis montosis, *Kingii mercenarius*; Bajajag valley, *Heinig*; Namuna ghar, *King*; Balughat, *Kingii mercenarius*: Baratang island, *Rogers*.

Typi in Herbario Horti Regalis ad Calcuttam conservati sunt. Species hæc ad *D. glabram*, Roxb., valde affinis est; differt foliis inflorescentiisque.

DIOSCOREA WARBURGIANA, Uline. *Radix* nobis ignota. *Caules* glabri, teretiusculi, leves, ut videtur dextrorsum volubiles. *Folia* alterna glabra, subcoriacea, utrinque viridia, ovato-elliptica, basi rotundata vel truncata, apice subito breviterque acuminata, apice ipso rotundato, 11—12 cm. longa, 8 cm. lata, margine rigido hya-

lino, septem-nervia, nervis extimis supra ad medium evanescentibus, nervulis reticulatis, supra et infra prominentibus; petiolus glaber, conspicue sulcatus, 4 cm. longus. *Spicæ masculæ* binæ vel ternæ vel quaternæ ad axillas foliorum, usque ad 17 cm. longæ; alabastra ovato-oblonga; flores ad 60, solitarii, sessiles, remotiores; bracteæ oblongo-lanceolatæ; bracteolæ ovato-oblongæ, acuminatæ, bracteis dimidio breviores. *Perianthii masculi* laciniae coriaceæ, ovato-oblongæ, apice rotundatæ, biseriatæ, brunneo-lineolatæ; exteriores basi latæ; interiores basi angustatæ, exterioribus minores. *Stamina* sex, ad basin perianthii inserta, subæqualia; antheræ oblongæ, filamentis duplo longiores. *Planta feminea* ignota. *D. warburgiana*, Uline MS., ex Koorders in Mededeel. 'S'Lands Plantentuin, xix (1898) 313.

INSULA CELEBES. In districtu Minahasa (Menado) in sylvis prope Pinamorongan, Koorders, 16720; ad Gorontalo, Riedel.

Species hæc ex exemplis a cel. Koordersio benevolente commissis descripta est.

DIOSCOREA WATTII. *Tubera* ignota. *Caulis* glabri, striati lineis 8 vel pluribus, juniores inermes, dextrorsum volubiles, virides, nec bulbiferi. *Folium* utrinque glabra, nitentia, viridia, coriacea, opposita vel alterna (sæpissime opposita vel subopposita), elongato-ovata, acuminata, apice mucronulata, basi rotundata, margine integro flavo indurato, ad 10 cm. longa, ad 5 cm. lata, 5-nervia, nervis extimis submarginalibus, nervulis secundariis subjectis supra subdistinctis infra distinctis; petiolus glaber, late sulcatus, 3—4 cm. longus. *Spicæ masculæ* 2—4-natæ in inflorescentiis racemiformibus strictis ad 20 cm. longis dispositæ, 3—4 cm. longæ, 15—25-floræ; rhachis paniculæ fere 2 mm. diametro; rhaches spicarum recti vel aliquomodo curvati: alabastra obovoideo-globosa, sessilia; bracteæ ovatæ, acuminatæ, ad axim repressæ; bracteolæ absunt. *Perianthii masculæ* laciniae exteriores late oblongæ, apice rotundatæ, firmæ, brunneo-lineolatæ, interiores similes minores. *Stamina* sex, æqualia, antheris filamentis æquilongis introrsis. *Spicæ femineæ* simplices, 10—12-floræ. *Capsulæ* magnæ, despicientes, pedicellatæ; alæ latiores quam semicirculares, admodum coriaceæ, ad basin cuneatæ, 30—34 mm. longæ, 25 mm. latæ. *Semina* in quoque loculo gemina, subovata, complanata, ala membranacea castanea parum inæqualiter circumcincta.

INDIA ORIENTALIS. In montibus sikkimensibus ad Rishop Jhora, King. In montibus Khasianis provinciæ Assam ad Cherrapunji, Griffith; ad Cherrapunji et prope rivulo Borpani, Hooker f. et Thomson; Mambo ad 3000 ped. alt., C. B. Clarke, 43801: in montibus Nagarum sine loco, Griffith, 5551 pro parte; ad Dimapur, 400 ped. alt., Kingii mercenarius; in districtu Sibsagar ad Rajahbari, Watt, 11264. In Bengalìa orientali, sine loco, Griffith, 5537, 5551,

Typi in Herbario Horti Regalis ad Calcuttam conservati sunt. Foliis *D. aculeatæ*, Linn., similis est.



48. Notes on a Buddhist Inscription from Hasra Kol, Gaya.

By ARTHUR VENIS.

The materials for this short notice I owe to the great kindness of A. W. Keith, Esq., of Gaya. During last winter, when opening one of the many mounds still to be seen in the tiny valley of Hasra Kol, 14 miles east of Gaya, Mr. Keith came on the circular slab with the inscription now reproduced. The slab of hornblende rock, 2' 2" diameter, was found in the centre of the mound and 4' below the surface: it was horizontally laid in clay on what would seem to have been the floor of a building. Below it was a shaft 9' square and 10' deep, coated with 1" lime-plaster compactly filled with earth, and resting on a bed of rock. Excavation of this shaft yielded nothing.

Our inscription is a dhāraṇī or magic litany for the protection of a building or enclosure of some kind which belonged to a monk named Vipulākaramati. Lines 11—19 contain the prayers, which begin with an invocation to the Ṛṣis and to the Uṣṇīṣa and white parasol of all the Tathāgatas, and continue with the magic syllables hūm, brām and the rest so combined as to hinder or destroy the evil influences not only of men, yakṣas and rākṣasas, but also of 84,000 demons and 28,000 constellations. Of more special interest to the student of the iconography of Buddhism in its later forms is the unusual combination of a sādhana or mystical invocation (lines 1—11) with a rough, but graphic representation of the process by which the devotee is to realize his identity with the deity (in this case, the Buddha) whom he invokes. There cannot be much doubt as to the symbolism of some of the objects drawn within the circle, viz., the Vajra and the Candra, or white disc of the moon, and the syllable hūm inscribed within the latter. But what is to be said of the human figure on the right and on the left of the Vajra? Mahāmahopādhyāya Haraprasāda Ḡāstri very kindly supplies a note in which he holds that the figure with the full mukūṭa is the Tathāgata with whom the worshipper is directed to identify himself; while the other figure, which does not wear a full mukūṭa, is the worshipper, the difference in the attitudes being intended to show that both the Tathāgata and the worshipper have left the Vajra behind in their flight. A second interpretation I owe to the courtesy of the Rev. Ekai Kuwaguchi of Tokio, now residing in Benares, according to whom "the figure on the observer's right is Upāyakaṅcālya or the Means of Salvation and that on the left is Prajñāpāramitā or Transcendental knowledge." Whether the rude drawings are in themselves decisive is a question for those who know. I would merely recall attention to our text

which describes the devotee at two stages ; first, when by a mental act he is about to realize the yellow hūm within the white disc of the moon (lines 1 and 2) ; and next, when after realizing his identity with the Buddha, he has turned away from Vajra and Moon, चन्द्रवक्षपरारुत्तमात्मानं (l. 4). Can it be the case that the figure here outlined is only that of the devotee himself as in progress through the stages which our text describes ?

Our inscription is not dated ; but on palæographical grounds it may be assigned to the twelfth century. Its alphabet clearly belongs to the Proto-Bengali type, to use the convenient name given by Buehler to that eastern variety of the Nāgari alphabet, which during the twelfth century shows numerous and distinct traces of changes leading up to the modern Bengali Script. The engraver has done his work badly. Some of his errors and omissions are noticed below.

Text.

- Lines 1. ओं नमो बुद्धाय ॥ इति निश्चित्य प्रथमसखच्छदीन्दौ ह्रं भा-
 ,, 2. वयत पीतं ॥ अ आ + + + + + + + + + ओ
 ,, 3. अं आः ॥ क + + + + + + + + + द
 ,, 4. घ + + + + + + + + ह क्ष ॥ भटिति तदनु त
 ,, 5. चन्द्रवक्षपरारुत्तमात्मातं पचामीकरप्रभं भूयर्शमुद्रया युतं ।
 ,, 6. दिव्यरत्नपद्मगर्वसिंहासने वक्षपर्यङ्के निगणं हाटशम-
 ,, 7. हापुरुषलक्षणाशीत्यनुत्यञ्जनविराजितं त्रिचीव-
 ,, 8. रप्रादृतं । विधुतकल्पनाजालगम्भीरोहात्मकं ध-
 ,, 9. र्मधातुखभावाकं तथागतमात्मानं विभाव्य । यथा
 ,, 10. सर्वतथागतास्तथाहमित्युच्चार्य सर्व-
 ,, 11. तथागतात्मभावं । ओं ऋषिगणप्रसस्ति ओं सर्व-
 ,, 12. तथागतोष्णीमसितातुपत्रे । ह्रं भूँ ? स्तम्भनेकरी ह्रं सूँ ? विद्या-
 ,, 13. सचक्षगकरी । ह्रं ? ? ? ष्योँ । मर्यदुष्तानां स्तम्भनकुरी ॥
 ,, 14. ? भ ? ? सर्वयक्षराक्षसग्रहाणां विध्वङ्गनकरी । ह्रं भूँ ह्रूँ
 ,, 15. ष्योँ चतुरशीतीनां ग्रहसहस्राणां विध्वङ्गनकरी । ह्रं भूँ ह्रूँ अ
 ,, 16. ष्टाविङ्शतीनां नक्षत्रासहस्राणां प्रीस्र्धाङ्गनकरी ।
 ,, 17. ह्रं भूँ ह्रूँ ष्योँ ? नां महाग्रहाणां विध्वङ्गनकरी ।
 ,, 18. ह्रं भूँ ह्रूँ ? रक्ष रक्ष भिक्षुविपुलाकरमतेः ॥

Lines 19.

भ्रं भ्रं भ्रं सालो

- „ 20. **आँ ये धर्मा हेतुप्रभवा हेतुन्तोषान्तथाग । तोह्यवदत्तेषां च यो
निरोध एवम्बादौ म ॥ हास्रमणः ॥**

Notes.

- Lines 1. 2. Read प्रथमं सच्चे हीन्दौ (or सच्चहीन्दौ) ह्रं भावयेत् पीतं । The loop to the left of ह्र is marked with a sort of Kākapakṣa, which would seem to mean that the loop is either च wrongly placed below ह्र, or is the vowel sign.
- „ 4. Omit त after तदनु ; as a mark of elision is visible in the right hand margin.
- „ 5. Read चन्द्रवचपरावृत्तमात्मानं तप्तचामीकरप्रभं The conjunct त्त was at first engraved after परावृत्तं and then corrected into म ; but the further necessary corrections were overlooked.
- „ 6. Read पद्मगर्भसिंहासने निषण्णं द्वाविंश
- „ 7. Read स्वभावकं
- „ 11. Supply a principal verb, e.g., विभावयेत् after तथागतात्मभावं Read ऋषिगणप्रशस्ति, which is a loose construction. The cursive form of प्र is here used.
- „ 12. Read तथागतोष्णीषसितातपत्रे ।
- „ 12, 13. विद्यासंरक्षणकरी or विद्वोभरक्षणकरी ?
- „ 13, 14, 16. Read दुष्ट. Mark the not infrequent conjunction of guttural ङ with palatal श which, as Buehler observes, was probably due to faulty pronunciation.
- „ 17. Read अष्टानां महायज्ञाणां. The engraver apparently began with the letter अ.
- „ 19. **भ्रं भ्रं भ्रं सालो** or **मालो** is obscure.



49. The Kosi River, and some lessons to be learnt from it.

By CAPTAIN F. C. HIRST.

Speaking of the work of man, in contrast with that of nature, in the basin of the Mississippi River, Chamberlin and Salisbury, two eminent American scientists, say¹ :—

“The millions of industrial freightage in the Mississippi basin, are, to-day, not wholly incomparable with the drainage transportation of the same area a century ago. . . . It is doubtful whether some parts of this region suffered as much erosion in the preceding five centuries as they have during the last one. . . . In the light of considerations such as these, man may be well regarded not only as a potent geological agent, but dangerously so to himself. The hope is that the intelligence that has wrought a change in surface conditions, serviceable for the present, but dangerously so to the future, will be so enlarged as to inspire a more intelligent control of surface conditions which shall compass the future welfare as well as transient benefit.”

The Mississippi and Ganges (with such parts of the feeders of the latter as occupy a portion of the region known as the Gangetic plain) have much in common, and the advice tendered by the two authorities quoted above applies with greater force to India than to America, because the conclusions arrived at by American experts are based on the results of a scientific examination of the Mississippi River, executed with greater care and in more minute detail than similar operations in any other part of the globe. Where the authorities in the United States have ample information to guide them in dealing practically with river questions, we, in India, are compelled to resort to speculation, based on the analogy of the rivers of other countries which, from time to time, have received careful attention. Since, however, all rivers flowing through plains similar to the Gangetic plain behave in much the same manner, it is not impossible to form a very fair idea of how far it is, or is not, at present, advisable to tamper with such a stream as the Kosi along its reaches in the plains themselves.

The Kosi River is well known to most people in Bengal as a scourge to the districts of Bhagalpur and Purnea, and, from time to time, what may be considered as futile efforts to mitigate, or even annul, the devastating effects of the river have been attempted; the means adopted have invariably been embankments, which, although they may have afforded temporary relief in certain places, cannot be considered to have justified the

¹ Chamberlin and Salisbury, “Geology and its processes,” p. 620.

expenditure which their provision and maintenance entailed and still entail. The history of the endeavours to keep the river under control appears to go back a very long way; although there is no direct evidence to show the date of construction of the Bir Band (*vide* diagram No. 1), which originally appears to have been built along the right bank of the Kosi as a protective work, that date is certainly several centuries back. The Band extends for many miles roughly along Longitude 87° East, and to this day is, in places, in a very fair state of preservation. It bears strong evidences, however, more particularly south of the Bengal and North-Western Railway, of having been broken from time to time, and the frequent gaps in it show that it has suffered considerably either at the hands of the Kosi, or—and this is just as likely—from the ravages of other rivers lying to the west of the Band; no waterways appear to have been left through the Band, and to-day it stands as a relic of a useless attempt to tamper with the movements of a river which has since shown itself to be the master of the situation. The above remarks are based on the assumption that the Bir Band is a river-protection work; there are those who look on it as a boundary fortification; if this latter view is correct, there would assuredly be portions of the Band raised above its ordinary level to serve as forts, blockhouses, or spy-posts. There is no sign of any such elevations in the whole length of the Band, and it may therefore, I think, be accepted without demur that the embankment was built to protect certain areas from riverain depredation.

In recent times, on the left bank of the Kosi, in the Purnea District, private enterprise has copied the work of the makers of the Bir Band, giving temporary relief, which, as will be seen later, is probably a menace to "future welfare." At the point at which the Kosi enters the Ganges considerable training works have been erected by the Bengal and North-Western Railway Company; these are of modern type, and a description of them is beyond the scope of this note.

In all the attempts referred to above, perhaps with the exception of the modern works at the mouth of the Kosi, which lead the river into the Ganges below a bridge, no effort appears to have been made to provide for suitable emergency or other outlets through the embankments; this point is significant, and its results will be explained in detail hereafter.

About eighteen months ago, an officer of the Public Works Department was placed temporarily on special duty to make a full enquiry into the movements of the Kosi River, and to report what steps could be taken to "muzzle" the river; for some reason not known to the writer, before this officer had carried out any of the considerable amount of field work which a report would have necessitated, he reverted to his substantive appointment, and the matter has not since been reopened. From time to time the Purnea Local Board has enquired into the subject, but no serious steps have been taken, as far as I am aware, to carry into practice the many and varied suggestions put forward by those who had

[N.S.]

a local knowledge of the river's action. Mr. Shillingford,¹ some years ago, published a pamphlet on the river, advocating the theory that it behaved somewhat like a swinging pendulum which hung from the point at which the Kosi leaves the hills and enters the plains; after gradually swinging further and further eastwards, it was assumed that a series of westward oscillations would occur. Mr. Shillingford believed that the lateral movement, after a definite period, became reversed, and in this manner the whole area of operation of the river was covered, time after time, by a succession of its beds. This theory is doubtless partially correct, but does not hold good altogether; recent writings, mostly published since Mr. Shillingford's time, show that a perpetual oscillation theory cannot be accepted under the circumstances.

Mr. H. Green, the Public Works Officer referred to as having been placed on special duty to examine the Kosi some months back, asked me, since I had then very recently finished a survey of the river in British territory, if I could give him any information which would be of use to him; but although I had been studying this river for some time, I did not feel competent to give any opinion which would be of practical use to Mr. Green; further, since I considered the embankment system to be an erroneous one for a river like the Kosi, and since I believed that the Public Works Department would, if it attempted training operations, be compelled to resort to rigid embankments, I decided that it would be best to give no opinion at that time, but to continue the study of the river. This note is the result of the further study just alluded to, and although it is somewhat superficial, the evidence used shows clearly that the time for the rigid training of the Kosi is at a considerable distance ahead of us. In arriving at this conclusion the reasoning made use of gives material for a discussion on other matters connected with the rivers of Bengal, Eastern Bengal and Assam, the importance of which does not appear to have been fully realized.

The training of rivers is a subject which has received much attention from engineers for many centuries past; the Phoenicians and the ancient Egyptians inaugurated a science which in the last 300 years has resulted in the launching of projects having far-reaching effects. The Chinese, however, probably give us the best examples of the deplorable results which wrongly-designed attempts to benefit one generation have had on posterity; an important river, in the act of fulfilling a definite programme of land construction by the deposition of the sediment carried in its waters, was forced into a fixed bed, and maintained there by the closing, with embankments, of the natural outlets which permitted flood waters to deposit the matter which they held in solution or suspension, on lands which sadly needed it. Each succeeding generation has been compelled to raise the height of the embankments, to make them keep pace with an ever-increasing flood

¹ "Journal" Asiatic Society, Bengal, Vol. xliv, part 1, page 1. See also Proceedings, 1898, page 41.

level; at the present time the river runs many feet above the surrounding country, while the low lands have been drained and cultivated and support a dense population increasing year by year; an unusually heavy flood breaks down or overtops the embankments, and the pent-up waters deal death to the posterity of those who, originally in good faith, prepared the way for disaster.

The terrible results of the embankment system in China should serve as a warning to Indian engineers; it is very doubtful if the warning has yet been taken, and it is more than probable that the heavy floods which in very recent years have devastated several of the North Bihar districts are mainly, if not entirely, due to the prevalence of embankments in those parts; any training works carried out with the object of forcing a river of the nature of those under discussion, however small that river may be, to follow and maintain a course which it has no tendency to assume, must be contrary to the intentions of nature herself. An embankment, with little or no waterway through it for the carrying off of flood waters, is a glove thrown in nature's face—an insult which she has not yet been known to leave unavenged.

I am told on good authority, by those with mature experience on the spot, that in North Bihar, the flood levels have risen in one district over eighteen inches in thirteen years, and in another over three feet in twenty years; the latter district is Darbhanga, where recent floods have done inconceivable and irreparable damage; the former district is Muzaffarpur, the figures being those of Mr. Disney, District Engineer, up to 1898. Since that date the flood levels appear to have shown signs of further rising. Further afield we find similar troubles, Midnapore being a fair example; there, I am informed, lands which were dry a few years back are now perennially inundated. Many other instances of floods being on the increase might be quoted, and it is very significant that in nearly every case embankments abound in the distressed tracts. I admit that there are well-known cases in which floods do serious damage although embankments do not exist in the neighbourhood, or, if they exist, they are too insignificant to be serious factors in the trouble; but as far as I can ascertain, there is no recorded case in which floods appear to be increasing in intensity in which embankments do not exist close at hand, and it seems to be pretty certain that where floods occur in localities in which there are no embankments, those floods do not appear to be becoming more violent as years go on. The natural inference is that the embankment is to blame for increases in floods under most circumstances.

There is a difference of opinion as to the actual effect of embankments on the beds of streams, some authorities holding that although the bed of the stream is undeniably raised, there is a limit to the possible rise. I do not consider that sufficient proof has yet been brought forward to show that a limit exists, and ~~whilst~~ speculation on the point remains, we can but assume that the damage which may occur before the limit is reached is infinitely worse than that which would be caused, in the interim,

by floods of a more or less fixed high level. Embankments designed to keep every drop of flood water from protected lands are inadvisable, but it may be admitted that if the design of the embankments permits certain flood waters to wander over protected areas, those embankments may be of use, and nature may, not unreasonably, show no resentment to their growth; in other words, it may, at any time of unusual flood, be necessary to admit flood waters to so-called protected lands even to the extent of seriously inundating those lands.

The catchment area of the Kosi, in the Himalayas, has been estimated by Colonel Burrard, F.R.S.,¹ at about 23,992 square miles; the river collects its water from mountains, of late elevation, geologically speaking, subjected to a heavy annual rainfall. In point of area of hill catchment, the Kosi is considered to be the third largest of the Himalayan Rivers, ranking second only to the Indus and the Brahmaputra. The Kosi, for the last 100 miles of its course, runs nearly in a straight line, lying almost due North and South, from the point at which it debouches from a defile in the Siwaliks (or outer Himalayas) to that at which it empties itself into the Ganges, opposite Colgong. This 100 miles occupies a bed, or rather a series of beds, on the plain, which slopes, with a slight tilt from West to East, from North to South. The tilt of the plain of the Ganges in this neighbourhood is of utmost importance. At first sight it would be natural to expect the river, in British territory, to take a course bearing somewhat east of South; in bygone days the river actually took such a course, but, from its original position (roughly South-east, and possibly still more East than South-east), it has gradually moved westwards until it assumed its present course, which it probably maintains mainly by virtue of the large volume of water which it carries in the rains.

The subject is perhaps best approached by considering the Kosi River as it was, as it is, and as it will be; history, tradition and science combine to give us a good idea of the past, the present is known, and the future history, thanks mainly to the careful attention given to the subject of the movement of rivers by the United States Government, can be foretold, I believe, with a considerable degree of accuracy.

The history of the river has been very greatly affected by the gradual depression of the rock floor underlying the Gangetic plain, owing, perhaps, to the amount and the weight of the silt which for ages has been accumulating on the surface. Some scientists aver that the weight of silt deposited is sufficient to bend inwards the more or less elastic crust of the earth: this depression may have caused a rise in land elsewhere, and the rise, in the case under discussion, would have occurred in the Siwalik Ranges. It is, however, much more probable that the Siwaliks, which are known

¹ Burrard and Hayden—"Geography and Geology of the Himalaya Mountains and Tibet," Part III, page 131; see also page 149 *et seq.* In discharge, as well as area of hill catchment, the Kosi is considered by three authors to be the third largest of Himalayan Rivers; but it is admitted that the figures on which the discharge has been calculated may be inaccurate.

to have been rising within a very recent period, and may still be rising, owe their elevation to the thrust from the North which has elevated the Himalayas. History, tradition, and even ocular evidence support the theory of recent elevation of the Siwaliks, and it is unnecessary to enter further into the scientific side of the question in this note.

Diagram No. 1 shows, in black, the country just North and South of the main channel of the Kosi River as it exists now, within the line of the hills, and, in red, the same area as surveyed by Rennell and published in his famous atlas of 1783; the positions of towns marked in red are identical in both the old and recent maps and they have been used as the fitting points between the two surveys; there are, undoubtedly, many discrepancies in Rennell's maps, but the area covered by Diagram No. 1 can, at any rate up to the hills, be considered as tolerably accurate, since the positions of most of the main towns and villages are correct according to our existing maps. The area inside the hills is not as correct as it might be, but, fortunately, in 1767 Kinloch marched up the Comla (Kamla) River and mapped his route, and it is from Kinloch's work that Rennell put in that portion of his map. The distance [from Mynathpur to the point marked X (in red) in Rennell's map] agrees almost exactly with the accepted distance between Mynathpur and the junction of the Likhu with the Kosi. Admitting, then, that Rennell's map is somewhat out in Azimuth (as will be seen later, it does not follow that this is the case), it is clear that inaccuracies which are of any practical importance need not be anticipated in direct distances in Rennell's map in this vicinity. A further point in favour of Rennell is that our own maps of this neighbourhood are not based on a careful detailed survey.

Examining the diagram, we find that in 1767 the Comla (Kamla) flowed right through the Siwaliks, while to-day it rises in them; further, on reaching the point X, Kinloch noted a strong stream flowing from the North, probably the main stream of the old Kamla, and he found (or he would surely have noted it) no stream running to the east as the main Kosi now runs. From X he turned westwards along the red stream shown in the diagram, and having followed it for some distance, he returned to Mynathpur by the road he had gone by. Now Rennell shows the west arm of the old Kamla (the stream last mentioned above) as rising east of the present junction of the Tamba and Kosi, and here we meet the only really inaccurate point in Rennell's map; the inaccuracy can, however, be explained by the fact that Kinloch did not follow that stream to its source and that he may have given it an imaginary source in high land into which it disappeared from his view. Be this as it may, I think that there is little doubt but that the stream carried the water of the Tamba Kosi to the point X, and there, receiving the waters of the Likhu Kosi, turned southwards, and was known as the Kamla for the rest of its course.

We may therefore suppose that the Likhu Kosi was the upper direct feeder of the Kamla, but the difference between the point X

and the junction of the Likhu and main Kosi still needs explanation. In 1767 no stream ran eastwards from the junction just mentioned, while a very strong stream now runs in that direction and intercepts the waters of the Likhu and Tamba Kosis; the natural tendency of the Likhu Kosi's mouth under the new conditions would be to move eastwards, and it is possible that Rennell's map is not, after all, out in Azimuth.

In addition to the evidence of Rennell's map, there are other points which support the conclusions drawn from that map.

We have said that the Tamba Kosi in 1767 very probably flowed into the Kamla; when it is remembered that different languages are spoken on either side of the Siwaliks, that K. and T. are almost, if not actually, linguistically interchangeable letters; and lastly, that the nomenclature of many Himalayan rivers is at present a controversial point, it must be admitted that there is a great similarity between the names Tamba and Kamla; this similarity is emphasized by the existence, in the Purnea District, of a stream also known as the Kamla which is in direct prolongation of the upper course of the most easterly feeder of the Kosi, *viz.*, the Tamru¹; here we find almost an identical parallel with the former example.

A further and even more striking case exists; the Tiljooga River now flows in imaginary prolongation of the Dudh Kosi; if the Siwaliks did not exist, the two rivers would probably be one. At one time this appears to have been the case; for, if we look to the north of the Choorea Ghatee Hills we find a stream called the Trigooja crossing the dotted red line between the Dudh Kosi and the Tiljooga; the elevation of the Choorea Ghatee Hills² would cause the appearance of such a stream as the Trigooja, and it is very remarkable that its name should be that of what I assume to have been a stream which once crossed the present bed of the Trigooja at right angles.

Tradition in North Bhagalpur states that, in the past, streams of much greater size than the existing rivers flowed from the north; a careful observer may notice that the undulations which occur in this part have, although long since smoothed by wind and weather, still the appearance of remains of old beds of important streams; in other cases, such as the Balan River, a stream now almost dead, runs in a bed which was obviously made for a river of very much greater importance.

Science, history, tradition and ocular demonstration all agree

¹ Burrard and Hayden, on page 150. Part III, of their "Geography and Geology of the Himalaya Mountains and Tibet," give the following sources to the different names used for this river: Tamru (Montgomerie); Tamor (Hodgson); Tambur (Hooker). The authors themselves accept the name Tambar.

² Burrard and Hayden—"Geography and Geology of the Himalaya Mountains and Tibet," Part III, footnote to page 149.

"The affluents of the Kosi have not been forced to converge by the ridges running southwards from Kinchinjanga and Gosainthan, but by the recent rise of the lesser Himalayan range across their path."

in pointing to a recent elevation of the Siwaliks, and I hope that sufficient evidence has been brought forward to convince the reader that the feeders of the Kosi within these hills, were, in very recent times, independent or semi-independent rivers flowing southwards through the area now occupied by the Siwaliks.

At first sight it may appear to be strange that of all the feeders of the Kosi River, north of the Siwaliks, only one, the Arun, has maintained a way through those hills to the plains; there are several reasons for the phenomenon; first, there are falls at the point of egress from the hills, and the elevation at that point has been insufficient to check the course of the river, or possibly the erosion of the river has been able to keep pace with the elevation. Secondly, from time to time, the Arun has been reinforced by the waters of other streams on each flank, and this reinforcement must have had a considerable effect both on the wearing power and the head of water passing through the gorge at which the Arun changes its name to the Kosi. Thirdly, the Arun is a much more powerful stream than any other feeder of the river. The second explanation is most probably the true one.

It is reasonable to suppose that the growth of the Siwaliks still continues, and it seems possible, but improbable, that the exit from the hills may eventually be closed. At the worst the closing would be temporary, for, if once blocked, the dammed-up waters would soon, having raised themselves to a sufficiently high level, re-establish the flow towards the plain. It is hardly likely, I think, that the rate of elevation to-day is sufficient to again cause the damming up of the river.

The changes detailed above are so far-reaching, startling, and contrary to the very slow processes of nature, as generally accepted by geologists, that, before proceeding further, it may be well to consider whether other agencies, besides that of slow growth due to the depression of the plains, have not helped to effect those changes.

Roughly speaking, a slow elevation of one foot in a century would, in a hill, be geologically rapid; from the term "slow elevation" I exclude the effects of a catastrophe. We do not know, unfortunately, how many feet were added to the height of the Siwaliks before the head-waters of the old Kamla were deflected towards the Arun. The minimum growth must have been several feet, and it is possible that even a fifty-foot rise may have been insufficient to cause the deflection. We have had earthquakes in the interval between Kinloch's time and our own, but since 1762 no sudden earth movement has occurred which would have caused the changes under discussion; Kinloch in 1767, or five years after the greatest earthquake which India has known in modern times, found a state of affairs existing which has altered very materially in the last 140 years, and, although the shock of 1762 may have been one of the ruling factors in the commencement of the changes, it cannot be altogether responsible for them, unless it caused a continued imperceptible growth which continued for some time. Since 1762 we seem to have had no convulsion of nature more

intense than such earthquakes as that of 1897; the effects of that shock are not properly known; certain areas in the plains were certainly depressed, but how far these depressions were only due to local conditions of sub-soil, etc., we have no knowledge.

It was noticed after the earthquake of 1897, by several old and experienced Indigo Planters in North Bihar, that many minor streams, in and near the Siwaliks, changed their courses considerably; it is well known that in this region minor changes are not of infrequent occurrence, and that nature has not yet assigned anything like permanent levels to the Siwalik regions; at the same time she seems to be on the balancing point between secure and insecure levels. After the earthquake, the Nepal Durbar caused an enquiry into the changes in stream beds to be made, but unfortunately the records of the enquiry have not been preserved.

It is of no use to speculate further on the subject; if geologists had free access to the areas under discussion they might throw much light on the causes we search for; for instance, there must be clear signs of water wear on the rocks over which the Comla flowed 140 years ago; and again, an examination of the supposed old sill of the Dudh Kosi, for the name of that river implies a heavy silt-carrying capacity, and consequently severe rock-abrasing power, might yield information that at one time a river had passed over what is now a dip in the Siwalik ranges. Surveyors, too, could throw light on the situation by measuring the heights of existing depressions in the Siwaliks above the present course of the western arm of the Kosi within the hills.

The past, present, and future history of that portion of the river lying within the hills has now been dealt with; its case is very different from that of the portion occupying the plains; in the hills the function of the river is to carry away, as fast as possible, all *débris* and matter it can pick up, carry, and push along, and also such material as it is able to transport in solution; the river is fed with matter to be transported in a number of ways, the details of which need not be entered into here; the chemical and mechanical denudation of the hills are the feeding agents, and a description of these two agents is outside the scope of this note. On reaching the plains, the river enters on a new phase of activity; in its mountain reaches it was destructive, but in the plains it is constructive in its action; the plains themselves are formed almost entirely by the river from deposits placed layer upon layer, deposits carried from the hills and built up by slow processes during many thousands of years. The plains section of the river is at the present moment engaged in construction work; at some future time, as will be seen later, its final life-object will be completed by the assumption of destructive action, during which stage, having first levelled its catchment area to the level of its plain area, it will, by slow degrees, reduce both to the level of the sea; until then the object with which nature originally created the river cannot be finally fulfilled; every river, except the mountain torrent which precipitates itself directly into the sea, into a large lake or another stream close to the hills, must pass through three stages of existence,

namely, its youth, during which it is destructive in its action, (the Kosi River in the hills), its middle age, or constructive stage (the Kosi in the plains, as we see it now), and, finally, its old age, or perhaps dotage is a better term, in which it again becomes destructive to the extent of eventually destroying itself. Earth movements may prolong any one stage for a period which to us is immeasurable, but the final result must be one, from the river's point of view, of self-annihilation.

The action of the river in its constructive stage is somewhat complicated; although definite laws are obeyed by every river under similar circumstances, there are certain points connected with these laws which, being often inexplicable to us, are classed together as the "character" of a river; for instance, if a river invariably carried the same amount of water, if its bed followed a slope which never varied, and if the soil, sand, or rock over which it passed were homogeneous and of the same material as its banks for its whole course, the river might fairly be classed as one with no individual character. Any variation, however slight it may be, from the perfect river just described, must introduce at least one element of character which may upset, at any moment, the calculations and plans of the greatest river expert living; fortunately for us, theoretically, the Kosi boasts of little personal character during the last 80 miles of its course, and, with one exception, its movements should be obedient to accepted rules. The exception is the actual reason for a sudden change of course, and it will be dealt with later on.

Immediately on the Indian side of the falls by which the Kosi enters the plains, lies a comparatively steep-sided cone consisting of silt, rocks and *débris* ejected from the hills by the current of the river, but which the energy of the river has been insufficient to carry forward and deposit uniformly over the plains, or remove to the sea; the loss of energy is due to the sudden change in grade which, above the falls, is that of a mountain torrent and below them that of a comparatively sedate body of flowing water; through the alluvial cone the river runs in one main channel which may be considered to be semi-permanent; its permanency depends entirely on no change occurring at its debouching point, and, since that point is hedged in by hard rock, a semi-permanent channel at least may be accepted through the *débris* cone; if a very heavy fall of rock occurred on the east or west side of the gorge, which now leads the Kosi into its present path, changes of great magnitude might be anticipated, but as will be seen later, the longer time the plain-building operations of the river are permitted to go on as at present, the smaller will become the danger of a great and unexpected change of course. Rocks wear away so slowly by weathering, and building operations progress so comparatively rapidly, that each year renders sudden changes at this point more improbable. South of the cone the plains spread out on all sides awaiting the pleasure of the river to elevate them.

The action of a moving body of water over a sandy plain is

somewhat similar to that of a freshwater stream entering the sea; the effect of the latter at once gives a clue to the methods of the former; if a freshwater stream enters the sea at a given point, under ideal conditions, a "bar" will be formed; one cause of this bar is the deposition of the silt carried by the river; the velocity of the stream, which alone permitted the carrying of silt, is neutralized by the sea, and practically all material carried in suspension is dropped. In addition to carrying matter in suspension as already stated, the stream exerts part of its energy in rolling sand, and sometimes stones and boulders, along the bottom of its bed; these, in their turn, help to increase the size of the bar; if we apply the action of this bar-forming river to that of the Kosi in the plains, on which there is no sea to neutralize the flow, it is easy to see what must happen.

The first work of the Kosi is to roll along its bottom the stones which it is propelling, and with them as much other material as can be conveniently transported; the result is a somewhat steep bed until, with a decreased current, the power to roll material falls to a minimum; the river has then reached what we may look on as a normal of gradient; even then it will continue to roll matter along its bottom, but the further we get from the cone the smaller in bulk will be the matter rolled. All this time two other phases of actions are in progress; as the velocity of the current decreases, its suspension-carrying capacity becomes smaller and matter is steadily deposited in the bed, so that the bed becomes gradually raised. The other phase is one which I believe has not been sufficiently noticed by writers on the subject; it is a kind of ploughing action which tends to push to one side, and deposit there, a considerable amount of material which helps very greatly to form the unstable banks which all such rivers as the Kosi have. Here we see the parallel between water running into the sea and into a plain sand. In the former a bar was formed, in the latter the water continues to push forward, and incidentally to one side, all the material that it can, this material being that which, under different conditions, would have made up a bar.

If the processes described above are permitted to continue undisturbed for some years, the river, its bed and its banks, will, except at high flood, be raised well above the country on either side; at flood times the banks will, however, be overtopped by water, and a spill, great or small, according to circumstances, will inundate the surrounding country. These spill waters, coming to rest, deposit practically all the sediment they held in suspension, thus spreading a layer of sand or mud over the areas in which they operate; a gradual building-up of the low lands is thus effected.

Before proceeding to discuss the further reasons for the elevation of the plains, it will be well to enter further into the question of how the banks of the river elevate themselves; Fergusson, in a masterly note¹ read by him in 1863 before the

¹ Geological Society of London—Journal, 1863, p. 321—354.

Geological Society, considered that bank elevation, so far as the Ganges was concerned, was often due to the running water of the river at times of flood, meeting still "jheel" water at its sides, the result being that, since still water neutralizes a running current very rapidly, a heavy deposit was formed along the edge of the river; this explanation is undoubtedly correct in a limited number of cases, but, as a general explanation of the principle it fails utterly when applied to such rivers as the Kosi, which, with comparatively little still water on either side (for the slope of the country is too great to admit of water standing as freely as it does near the Ganges), steadily for the whole of their lengths, elevate their banks. Other writers give other reasons for this phenomenon, but none, I venture to think, meets the case of the Kosi so well as the ploughing theory given above. When once the bank is formed there are other agencies which tend to raise it still further, and one of these is particularly significant in the case of the Kosi River.

At about Longitude 87° East the force of the west winds which sweep Bihar from March until the monsoon bursts, begins to feel, in a very marked manner, the effect of the damp climate of Eastern Bengal; these winds, heavily laden with dust and sand, on meeting the first sign of a damp atmosphere begin to lose their strength, and, as in the case of a silt-laden river, the decreased velocity causes the dropping of, at any rate, a part of the burden carried. It is probable that more deposit is dropped from the heavens in the neighbourhood of the Kosi River in the manner described above than in any equal area in the world; how far the banks are actually raised by this deposit, cannot be said, although it would not be difficult to obtain a tolerably accurate idea if a few simple field experiments were carried out. It must be remembered, however, that although a deposit occurs, the winds are still sufficiently strong to pick up as well as deposit, and it may be that much of the material dropped is picked up again. I cannot help thinking, however, that the action of the wind, if not constructive as a heightening agent, and I believe it to be constructive in that way, must tend to consolidate.

the banks of the river, since it must give them increased width.

There remain two other points which throw a considerable light on the building operations of the river; they are the effect of spill water deposits on undulating country, and the reasons for, and effect of, changes in bed on the country itself. Undulations in the area of operation of the river are, in all probability, entirely due to former changes in bed, and an important agent in smoothing them over is the deposit thrown down by spill waters. We will first examine the effect of spill water deposits on undulating tracts.

If spill waters cover an undulating country altogether, the deposit will be greatest where the water is deepest; it is therefore easy to see how low lands grow more rapidly than those situated at a greater elevation; a series of floods, consequently, may be looked on as capable of levelling altogether a slightly undulating area.

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The waters are undoubtedly helped by wind and weather, but the main levelling agent must be the silt they carry.

It has been stated that changes in river bed are the probable causes of such undulations as occur in the neighbourhood of the Kosi River; the explanation of this is contrary to the views of many who have written on the subject, but to my mind it is so simple and logical, that I take the liberty of putting forward my own views.

Let us assume that the river has for some years occupied one bed and that it has raised that bed and its banks considerably; at a time of rising flood, a tree trunk, sunken boat, or some such obstacle becomes lodged in one bank of the river and forms, on its up-stream side, an eddy, which, since the banks are of sand, has no difficulty in eating a passage through the bank. When once a breach is effected, a change in the direction of the whole river may occur; let us assume this to be the case; the river, precipitated over the low lands on the side on which the breach has occurred, after doing an enormous amount of damage, eventually, let us say for argument's sake, takes a new course parallel to the old one, half a mile to the east; it is possible to conceive a series of such moves, which will leave ridges along which the river recently ran, and depressions between each two ridges, in which, for many centuries, no river bed has existed. In course of time winds, rain, spill waters and other agencies, not having had sufficient time to actually level the area, will turn it into an undulating tract in which the higher portions are the most recent river beds; eventually the turn of this undulating land comes round again and it is finally levelled and no trace of former depressions left.

At first sight this theory appears unreasonable. A little consideration will, however, show that there is nothing unreasonable in it, and that logically it is sound.

We have seen how, by operating in a series of beds over the whole area assigned to it, the Kosi gradually raises the level of that area, partly by heightening its successive beds, and partly by the action of its spill waters; the actual raising by these two joint agencies proceeds in obedience to a definite law which every constructive river in the world obeys. The law may be stated briefly as follows:—“A constructive river, by the deposition of its silt, gradually reduces its grade, or fall per mile, starting from the point most distant from its source and continuing the reduction in grade upstream”—the building up of the portion of British India involved has therefore commenced near the Ganges and is slowly invading the whole plain northwards, the rate of progress depending on many things which require some explanation.

Diagram No. 2 is somewhat similar to a diagram given by Ferguson in the note already referred to. It is a comparison between Rennell's survey and Survey of India maps up to date; the diagram shows that in 1780 the Ganges and Brahmaputra operated in certain areas in the plains; about a century later, very great changes have occurred, the Tista, instead of being a tribu-

tary of the Ganges, has become a feeder of the Brahmaputra, and the Brahmaputra, instead of running east of Dacca, has moved to the west; other changes will be noticed, but the two most important are those just referred to. Of these, the latter does not immediately affect the subject under discussion. Now, like the Kosi, the Ganges and Brahmaputra have, for centuries, been busy reducing their grades by the deposition of their silt; the plain of the Ganges slopes in a south-easterly direction until it meets the sea or the plain of the Brahmaputra; the sphere of the latter slopes, from where it crosses Longitude 90° , almost due south, and is bordered on the west by the plain of the Ganges. The land lying in the rectangle formed by Latitude 24° to $26^{\circ} 20''$, and Longitude 88° and 90° , is therefore liable to vary between the plain of the Ganges and its feeders, and that of the Brahmaputra and its tributaries, the main agent which causes a variation being a high flood. Diagram No. 2 illustrates the conflict which has raged between these two great rivers in the last 150 years. We have seen that the Brahmaputra, during that time, thanks to an unprecedented flood of the Tista, robbed the Ganges of the water of the Tista River. This piracy is very probably not the first of which the Tista has been the victim; it has, in all probability, in bygone days, alternated, at different periods, between the two master streams. Be this as it may, it seems to be not unlikely that the Brahmaputra has now finally become possessed of the Tista. Now the Kosi (old and new) has operated at different times over all the land between the debateable area along the junction of the Ganges and the Brahmaputra plains, and, roughly, Longitude 87° East; West of that Longitude and north of Latitude 26° , the land is tolerably high, but south of Latitude 26° there is an area some 30 miles wide, which is low-lying; in this low-lying area minor channels of the main Kosi are at present busy building up most of the depressions.

The sphere of action of the Kosi, then, since the Tista, Attri, and other rivers, before the Tista last returned to the Brahmaputra, apparently filled up fairly solidly everything east of Longitude 88° , may be defined roughly as a rectangle made by the intersections of Longitudes 87° and 88° and Latitudes $25^{\circ} 20''$, and $26^{\circ} 20''$ respectively; of this area all, except on each side of Longitude 87° , appears to have been dealt with by the Kosi in its older stages or by smaller streams issuing from the hills north of Purnea; the Kosi, therefore, is not likely to move appreciably either east or west of its present position. In the last 150 years the river has shifted slightly to the west, and its final point of entry into the Ganges may, I think, be safely put at less than 10 miles further west than the present Kosi bridge, the probability being that the move will be much smaller, but the final exit will not be known until the Himalayas are worn down to the approximate level of the plains. Changes must be expected, but great changes only if the river is trained by rigid embankments which prevent it temporarily from carrying out the work upon which it is engaged, which work it will assuredly, in spite of any effort of man, eventually perform.

The question of embankments has been raised at this point because there is the possibility of existing embankments inducing a change in the river to the east; it is even possible that the damage has already been done. This question is dealt with later on in this note. The estimate of probable movements given above is dependent on no sudden change in the depression of the plains taking place; if the depression ceases, no harm will be done; if it becomes more rapid than it now is, it is hopeless to attempt to anticipate the future. For instance, Oldham¹ and other authorities consider that the Ganges at one time flowed westwards to the Indus, or that the Indus once flowed into the Ganges. Again, Colonel Burrard has recently pointed out that the Sangpo² (Upper Brahmaputra) at one time, in all probability, flowed into the Indus; if a repetition of such things occurred the movements of the Kosi would be difficult to foretell! All that we can do is to assume that the rate of depression of the plains is constant, and that no changes such as those referred to will recur.

The main difficulty in estimating the rate at which the Kosi's building operations are progressing, lies in our lack of exact knowledge of the amount of depression now going on; we have neither gauged this rate nor that at which the Siwaliks are rising; between a rising Siwalik and a falling point in the plains, there must be some point which neither rises nor falls. If we could find such a point, or better still, a series of them, it would be possible to do something towards deciding this difficult question.³ In this discussion I propose to eliminate the factor of depression altogether; as will be seen later, even if we eliminate what is quite probably the main argument in the calculation, it is possible to show that many centuries must elapse before rigid training works, on a large scale, will be advisable along the lower reaches of the Kosi River.

It has already been stated that the building operations of the Kosi commence near the point at which it enters the Ganges, but since that river is also engaged in land construction work, a complication at once arises in discovering how far north of the Ganges its silt-depositing sphere exists. What should, however, be a complication, has already been eliminated by the railway embankments of the Bengal and North-Western Railway; the Kosi passes below a bridge built by that railway, the railway line in prolongation of the bridge, on either side of it, running along an embankment which, for some distance, is roughly parallel to the Ganges. I believe that this embankment contains, from Mansi to Katihar, a direct distance of about 60 miles, an average waterway per mile of about 75 feet. If we cut out the waterway

¹ Oldham—*Geology of India, Stratigraphical and Structural*, Ch. XVII, p. 428.

² Burrard and Hayden—"Geography and Geology of the Himalaya Mountains and Tibet," Part III, p. 155.

³ Vide page 51 of the Annual Report of the Board of Scientific Advice for India 1906-07; the effects of the 1905 earthquake on the height of Mussoorie are discussed by Mr. J. Eccles, M.A., Survey of India.

allowed for important streams (Chota Kosi, Boro, Barundi and Kosi), and these can be eliminated since they are not exits for Ganges water spilling to the north, we find that only just over 3 feet of waterway per mile remain for carrying Ganges spill through the embankment. In other words, the Ganges is not building at all north of the embankment. To me this embankment appears to be a "band" of the most dangerous type, namely, one which interferes unnecessarily with the work of Nature. During a journey made very recently from the west by the B. & N. W. Ry. I noticed the following points which, I hope, will show that the statement made above regarding the danger of the embankment is not without foundation; for some distance, before reaching the bridge, I noticed several depressions, on the north of the embankment, which were obviously beds of small streams. On reaching these I found that they were stopped altogether by the embankment, with the result that they could not, as they obviously did before the building of the embankment, carry their water to the Ganges; on the south of the embankment, in one case, there was absolutely no visible trace of the old bed, and in several other cases, although the old beds could be seen, they were very much less marked than on the north side of the embankment; this result is not due to the south side being cultivated and the north side uncultivated, but simply and solely to too little waterway for spill water from the Ganges being permitted to pass through the railway embankment; on the south side, the land is being raised rapidly by the Ganges, and on the north side little or no deposit is, in the place of which I speak, being given to the areas on the north, obviously legitimately within the sphere of the Ganges, but excluded from it by the railway embankment.

Let us turn to the south side of the Ganges. I have on several occasions searched that line for examples such as those just quoted, but so far without success; the reason is that although the E. I. Ry. was built at least 30 years before the B. & N. W. Ry., it was considered then that sufficient waterway¹ to admit flood water through the embankments was essential; in looking for the final result we find the south bank of the Ganges being raised as originally intended by nature, and the north bank suffering from a lack of deposit except along a narrow strip on the south of its railway embankment. After a limited number of years, a breach in the B. & N. W. Ry. embankment may very possibly result in damage being done to others than those interested in the railway itself; the future can but give an increasing flood level to the Ganges at this point, and it seems quite probable that the action now going on will result in deterioration of the navigable channel of the Ganges further up stream.

¹ Excluding rivers, the linear waterway per mile between Mokameh and Bhagalpur is about 87 feet. I am aware that sectional comparisons, for waterway, are infinitely preferable to linear comparisons, but, since the E. I. Ry. embankments are higher than those of the B. & N. W. Ry., it is not necessary to give sectional areas of waterway when comparing the two railways in this note.

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From the point of view of this paper, however, the limiting of the depositing sphere of the Ganges by the embankment on the north, simplifies the question under discussion, in that we need not take into account at all the Ganges as a depositing agent.

Before passing to the Kosi itself, the Ghuggri River remains to be dealt with; by far the greatest part of the water carried by this stream from its junction with the Kosi belongs to the latter. The Ghuggri as a depositing agent may be neglected also because its deposits are practically altogether made outside the sphere which we have assigned to the Kosi.

For all appreciable purposes, then, we may assume that the Kosi only has itself to depend upon to complete the forming of the ground on each side of it from the Kosi Bridge to a point 100 miles above it.

We do not, unfortunately, know anything definite regarding the silt-carrying capacity of the Kosi; any calculation made must be based on analogy. As far as I can ascertain, the two rivers most suited to the case, of which we have figures, are the Ganges and the Irrawady. Archibald Geikie gives the basin of the upper Ganges as 143,000 sq. miles, and the annual discharge of sediment as 6,368,077,440 cubic feet; according to Wheeler, a cubic foot of alluvial matter weighs between 120 and 170 pounds, while a cubic foot of silt weighs 103 pounds; since the Ganges and its affluents discharge a mixture of alluvial matter and silt in at present unknown proportions, I have, to reduce Geikie's sediment figures to tons, taken a cubic foot of sediment to weigh 120 lbs; this assumption gives the discharge of the Ganges as 341,147,050 tons of sediment per annum.

Babb estimates the Irrawady to have a basin of 125,000 sq. miles, with an annual sediment discharge of 291,430,000 tons; if we compare Geikie's and Babb's figures the sediment-carrying capacity of the Irrawady to the Ganges is as 2.33 to 2.38, and considering the similarity of the two rivers, we may, I think, accept Geikie's figures as sufficiently correct for the purposes of the rough calculation given below.

The Kosi has no feeders of any importance outside its catchment area, which is roughly 24,000 sq. miles; the river, therefore, if it is the counterpart of the Ganges and Irrawady, carries approximately 55 millions of tons of sediment per annum; of this amount probably not more than one half is used in building operations. I assume, to be on the safe side, that two-thirds, or about 37 millions of tons, are deposited annually on the lands to the sides of the river; 37 millions of tons of sediment are the equivalent of 691 millions of cubic feet.

Now the actual slope in the bed of the Ganges for the last 300 miles of its course, measured in a straight line, is about 6 inches per mile, a low grade even for a canal; during those 300 miles the river is by no means a tractable stream. The object of this calculation is to show what minimum period of time must elapse before the Kosi River will be as far advanced in age, in

other words in want of tractability, as the lower Ganges is at the present moment; the slope of the bed of the Kosi River, measured along a straight line, is between 1 foot and 18 inches per mile. For the purposes of calculation, let us accept the former; the area on which the Kosi deposits its silt is probably on an average at least 20 miles wide; if we accept a strip of 5 miles on each side as the area on which deposition will occur, we must err on the right side in our calculation; in other words, we assume that the area to be raised is 100 miles in length, and 10 miles in breadth. If from the above figures we calculate the time which must elapse for the slope of the 100 miles of the Kosi under discussion to average 6 inches per mile, we shall find that about 1,000 years is the answer to the calculation. I admit the figures I have accepted are not based on the results of observations, but, notwithstanding this, they give not uninteresting results.

The period is, in all probability, much shorter than that which will actually elapse before the Kosi reaches as forward a state as the lower Ganges is in to-day; exaggerated figures have been used in the calculation and the depression of the plains has been entirely neglected; if the depression equals the building power of the river, matters will remain stationary until one side proceeds faster than the other. From a human point of view, therefore, if we assume that the plains are still sinking, our estimate may be multiplied with absolute safety, by infinity. From the above, it will, I think, be agreed that the time has not yet come for the rigid training of the Kosi River.

Before any practical attempt can be made to save those areas in Purnea and Bhagalpur from the ravages of the Kosi, a considerable amount of enquiry is necessary; this enquiry will entail certain field work. Below is given a series of items about which full information will be required:—

(1) Two cross sections of the river surveyed normally to the current, one at a point as close to the exit from the Siwaliks as possible, and another at the railway bridge; the latter may be obtainable from the B. & N. W. Ry. authorities. If possible, a third section should be measured midway between the two just mentioned.

(2) At each section, measurements of (a) changes in bed, (b) rate of current; (c) amount of silt carried; (d) chemical examination of silt carried at different phases of flood level of the stream, should be made for at least one year. (a) Should be taken monthly; (b) and (c) daily at a given time; and (d) at all differences of height of stream at intervals of 6-inch changes.

(3) From data already described, the mean annual discharge of the river (a) in water, (b) in silt, should be computed.

(4) The rate at which the plains are being depressed and the Siwaliks raised, should be found experimentally; this will entail the discovery of several points which lie between the Siwaliks and their complement, the plains which do not alter in altitude. If several lines of really careful levels were run in such a way as to converge from masonry points on the hills on the south side of the

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Ganges on to a known high point in the Siwaliks, the checking of these levels annually would, in a few years' time, give a very fair idea of what points had remained stationary; there are factors in this calculation which would tend to vitiate the final result, but a sufficiently accurate idea could be obtained to be of practical value. In addition to the one point in the Siwaliks mentioned above, others should be fixed and observed to. If sufficiently long lines across the plains were run, the actual subsidence could be computed in cubic feet, but if annual changes were too small to be noticeable, the operation should be continued for a series of years.

The two main points which would vitiate the results are: (a) the amount of annual denudation of the Siwaliks due to weathering; this might be eliminated, unless it is a negligible quantity, and this it probably is, by carefully protecting from the weather the points observed to; (b) the effect of the deflection of a plumb line from the normal owing to the proximity of the mass of the Himalayas. For this, with present knowledge, an approximate correction, sufficiently accurate for all practical purposes, might be utilized.

(5) The effects of the Ganges flooding before the Kosi, and *vice versa*, must be observed; in the former case it would be necessary to discover how far up stream the waters of the Kosi and Ghuggeri were dammed up; to what extent excess deposits through spill waters in the area outside the beds were induced, and how far the releasing of the Kosi's waters affected the bed of the river.

(6) Other information would be required, such as the water and silt-carrying capacity of the Ghuggeri which would have to be deducted from discharges computed in (3) above. Another example is the finding, by levels, of the fall per mile of the bed of the stream.

(7) If the existing maps are not sufficiently recent, a careful survey should be made showing all details of minor streams, low-lying areas, and existing embankments with details of waterway (if any) allowed through them.

Although the field work outlined above is not by any means an exhaustive statement of all that might be required, its compilation would give a very fair idea of what alleviation for those who, at present, bear the brunt of devastating floods, might be possible. Until this work is carried out, and carried out with the utmost care, it is impossible to say whether or not any means of alleviation are at present advisable. In the above, the enquiry regarding para 4 (rate of elevation and depression of the Siwaliks and plains respectively) might perhaps be postponed; if it is postponed, then levels must be run from side to side of the area of operation of the river or insufficient information will be collected.

The relief to those affected by the floods of the river must take one or both of two forms: either embankments must be erected with such an amount of waterway through them that the river will not be hindered from carrying out its programme of

land construction; or else the Italian system of Bonificazione (artificial land construction) must be resorted to.

The former will necessarily mean that at times of heavy flood the interests of those for whom embankments have been constructed must be sacrificed in the interests of posterity; crops must probably be ruined if the river would have flooded them if unconfined, and a state of affairs brought about by Government which would be liable to grave misunderstanding from those who, accustomed to look upon an embankment as a protection against the loss of their crops, find, on occasion, that, to their uneducated minds, the embankment is in itself a menace; although, if careful discrimination is used, it is quite possible to do much to alleviate the lot of those at present in difficulties, it is extremely doubtful if even a really well-devised system of "bands" would be administratively advisable.

The Italian system might perhaps be used; briefly stated, it consists of the running of silt-laden waters into low-lying areas in such a manner that, after the water has come to rest and the silt been deposited, the water can be run off. A detailed description of this system was given in a note read before the Arts Society in London some short time ago by Sir Edward Buck, K.C.S.I. The system is doubtless excellent, if a careful chemical examination of the silt carried at certain heights of rising or falling flood is known, and if the fall of the river and surrounding country is sufficient to permit of the water admitted to low lands being run off by gravitation after it has performed the work intended to be obtained from it. In the case of the Kosi, it is possible that much might be done by this system, but without accurate levels it is not possible to say how far Italian methods can be copied. Sir Edward Buck advocates a proper enquiry into the system of Bonificazione as applicable to India, and, although, before he left India, he made careful enquiries into the amount of artificial fertilization by silt, and was in a position to expect to obtain full answers to his enquiries, it is very significant to notice that the case of Chota Nagpur (where a form of Bonificazione has been practised probably for many centuries, and where it is perhaps more actively used than anywhere else in India) has no place in Sir Edward's able note. The traveller in Chota Nagpur cannot but notice the quaint way in which rice lands collect on each side of the "nalas" in undulating country; the running water is directed down the centre of the depression and is capable of deflection into any "kiari," or sub-field, at will; the silt of the stream is thus deposited where wanted, without any difficulty; Sir Edward briefly reviews the different methods reported to him by Indian officials in his paper, and since no mention is made of the Chota Nagpur system it must be assumed that the officials in those parts had, at the time of enquiry, failed to notice it. The case is quoted at some length here since it shows that, from the methods of an Indian race only half emerged from savagery, we may learn at any rate some of the elements of one system which is perhaps applicable to the mitigating of the evil-doing of the Kosi River.

I admit that, owing to greater declivity of bed, the Chota Nagpur streams are not a true parallel with such rivers as the Kosi, and also that Bonificazione is only practical in the reaches of streams whose bottoms are not visibly rocky; at the same time it must be admitted that lessons are to be learnt from the methods of the Chota Nagpuris.

The Kosi River is really only of local interest; the examination so far made in this note, however, leads to questions of more general importance; although the Kosi cannot be called navigable to-day, the time will come when it will be so; that time will probably not be until the Himalayas almost disappear. As soon as the bed of the river approximates a slope of six inches to the mile, it will assuredly then be capable of being navigable, and it is not improbable that this happy state of affairs may arise with a bed of somewhat greater declivity; with a slope in bed of six inches to four inches to the mile, when that grade is *first* reached, a river may, I think, be considered to have attained mature middle age; as the slope decreases beyond that limit, in the case of rivers running through country formed by their own deposits, after passing the transitional state between old middle age and young old age, old age actually sets in and the action of the river changes; despite a reduced grade, and one which has fallen almost to a minimum, the river begins to deepen its channel. This is the second real sign of self-destruction; the first sign is to be observed during the transitional stage. After raising the surrounding country as far as possible, the river must begin to think about destroying the work which it has been engaged upon for many centuries: in doing this it is forced into a fixed bed, but, before that bed becomes actually permanent, since the country through which the river flows is very little different from a flat surface and its consistency is homogeneous, it naturally flows in a wide and shallow stream, and later, by a series of contractions, due to the actual middle of the stream beginning to eat away a suitable bed, a final and winding course is decided upon and maintained.

It is thought by some that the lower reaches of the Ganges are bordering on the transitional state at the present moment; the river, for some reason, appears at times to be more shallow than it used to be; it is not impossible that the Ganges hopes shortly to assume a permanent bed, but, if modern theories are of any value, and they are based on carefully recorded experience in many parts of the world, we have only to look at the Himalayas to obtain the correct answer. According to Russell,¹ in round numbers, the basin of the Mississippi is being reduced in height at the rate of one foot in about 4,000 years; this degradation includes both mechanical and chemical action; and before the Mississippi, the Tista, the Kosi, or any other similarly-situated river can be said to have reached a transitional stage, the height of the Himalayas must have been considerably reduced; these

¹ See page 84 of Professor Russell's *River Development*.

rivers must be constructive in their lower reaches until they have practically levelled to their plain elevation the mountains from which they collect their water, and with their water their silt. This being so, we cannot expect the Ganges (below Benares) and the Brahmaputra (throughout British Territory) to reach a stage at which they are likely to be permanently navigable without artificial help for a considerable time to come; it is pleasant to anticipate that at some period, assuming that climatic conditions remain unchanged, the Himalayas will be an undulating country more suited as a retiring ground for Anglo-Indians than any place we can imagine. This acme of perfection is, however, far ahead of us, but until it is somewhat close at hand, we cannot expect our rivers to be naturally navigable; at present Nature, with the forethought which all of us unhesitatingly allow to be her crowning virtue, is busily engaged in a struggle with the rivers themselves to prevent them becoming navigable, or to frustrate their suicidal efforts to avoid the work which they have got to carry through, and we may confidently anticipate that Nature will win the day. Nature wishes to prevent the assumption of a permanent bed which by degrees will contract; to present-day river navigation a permanent bed is not an essential, and we shall not thwart Nature in any way by keeping open by dredging; or other measures, the changeable channels of the Ganges and Brahmaputra.

The Ganges and the Brahmaputra are both, within limits, at the present moment, navigable up to certain points. With regard to the former, since she is practically hedged in by railways on either side for the greater part of her length, it may be argued that the keeping open of steamer ways is of no great importance; at the same time, the paralysing effects of the recent strike on the East Indian Railway, which for a considerable distance follows the Ganges, suggests the grave necessity of due attention being paid to that river as a transport medium; if steamer lines had existed on the Ganges to the extent to which they might have existed, there is little doubt but that the effects of the strike would have been less paralysing.

It has been here assumed that railway transport, if available, is always preferable to river transport; the assumption is a wrong one and it should be remembered that for many articles water is preferable to railroad carriage. Continental and other nations are rapidly, at the present moment, increasing their lines of canals and improving their river channels for that very reason, and so seriously is the necessity for efficient water transport recognised, that canal dues are being rapidly abolished; as the old road toll bar levies disappeared, so canal dues must go to the wall, and the school which maintained that the introduction of railways was the death-knell of canals, has, in civilized countries, long since been recognised to have preached unsound doctrine. We may therefore take it that, if at reasonable expense we can, without upsetting the balance of Nature's arrangements, keep the Ganges open for low-draught steamer vessels throughout the year, it is

essential, in the interests of the advancement of the inhabitants of the Gangetic Plain, that the requisite expenditure should not be grudged.

The case of the Brahmaputra is, however, still more important than that of the Ganges; this river, in its whole length in British Territory, is, as a public highway, of the utmost importance at present, and yet nothing, except by private enterprise, is being done to improve its navigation. River steamers stick on sand banks for hours, and sometimes for days, when, by the copying of American methods, the obstacles which cause all the delay described can, at small cost, be done away with.

In making such statements as those just made, I do not intend to criticise the attitude of Government; the records of the tours of Sir Lancelot Hare, Lieutenant-Governor, E. B. & Assam, for the last year, show clearly the sympathy he feels with those incommoded by the action of the rivers of his Province, and the wish he invariably expresses for applicants to be patient and to give the Government full time for consideration of such an important subject, speaks for itself. To rush into the attempted adjustment of the complications of nature's machinery would be unwise, and all concerned should clearly recognise that, without considerable delay, any attempt to deal with the question wholesale would be an unsound, if not a positively dangerous, policy. Already there are signs that Government intends acting as soon as possible, and when action is taken a vast stride in the advancement of North Eastern India will have been made.

Whatever the changes are which are going on in the levels of the channels of the Ganges and Brahmaputra, they are proceeding very slowly, and anything that can be done to improve those channels, although it will involve work year by year, may be looked on as labour which, although it may not have a permanent result, will help materially to improve our own communications, and, if continued, those of future generations.

In our inquiry into the possibility of training these rivers there are two final objects which require to be borne in mind: (a) the improvement of low water channels; (b) the protection of country from floods. It has already been shown that wholesale protection from floods is either inadvisable or impracticable. The provision of suitable embankments may, I think, for reasons already given, be dismissed as a general plan of alleviation; the possible courses open to us are at once narrowed down to—(a) dredging; and (b) contraction of the stream by "bandals" or some similar method.

Bandals are screens of mats and bamboos placed across the sides of wide and shallow beds in such a way that a series of such screens breaks the force of the current to the extent of forcing it to deposit silt in suitable places, places in which it would otherwise not deposit; the current in the middle of a shallow reach can be thus accelerated, and a deeper bed maintained at lower water. Bandals can be made to carry out two main kinds of work—(a) bank consolidation; and (b) channel deepening; the case of

the bank is dealt with by compelling the main stream to keep away from the banks and so preventing it from eating away the sand of which they are generally composed; bandals are a true imitation of the methods of nature; they cost little, are efficacious, and, for our Indian rivers, are probably the most suitable means of river training which we could adopt. American experience, however, teaches that the forced deposition of silt does not tend to improve channels appreciably if the slope in the bed is less than '4 feet per mile; at the same time, it is not impossible that the banks of streams whose grades are less than '4 feet per mile could be protected somewhat by the bandal system.

Speaking roughly then, our scheme for treating the Ganges and Brahmaputra should take the following lines:—Where grades are 5 inches per mile and less, channels should be improved by the use of hydraulic dredgers; where grades are greater, bandals should be used—(a) to contract and so deepen channels; and (b) (which in many cases would be included in (a)), to consolidate or to prevent unstable banks being eaten away. Finally in the lower reaches in which Hydraulic dredgers would be used, the improvement of banks would be made, after careful enquiry, by bandals where possible, and occasionally protective embankments which would not be designed to stop spill water of any but the lowest of high floods.

One other point only remains for consideration, *viz.*, the question of lighting rivers for night traffic, for without lights an expeditious service is impossible. At present, except in times of fog, the Brahmaputra is navigated by steamers both by day and night; the lighting is done by the company owning the steamers used, and such bandalling as exists is also done at the expense of that company; the freight rates by steamers are considerably lower than railway rates, but they could, I believe, be still further lowered if the lighting and keeping open of the channels was not done at the expense of private enterprise. At present, as has already been stated, nearly every civilized nation in the world is busy improving its waterways at the expense of the State, and the abolition of dues for this work is proceeding apace. India alone hangs back, although her possibilities are far ahead of those of most other countries. For years the question of the improvement of the Indus has been under discussion; seven years ago Dawson published his notes on the Mississippi River and showed how the methods of American engineers could be copied with advantage in India. Dawson has, unfortunately, since died, but his able book still stands as a monument of careful work and careful study, and shows us, in India, how very far we are behind the times.


Mr. Lees has shown that by moderate expenditure the water routes from Calcutta to Eastern Bengal, Assam, and the United Provinces can be enormously curtailed, but so far, very little action appears to have been taken on his suggestions.

The examination of the Kosi River which we have made has shown that there is much to be learnt by studying the movements and causes of movements of the river. There are, however, a

[N.S.]

number of other matters which might have been included in this note, but, as they will involve an examination of the Sunderbans tract, and the application of its methods of formation to those of such rivers as the Kosi, it has been thought best to postpone further discussion on those points until a future date.

In conclusion, I may add that it is with considerable diffidence that I have written this note. I am an amateur student of the subject, and my practical experience is limited to some seven year's observation of large rivers in Bengal and Eastern Bengal, at such times as my work has called me to visit them. At the same time, since the questions raised appear to have received so much less attention than they deserve, I have, after much hesitation, made bold to place my views on paper. There are many with a better knowledge of the subject than I, who will disagree with much that this note contains: if my comments are capable of raising a proper discussion amongst those competent to criticise them, the object of my simple effort will be partially fulfilled. If such a discussion ends in the questions being dealt with practically, that object will be amply fulfilled.



1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in enhancing data management and analysis. It discusses the benefits of using data management systems and the importance of ensuring data security and privacy.

4. The fourth part of the document addresses the challenges associated with data collection and analysis. It identifies common issues such as data quality, data integration, and data security, and provides strategies to overcome these challenges.

5. The fifth part of the document discusses the importance of data governance and the role of data stewards. It emphasizes the need for clear policies and procedures to govern the use of data and the importance of assigning responsibility for data management to specific individuals.

6. The sixth part of the document discusses the importance of data literacy and the need for training and education. It highlights the benefits of having a data-literate workforce and provides recommendations for developing data literacy programs.

7. The seventh part of the document discusses the importance of data ethics and the need for responsible data use. It emphasizes the need to consider the ethical implications of data collection and analysis and to ensure that data is used in a fair and transparent manner.

8. The eighth part of the document discusses the importance of data sharing and the need for interoperable data systems. It highlights the benefits of data sharing and provides recommendations for developing data sharing policies and procedures.

9. The ninth part of the document discusses the importance of data visualization and the need for effective data communication. It emphasizes the benefits of using data visualization tools and provides recommendations for developing effective data communication strategies.

10. The tenth part of the document discusses the importance of data security and the need for robust security measures. It emphasizes the need to protect data from unauthorized access and provides recommendations for developing data security policies and procedures.

50. Proposals for a Standard Temperature for Tropical Countries.

By PAUL BRÜHL.

I am probably not wrong in assuming that other people besides myself, engaged in physical and chemical work in India, have seriously felt the want of tables such as we find in Landolt-Börnstein's *Physikalisch-Chemische Tabellen* and similar publications, but constructed for a higher temperature than 15°C . or 62°F . or even 20°C . In the year 1892 I consulted several analytical chemists on what might be the most convenient temperature to be adopted as a standard temperature in such intellectual centres as Calcutta, Madras, Bombay, Allahabad, and others; and all of them agreed that the conclusion at which I had arrived, after ten years' experience in Bengal, was correct, namely, that 30°C . would be the most suitable temperature to choose as a standard temperature for India, and probably also for other tropical countries. Acting on this opinion I had a set of volumetric apparatus constructed by Muencke of Berlin, correct at 30°C ., and I have been using that set with satisfactory results ever since 1895. A more complete set has been lately made to my specification by Mueller-Uri of Brannschweig.

Besides persons engaged in purely scientific, chemical and physical work, it is analytical chemists such as mining and metallurgical chemists, agricultural chemists, sugar chemists, further electricians in charge of electric-testing laboratories, the Survey Department and others who are interested in the definite choice of a standard temperature for tropical countries, because it is only after a definite temperature has been fixed as a standard temperature that it will be worth while proceeding to the working out of percentage and other tables specially useful to people working in tropical climates.

I am evidently not alone in considering a temperature somewhere near 30°C . as a suitable standard temperature for India. When obtaining, in 1897, a potentiometer set for the Physical Laboratory of the Sibpur Engineering College from Crompton & Co., London, Col. Crompton, who is personally acquainted with Indian thermal conditions, of his own accord sent out some one-volt standard cells correct at 32°C . Mr. Meares, M.I.C.E., the Electrical Adviser to the Government of India, writes as follows: "I heard recently that it is proposed to fix a standard temperature for India, 15°C . being obviously unsuitable. Owing to the large temperature corrections in electrical work of accuracy it is almost a necessity to have the instruments standardised near the mean temperature of the place; and in drawing up the specifications for the standard balances, resistances, etc., for the

Laboratory which the Government of India are about to establish under my charge, I have made 30° C. the standard. We work, of course, almost entirely in centigrade, which is a sufficient reason for having an integral value for the standard on that scale."

The Indian Survey Department are in possession of a standard yard, which is kept in the Mathematical Instrument Office, Calcutta. The following is a copy of the certificate:—

Dated the 20th February, 1889.

This is to certify that the Government of India have had and received from the Standard Department of the Board of Trade an accurate copy of the Imperial Standard Yard, a standard foot, and a standard inch, as follows:—

I. The scientific length of the yard at sixty-two degrees Fahrenheit is determined by two fine lines marked on the gold studs inserted in the brass bar which accompanies this certificate, which brass bar is marked:—

"Accurate Copy of Imperial Standard Yard, 1889."
"Calcutta." "Standard Yard at 85° Fahr."

At 85° Fahr. the precise length of this yard is 36·00039041 inches, and for one degree Fahrenheit its thermometric expansion is 0·0003744 inch.

II.

Signature.

7, Old Palace Yard,
Westminster.

The temperature of 85° F. was selected as a standard temperature, because it is a convenient temperature of reference in the Indo-Gangetic Plain as well as in most localities of the Indian Peninsula. Eighty-five itself was evidently chosen because it lies midway between 80° F. and 90° F., the former temperature being too low, whilst 90° F. is somewhat too high. Unfortunately 85° F. does not correspond to an integral value on the centigrade scale, whilst 86° F. is the same as 30° C. The difference of one degree Fahrenheit is a very small one for the purposes of the Survey Department, and a change in the standard temperature from 85° F. to 86° F. will therefore hardly affect the working of that department, for the coefficient of expansion of the standard bar having been determined, the correct distance of the two marks at 86° F. = 30° C. can be easily calculated.

I should have liked to make a set of thermographic observations in my own laboratory, but I did not succeed in getting the loan of an automatic temperature recorder.

My friend, Dr. Amrita Lal Sircar, the Secretary of the Indian Association for the Cultivation of Science, has recorded a continuous series of temperature observations for a number of years in his Calcutta residence. An inspection of these records proves that 30° C. is a convenient standard temperature for Calcutta.

Of special interest in connection with our subject is a study

of plates 37 to 62 of Sir John Eliot's beautiful Climatological Atlas of India. The following table shows the limits between which the mean temperature of the day, the mean maximum, and the mean minimum, all expressed in Fahrenheit degrees, lie within the region containing the main centres of intellectual activity in India:—

TABLE I.

	Mean minimum.	Mean maximum.	Mean of the day.
January	42—75	70—85	60—80
February	45—75	73—93	60—80
March	57—77	85—95	70—82
April	65—77	90—102	80—92
May	75—80	90—102	82—95
June	72—82	82—102	80—95
July	70—80	82—97	77—90
August	70—80	82—95	77—87
September	70—75	80—95	77—85
October	65—75	85—92	77—80
November	50—75	80—85	65—78
December	42—75	72—85	57—77

The following table gives the mean daily temperatures of Calcutta, Allahabad, Bombay, Poona, Bangalore, Madras, and Rangoon for the different months of the year:—

TABLE II.

	Calcutta.	Allahabad.	Bombay.	Poona.	Madras.	Bangalore.	Rangoon.
January	66	61	73	74	76	76	74
February	71	66	75	77.5	77	78	78
March	79	78	79	83	78	84	80
April	85	88	82	87.5	84	88	85.5
May	86	92.5	84	87.5	88.7	87.5	83
June	84	91	82.5	83	88	82.5	80
July	83	85	78	79	85.5	79.5	80
August	82.5	83	78	78	86	79.5	79.5
September	83	83	78	78	86	79	79.5
October	79.5	77	80.5	81	81	79.5	81
November	72.5	69	78	77	78	77	78
December	66.5	61	76	74.5	76	74	75

The next table gives the mean maximum temperatures of the same localities.

TABLE III.

	Calcutta.	Allahabad.	Bombay	Poona.	Madras.	Bangalore.	Rangoon.
January	78	74	85	85	85	86	86
February	83	80	84	85	88	89	91
March	90	91	89	91	90	94	95
April	97	101	90	100	95	95	95
May	95	106	98	97	98	95	90
June	92	100	88	89	98	87	87
July	88	92	83	84	97	85	85
August	87	87	83	83	94	85	85
September... ..	86	91	83	84	92	85	85
October	86	90	88	88	90	85	87
November	82	82	88	88	85	83	87
December	78	77	85	86	83	80	85

The following table shows side by side the absolute maxima and minima temperatures:—

TABLE IV.

	Calcutta.	Allahabad.	Bombay.	Poona.	Madras.	Bangalore.	Rangoon.
January	89-45	87-36	96-53	95-44	93-57	89-49	95-55
February	99-45	96-38	95-55	100-45	98-60	93-50	97-55
March	103-53	106-46	100-60	106-50	104-63	100-54	102-60
April	107-63	107-57	98-68	105-60	104-69	100-59	106-68
May	105-66	112-64	99-69	106-60	112-70	107-64	106-69
June	105-70	117-70	96-69	105-68	110-68	96-64	98-68
July	96-73	115-69	95-69	96-68	107-68	95-65	93-71
August	95-73	106-71	89-69	92-65	103-70	95-59	93-70
September	95-72	106-67	94-69	95-65	103-69	94-61	94-68
October	95-62	106-53	95-64	100-55	98-66	93-59	95-67
November	90-51	96-37	98-61	98-47	94-60	90-54	94-61
December	88-47	87-36	94-52	95-45	93-57	88-49	96-56

The mean day temperature, calculated on the whole year as an average of twenty years' observations, is according to plate 49 of the Climatological Atlas:—

TABLE V.

	Calcutta.	Allahabad.	Bombay.	Poona.	Madras.	Bangalore.	Rangoon.
Mean day temperature ...	78	78	79	79	82	80	80
Mean maximum ...	87.5	90	87.5	88	89	90	89
Mean minimum ...	72	66	73	67.5	75	64	71

As in standardising work, the range within which temperature varies is a matter of considerable importance, we subjoin a table showing the diurnal range of temperature, in Fahrenheit degrees, for the different months in the year and for the stated localities.

TABLE VI.

	Calcutta.	Allahabad.	Bombay.	Poona.	Madras.	Bangalore.	Rangoon.
January ...	21	26	20	30	16	22	23
February ...	25	27	15	31	18	27	26
March ...	23	31	16	32.5	18	27	26
April ...	20	31	14	25	16	23	21
May ...	17	26	10	25	18	22	14
June ...	12	18	8	15	16	17	10
July ...	10	12	7	10	16	17	9
August ...	8	12	8	11	16	17	8
September ...	10	14	9	15	16	17	9
October ...	14	23	14	20	14	17	13
November ...	16	26	15	26	14	19	16
December ...	21	26	20	30	15	20	21

As for the purposes of calibration the diurnal range of variations in temperature is even of more importance than the closeness of the actual temperature to a chosen standard temperature, it will be seen, on scrutinising the preceding table, that all over India the months of June, July, August, and September are the best in which to carry out standardising operations; whilst starting from the town most favourably situated the stated localities arrange themselves in the following order: Bombay, Rangoon, Calcutta, Poona, Allahabad, Madras, Bangalore. This

is the order in which they appear, if we compare the temperature ranges in June, July, August, and September. If we take account of the data for the whole year, the order is different, namely, Bombay, Madras, Rangoon—Calcutta, Bangalore, Poona, Allahabad. The range of variation is most uniform for Madras; the other localities do not differ much from each other in this respect.

As most of the scientific work in colleges and laboratories is carried out during the hotter part of the day of 24 hours, the mean maxima given in Table I are of special interest. If we further consider that a standard temperature is more suitably fixed above the mean temperature of the day than below it, it appears that 30°C . is by no means too high a standard temperature for India. On the other hand it would hardly serve a useful purpose to fix the standard temperature at a much higher level; 32°C . would probably be the highest temperature which it might be reasonable to choose, and 35°C . is certainly too high. But just as Mr. Meares and myself object to 85°F . as a standard, because its equivalent on the centigrade scale is not a whole number, so 32°C . would be objectionable, because it is equal to $89\frac{2}{3}^{\circ}\text{F}$. On the other hand 25°C . = 77°F . is distinctly too low. That seems to me clearly proved by the data contained in the foregoing tables. Every argument appears, therefore, to be in favour of 30°C . as a standard temperature for India, and probably for tropical and sub-tropical countries in general.

The choice of a standard temperature is, however, the least part of the business. The main part of the work will consist in working out percentage tables and collect data for that temperature. And that is not the work of a single man. I shall shortly publish tables giving the percentage composition of sulphuric acid of different specific gravities, for various temperatures, from 20°C . upwards, but specially worked out for 30°C . Generally, we want tables constructed for 30°C . giving the percentage composition corresponding to different specific gravities of hydrochloric, nitric, oxalic, and acetic acids, of methylic and ethylic alcohol, of solutions of caustic potash, caustic soda, and ammonia; further tables for polarimetric work, tables of specific gravities of various solids and of organic liquids, tables of electric conductivities, and others.

Now, as a look at the preceding tables shows, 30°C . is somewhat too high a temperature of reference during part of November, December, and January. It appears to be generally recognised that 15°C . is too low a standard temperature even for Europe, and a number of data are now available for 20°C . Sometimes a tendency is discernible towards going even beyond 20°C ., say to 22°C . There are of course objections to 22°C . which we need not point out here. But 22°C . would really be a good temperature of reference for our cold weather. I am far from advocating the fixing of two standard temperatures. But it is sometimes easy to determine constants for more than one temperature, if one once is engaged in work of that nature; and it might be

useful to recommend a definite lower temperature as a second temperature for which to collect data, this second temperature not being a real standard temperature, but a sort of auxiliary temperature of reference for cold-weather work. And either 20°C . or 22°C . would serve our purpose. The decision on this, as well as on other points connected with the present subject, will have to be left to a committee of scientific workers.

SEPTEMBER, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 2nd September, 1908, at 9-15 P.M.

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L., President, in the chair.

The following members were present:—

Dr. N. Annandale, Mr. I. H. Burkill, Mr. B. L. Chaudhuri, Babu Amulya Charan Ghosh, Vidyabhusana, Mr. K. A. K. Hallowes, Mr. C. M. Hutchinson, Mr. T. H. D. La Touche, Dr. Girindranath Mukhopadhyaya, Captain C. C. R. Murphy, Suffolk Regt., Dr. E. D. Ross, Mr. G. H. Tipper, Dr. T. F. Pearse, Dr. Satis Chandra Vidyabhusana.

Visitors:—Babu Jogindraprasad Moitra, Babu Jitendra Nath Rakshit.

The minutes of the last meeting were read and confirmed.

Seventy-five presentations were announced.

The General Secretary reported the death of Mr. J. F. Hewitt, an Ordinary Member of the Society.

The General Secretary also reported that the Rev. A. H. Phillips had expressed a wish to withdraw from the Society.

The following four gentlemen were balloted for as Ordinary Members:—

Lieut. R. Foster, I.A., Survey of India, proposed by Mr. T. H. D. La Touche, seconded by Captain F. C. Hirst, I.A., *Rev. A. G. Ridsdale*, Bengal Chaplain, St. Thomas', proposed by Mr. T. H. D. La Touche, seconded by Rev. W. K. Firminger; *Syed Fida Ali*, Registration Office, proposed by Maulvi Abdul Wali, seconded by Syad Naseer Hosain Khan; and *Professor John Richard Cunningham*, Assistant Director of Public Instruction, Bengal, proposed by Professor J. A. Cunningham, seconded by Mr. H. R. James.

Dr. N. Annandale exhibited specimens of Indian barnacles and fish procured by the Bengal Government steam trawler "Golden Crown."

The following papers were read:—

1. *Saptagrama or Satguaw*. By RAKHAL DAS BANERJI: with a note on a new inscription of Alauddin Husain Shah.—By DR. T. BLOCH.

This paper will be published in a subsequent number of the *Journal*.

2. *Notes on a Buddhist Inscription from Hasra Kol, Gaya.*—
By ARTHUR VENIS.

3. *Madhainagar Grant of Laksmana Sena.*—By RAKHAL DAS
BANERJI.

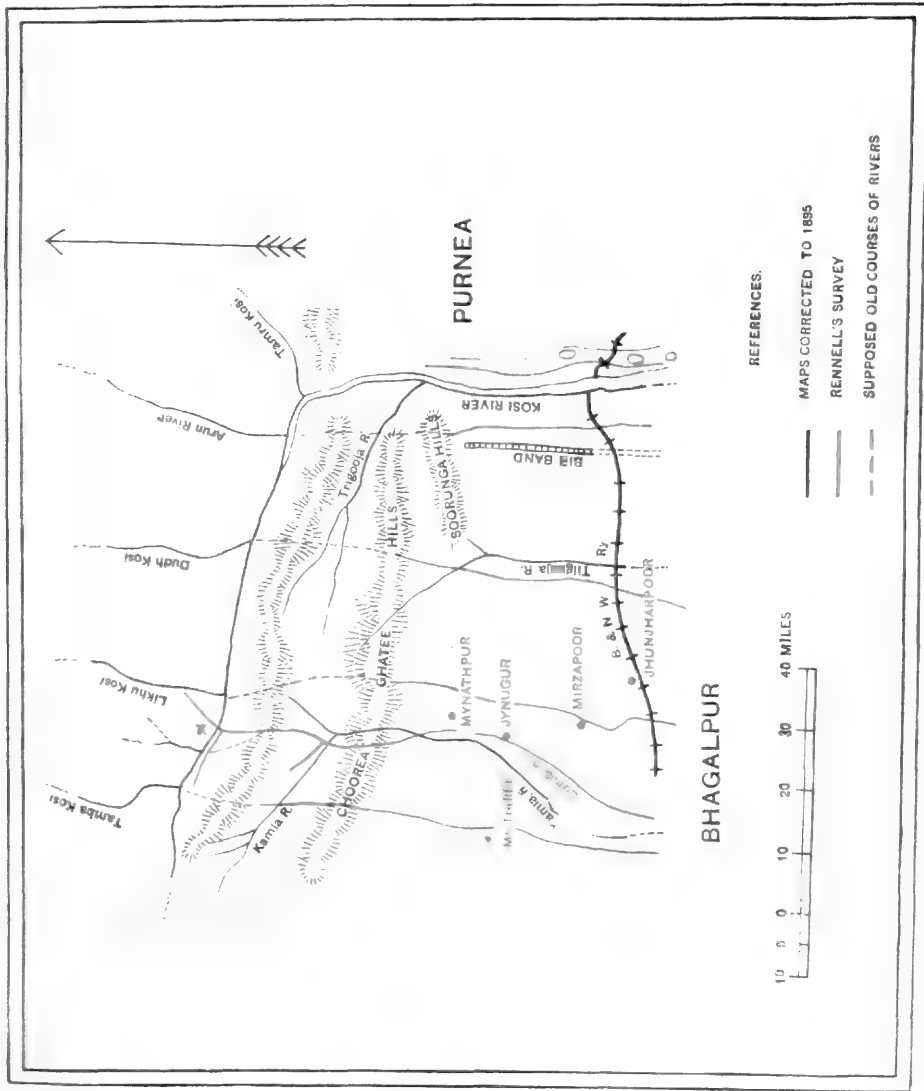
This paper will be published in a subsequent number of
the *Journal*.

4. *A Polyglot List of Birds in Manchu, Chinese and Turki,*
Part 2.—By DR. E. D. ROSS.

This paper will be published in the *Memoirs*.

5. *On the retardation and acceleration in the dissolution of
mercury in nitric acid in the presence of minute traces of ferric
nitrate and manganous nitrate.*—By PROFESSOR P. C. RAY, D.Sc.

This paper has been published in the *Journal* for August,
1908.



BHAGALPUR

PURNEA

REFERENCES.

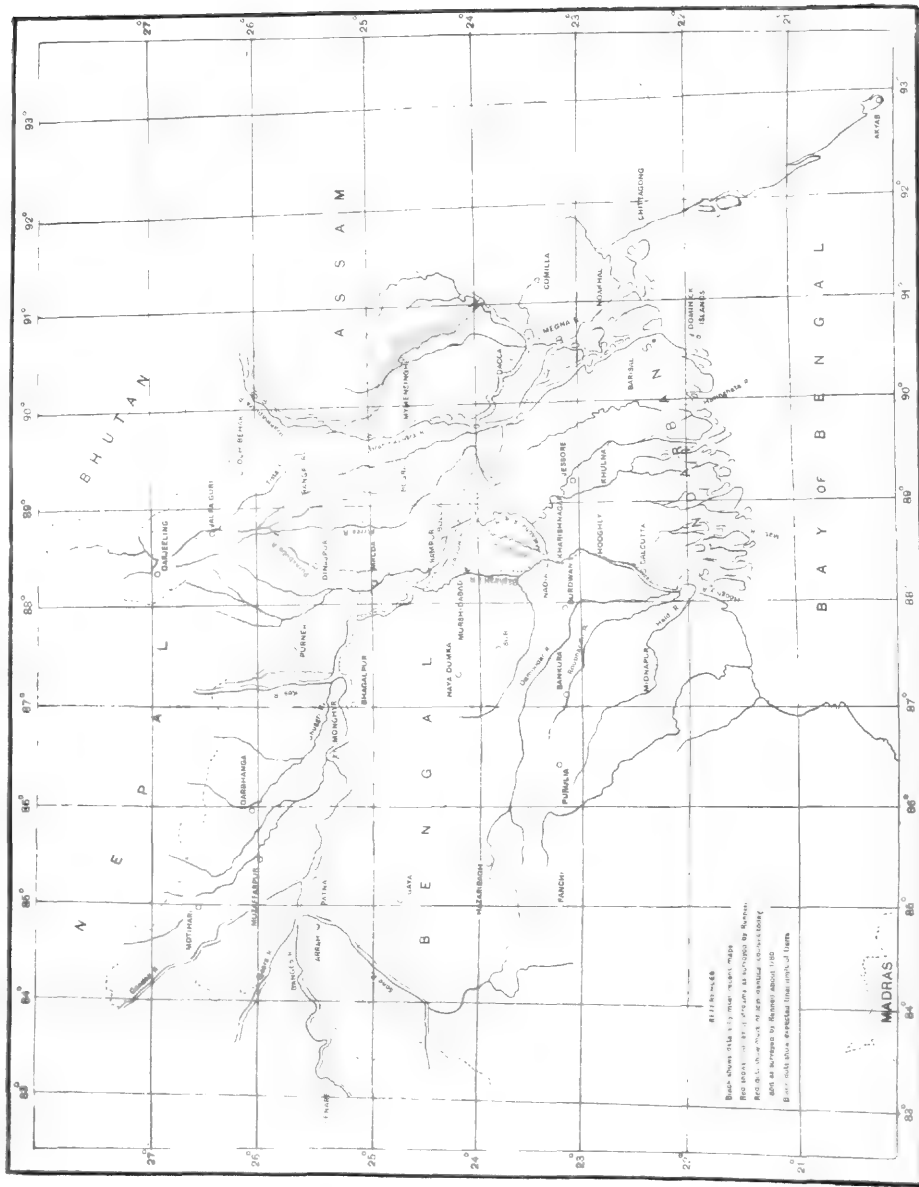


- MAPS CORRECTED TO 1895
- - - RENNELL'S SURVEY
- · · SUPPOSED OLD COURSES OF RIVERS

DIAGRAM No 1.



MAP SHOWING THE MAIN RIVERS OF BENGAL AND EASTERN BENGAL, TO ILLUSTRATE ENCROACHMENTS OF THE BRAHMAPUTRA ON THE PLAIN OF THE GANGES BETWEEN 1760 AND 1908.



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

- Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

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- (b) To propose and second candidates for Ordinary Membership.
- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
- (e) To take out books, plates and manuscripts from the Library.
- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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List of Officers and Members of Council

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51. A General Theory of Osculating Conics (Second Paper).¹

By PROF. SYAMADAS MUKHOPADHYAYA, M.A.

INTRODUCTION.

Abel Transon in a classical memoir, published in *Liouville's Journal* (vol. vi, 1841, Researches on the curvature of lines and surfaces), gave the first impulse to the study of *osculating conics and higher affections of curvature*.

To him we owe the important discovery, that if O be the middle point of an infinitesimal chord PQ , and T the summit of the arc PQ , then the line OT , in its limiting position, makes an angle δ with the normal, such that $\tan \delta = \frac{1}{3} \frac{d\rho}{ds}$. He calls the line OT , in its ultimate position, *the axis of deviation*, and takes $\tan \delta$ as the measure of *the rate of deviation of the curve from circular form*, or, of *the second affection of curvature*.

The more exact interpretation of $\tan \delta$ ² seems, to the present writer, to be what he has called *the partial rate of variation of curvature*, and the formula $\tan \delta = \frac{1}{3} \frac{d\rho}{ds}$ follows at once from this interpretation.

Transon notices that the deviation axis is the locus of centres of osculating conics of four-pointic contact. He determines the centre of the conic of five-pointic contact, as the intersection of two consecutive deviation axes. The distance R of this centre, from the point of contact, he first expresses in terms of ρ , $\frac{d\rho}{dw}$, $\frac{d^2\rho}{dw^2}$, and then reduces to an expression in q , r , s , taking p to be zero. His result is—

$$R = \frac{3\rho^2 \left\{ \left(\frac{d\rho}{dw} \right)^2 + 9\rho^2 \right\}^{\frac{1}{2}}}{4 \left(\frac{d\rho}{dw} \right)^2 + 9\rho^2 - 3\rho \frac{d^2\rho}{dw^2}}$$

$$= \frac{3q (r^2 + 9q^2)^{\frac{1}{2}}}{3qs - 5r^2}$$

He gives elegant geometrical constructions for completely determining the osculating parabola and the osculating conic, after $\tan \delta$ and R have been determined.

His work is quasi-geometrical. His chief aim was to discover 'the second and third affections of curvature.' His discovery

¹ Continued from *Journal A.S.B.*, vol. iv, No. 4, New Series.

² Vide 'The Geometrical Theory of a Plane Non-cyclic Arc, finite as well as infinitesimal' (*J.A.S.B.*, vol. iv, No. 6, New Series).

of $\tan \delta$ was beautiful, and he rightly thought he had obtained the *third affection of curvature* when he had determined the value of R , which enabled him to construct the osculating conic.

Professors M. and R. Roberts and J. Wolstenholme have, as isolated problems set in University Papers or published in Collections of Problems, made a number of useful determinations about osculating conics. They have not done, however, any systematic work, and it is not apparent what methods they may have followed in deducing the results. There is strong presumption that they have mainly relied on Transon's researches.

Dr. A. Mukhopadhyaya, in his admirable contributions to the *Journal of the Asiatic Society of Bengal*, more specially in his paper 'On the differential equation of all parabolas,' has treated the subject more methodically, and has deduced and interpreted several important results.

This second paper is based entirely on certain transformations of analytical equations, deduced in determinant forms, in the first paper. The results have been invariably expressed in general differentials. The use made of the quantities P, Q, R, S , etc., will, it is hoped, be found interesting.

14. The general equation of the osculating conic, obtained as equation (41), namely—

$$\begin{vmatrix} (X-x)^2 & (Y-y)^2 \\ 2(dx)^2 & 2(dy)^2 \\ 6dx d^2x & 6dy d^2y \\ 6(d^2x)^2 + 8dx d^3x & 6(d^2y)^2 + 8dy d^3y \\ (X-x)(Y-y) & (Y-y)dx - (X-x)dy \\ 2dx dy & d^2y dx - d^2x dy \\ 3dx d^2y + 3dy d^2x & d^3y dx - d^3x dy \\ 6d^2x d^2y + 4(dx d^3y + dy d^3x) & d^4y dx - d^4x dy \end{vmatrix} = 0$$

is capable of a simple transformation.

If we write—

$$\begin{vmatrix} (Y-y)dx - (X-x)dy = L \\ (Y-y)d^2x - (X-x)d^2y = M \\ d^3y dx - d^3x dy = Q \\ d^3y dx - d^3x dy = R \\ d^3y dx - d^3x dy = S \\ d^3y dx - d^3x dy = T \\ d^3y d^2x - d^3x d^2y = R' \\ d^3y d^2x - d^3x d^2y = S' \\ dx^2 + dy^2 = P \\ dx d^3x + dy d^3y = Q_1 \end{vmatrix} \quad (51)$$

then, equation (41) easily transforms into—

$$\begin{vmatrix} L^2 & M^2 & LM & L \\ O & 2Q^2 & O & Q \\ O & O & -3Q & R \\ 6Q^2 & -8QR' & -4QR & S \end{vmatrix} = 0$$

or,

$$\begin{vmatrix} L^2 & M^2 - 2QL & LM \\ O & -2QR & -3Q^2 \\ 6Q^2 & -8QR' - 2QS & -4QR \end{vmatrix} = 0$$

or,

$$(3QM - RL)^2 + (3QS - 5R^2 + 12QR')L^2 = 18Q^3L.$$

or,

$$\begin{aligned} & \{ (Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy) \}^2 \\ & + (3QS - 5R^2 + 12QR') \{ (Y-y)dx - (X-x)dy \}^2 \\ & = 18Q^3 \{ (Y-y)dx - (X-x)dy \}^2 \end{aligned} \quad (52)$$

Hence, the osculating conic is an ellipse, hyperbola or parabola, according as

$$3QS - 5R^2 + 12QR'$$

is positive, negative or zero.

(53)

15. Again, the condition that a conic may pass through six consecutive points on any curve, obtained as equation (49), namely,

$$\begin{vmatrix} dx^2 & dy^2 \\ 3dxd^2x & 3dyd^2y \\ 3(d^2x)^2 + 4dxd^3x & 3(d^2y)^2 + 4dyd^3y \\ 10d^2xd^3x + 5dxd^4x & 10d^2yd^3y + 5dyd^4y \\ 2dxdy & dx^2y - dyd^2x \\ 3(dxd^2y + dyd^2x) & dx^3y - dyd^3x \\ 6d^2xd^2y + 4(dxdy^3 + dyd^3x) & dx^4y - dyd^4x \\ 10(d^2xd^3y + d^3xd^2y) + 5(dxd^4y + dyd^4x) & dx^5y - dyd^5x \end{vmatrix} = 0$$

likewise transforms easily into

$$\begin{vmatrix} O & Q^2 & O & Q \\ O & O & -3Q^2 & R \\ 3Q^2 & -4QR' & -4QR & S \\ 10QR & -5QS' & 10QR' + 5QS & T \end{vmatrix} = 0$$

or,

$$\begin{vmatrix} O & R & 3Q \\ 3Q & S + 4R' & -4R \\ 10R & T + 5S' & 10R' + 5S \end{vmatrix} = 0$$

or,

$$40R^3 - 45QES + 9Q^2T - 90QRR' + 45Q^2S' = 0 \quad (54)$$

which is, therefore, the general form of the differential equation of a conic.

16. The conic of four-pointic contact, at any point (x, y) of a given curve, has the first, second and third differentials of x and y , the same as with the given curve, but the fourth and higher differentials arbitrary, and, in general, different from those with the given curve. Hence if we put, in equation (52),

$$3QS - 5R^2 + 12QR' = \lambda \tag{55}$$

where λ is an arbitrary constant, we shall have, as the equation of the system of conics, of four-pointic contact, at any point (x, y) of a given curve,

$$\begin{aligned} & \{(Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy)\}^2 \\ & + \lambda\{(Y-y)dx - (X-x)dy\}^2 = 18Q^3\{(Y-y)dx - (X-x)dy\}^2 \end{aligned} \tag{56}$$

Again, if we consider third and higher differentials of x and y arbitrary, and put $\frac{R}{3Q} = \mu$, $\frac{\lambda}{9Q^2} = \nu$, where μ and ν are arbitrary constants, we have as the equation of the system of conics of three-pointic-contact, at any point (x, y) of a given curve,

$$\begin{aligned} & \{(Y-y)(d^2x - \mu dx) - (X-x)(d^2y - \mu dy)\}^2 \\ & + \nu\{(Y-y)dx - (X-x)dy\}^2 = 2Q\{(Y-y)dx - (X-x)dy\} \end{aligned} \tag{57}$$

In particular, the equation of the system of parabolas of three-pointic contact is

$$\{(Y-y)(d^2x - \mu dx) - (X-x)(d^2y - \mu dy)\}^2 = 2Q\{(Y-y)dx - (X-x)dy\} \tag{58}$$

17. It may be interesting to deduce directly the equation of a conic of three-pointic contact, from a special form of the equation of a conic passing through three given points.

Let (x, y) , (x_1, y_1) , (x_2, y_2) be the co-ordinates of any three points P, P_1, P_2 , and let

$$\left. \begin{aligned} L & \equiv (Y-y_1)(x_1-x) - (X-x_1)(y_1-y) \\ M & \equiv (Y-y_1)(x_2-x_1) - (X-x_1)(y_2-y_1) \\ N & \equiv (Y-y)(x_2-x) - (X-x)(y_2-y) \end{aligned} \right\} \tag{59}$$

be the equations of the lines PP_1, P_1P_2 and PP_2 , respectively. Then

$$\left. \begin{aligned} M - L & \equiv (Y-y_1)(x_2 - 2x_1 + x) - (X-x_1)(y_2 - 2y_1 + y) \\ M + L & \equiv (Y-y_1)(x_2 - x) - (X-x_1)(y_2 - y) \\ L + M - N & \equiv (y_2 - y)(x_1 - x) - (x_2 - x)(y_1 - y) \end{aligned} \right\} \tag{60}$$

Now, the equation of a conic through P, P_1, P_2 can evidently be written in the form

$$\lambda LM - \mu N(M-L) + (M-L)^2 - (M+L)(M+L-N) = 0$$

where λ and μ are arbitrary constants, for, it is the same as

$$\lambda LM - \mu(MN - NL) - (4LM - MN - NL) = 0$$

which circumscribes $L=0, M=0, N=0$

Thus, the general equation of a conic, through three given points, is of the form

$$\begin{aligned} & \lambda\{(Y-y_1)(x_1-x) - (X-x_1)(y_1-y)\}\{(Y-y_1)(x_2-x_1) \\ & \quad - (X-x_1)(y_2-y_1)\} \\ & - \mu\{(Y-y)(x_2-x) - (X-x)(y_2-y)\}\{(Y-y_1)(x_2-2x_1+x) \\ & \quad - (X-x_1)(y_2-2y_1+y)\} \\ & + \{(Y-y_1)(x_2-2x_1+x) - (X-x_1)(y_2-2y_1+y)\}^2 \\ & - \{(Y-y_1)(x_2-x) - (X-x_1)(y_2-y)\}\{(y_2-y)(x_1-x) \\ & \quad - (x_2-x)(y_1-y)\} = 0 \end{aligned} \tag{61}$$

Now if $(x, y), (x_1, y_1), (x_2, y_2)$ be consecutive points on a curve then

$$\left. \begin{aligned} x_1 &= x + dx, \quad x_2 = x_1 + dx_1 = x + 2dx + d^2x \\ y_1 &= y + dy, \quad y_2 = y_1 + dy_1 = y + 2dy + d^2y \end{aligned} \right\}$$

Therefore (61) becomes

$$\begin{aligned} & \lambda\{(Y-y)dx - (X-x)dy\}^2 - 2\mu\{(Y-y)dx - (X-x)dy\}\{(Y-y)d^2x \\ & \quad - (X-x)d^2y\} + \{(Y-y)d^2x - (X-x)d^2y\}^2 - 2Q\{(Y-y)dx + (X-x)dy\} = 0 \\ & \text{Or } \{(Y-y)(d^2x - \mu dx) - (X-x)(d^2y - \mu dy)\}^2 \\ & + \nu\{(Y-y)dx - (X-x)dy\}^2 = 2Q\{(Y-y)dx - (X-x)dy\} \end{aligned}$$

where $\nu = \lambda - \mu^2$. This equation is the same as (57).

18. Again, the general equation of a cubic through three given points $(x, y), (x_1, y_1), (x_2, y_2)$ can evidently be written in the form

$$\begin{aligned} & \alpha(X-x)(X-x_1)(X-x_2) + \beta(Y-y)(Y-y_1)(Y-y_2) \\ & + \gamma(X-x)(Y-y_1)(Y-y_2) + \delta(Y-y)(X-x_1)(X-x_2) \\ & + \lambda\{(Y-y_1)(x_1-x) - (X-x_1)(y_1-y)\}\{(Y-y_1)(x_2-x_1) \\ & \quad - (X-x_1)(y_2-y_1)\} \\ & - \mu\{(Y-y)(x_2-x) - (X-x)(y_2-y)\} \\ & \quad \{(Y-y_1)(x_2-2x_1+x) - (X-x_1)(y_2-2y_1+y)\} \\ & + \{(Y-y_1)(x_2-2x_1+x) - (X-x_1)(y_2-2y_1+y)\}^2 \\ & - \{(Y-y_1)(x_2-x) - (X-x_1)(y_2-y)\} \\ & \quad \{(y_2-y)(x_1-x) - (x_2-x)(y_1-y)\} = 0 \end{aligned} \tag{62}$$

which contains the necessary terms and the necessary number of arbitrary constants.

Therefore, the cubic of three-pointic contact at any point (x, y) of a curve, is of the form

$$\begin{aligned} &\alpha(X-x)^3 + \beta(Y-y)^3 + \gamma(X-x)(Y-y)^2 + \delta(Y-y)(X-x)^2 \\ &\quad + \lambda\{(Y-y)dx - (X-x)dy\}^2 \\ &\quad - 2\mu\{(Y-y)dx - (X-x)dy\}\{(Y-y)d^2x - (X-x)d^2y\} \\ &+ \{(Y-y)d^2x - (X-x)d^2y\}^2 - 2Q\{(Y-y)dx - (X-x)dy\} = 0 \end{aligned} \quad (63)$$

In general, the equation of a curve of the n^{th} degree, which has three-pointic contact with a given curve at the origin will have the portion below third degree, of the form

$$\begin{aligned} &\lambda\{Ydx - Xdy\}^2 - 2\mu\{Ydx - Xdy\}\{Yd^2x - Xd^2y\} \\ &\quad + \{Yd^2x - Xd^2y\}^2 - 2Q\{Ydx - Xdy\} = 0 \end{aligned} \quad (64)$$

19. It is easy to deduce from the general equation of a conic of three or four-pointic contact, that of a four or five-pointic contact, and the method is a useful one.

For example, the general equation of a parabola of three-pointic contact is (58)

$$\begin{aligned} &\{(Y-y)(d^2x - \mu dx) - (X-x)(d^2y - \mu dy)\}^2 \\ &= 2Q\{(Y-y)dx - (X-x)dy\} \end{aligned}$$

If this parabola meet the curve again at an adjacent point (X, Y) , then

$$\left. \begin{aligned} X &= x + dx + \frac{1}{1.2}d^2x + \frac{1}{1.2.3}d^3x + \&c. \\ Y &= y + dy + \frac{1}{1.2}d^2y + \frac{1}{1.2.3}d^3y + \&c. \end{aligned} \right\} \quad (65)$$

Substituting (65) in (58) and remembering that μ is an infinitesimal of first order, we have

$$\left(-Q - \frac{1}{2}\mu Q\right)^2 = 2Q\left\{\frac{1}{2}Q + \frac{1}{6}R\right\}$$

or,
$$\mu = \frac{R}{3Q}$$

Again, to determine λ , so that we may get the conic of five-pointic contact, from the system of four-pointic (56),

$$\begin{aligned} &\{(Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy)\}^2 \\ &+ \lambda\{(Y-y)dx - (X-x)dy\}^2 = 18Q^3\{(Y-y)dx - (X-x)dy\} \end{aligned}$$

Substitute (65) in (56), and remembering that λ is an infinitesimal of order eight, we have

$$\begin{aligned} & (-3Q^2 - \frac{1}{2}RQ + \frac{1}{2}QR' - \frac{1}{6}R^3)^2 + \lambda\{\frac{1}{2}Q + \frac{1}{6}R\}^2 \\ & = 18Q^3\{\frac{1}{2}Q + \frac{1}{6}R + \frac{1}{24}S\} \end{aligned}$$

or,
$$9Q^4 + 3RQ^3 + \frac{3}{4}R^2Q^2 - 3R'Q^3 + \frac{1}{4}\lambda Q^2$$

$$= 9Q^4 + 3Q^3R + \frac{3}{4}Q^3S$$

or,
$$\lambda = 3QS - 5R^2 + 12QR'$$

20. Equation (56) can be written as

$$\begin{aligned} & \{(Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy)\}^2 \\ & + \lambda\left\{(Y-y)dx - (X-x)dy - \frac{9Q^3}{\lambda}\right\}^2 = \frac{81Q^6}{\lambda} \end{aligned}$$

whence,

$$(Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy) = 0 \quad (66)$$

and
$$(Y-y)dx - (X-x)dy = \frac{9Q^3}{\lambda} \quad (67)$$

are the equations of two conjugate diameters.

Equation (66) gives the diameter through the point of contact, and as it is independent of λ , it represents the locus of centres of all conics of four-pointic contact at the given point.

Equation (67) gives the diameter parallel to the tangent at (x, y) .

The intersection of (66) and (67) is the centre, whose co-ordinates are

$$X = x + \frac{3Q(3Qd^2x - Rdx)}{\lambda} \quad Y = y + \frac{3Q(3Qd^2y - Rdy)}{\lambda} \quad (68)$$

The osculating semi-diameter OP is given by

$$\begin{aligned} OP^2 &= \frac{9Q^2}{\lambda^2} \{(3Qd^2x - Rdx)^2 + (3Qd^2y - Rdy)^2\} \\ &= \frac{9Q^2\{9Q^4 + (3QQ_1 - RP)^2\}}{\lambda^2 P} \end{aligned} \quad (69)$$

For,
$$(3Qd^2x - Rdx)^2 + (3Qd^2y - Rdy)^2$$

$$= 9Q^2\{(d^2x)^2 + (d^2y)^2\} - 6QR\{dx d^2x + dy d^2y\}$$

$$+ R^2(dx^2 + dy^2)$$

$$= 9Q^2 \frac{Q^2 + Q_1^2}{P} - 6QRQ_1 + R^2P$$

$$= \frac{9Q^4 + (3QQ_1 - RP)^2}{P} \quad (70)$$

If ψ be the angle between the normal and line of centres (66), called the angle of *aberrancy*, then evidently

$$\left. \begin{aligned} \tan \psi &= \frac{3QQ_1 - RP}{3Q^2} \\ \cos \psi &= \frac{3Q^2}{\{9Q^4 + (3QQ_1 - RP)^2\}^{\frac{1}{2}}} \\ \sin \psi &= \frac{3QQ_1 - RP}{\{9Q^4 + (3QQ_1 - RP)^2\}^{\frac{1}{2}}} \end{aligned} \right\} (71)$$

If a and b be the semi-axes of the conic (56), then, evidently,

$$\begin{aligned} \frac{1}{a^2} + \frac{1}{b^2} &= \frac{\lambda}{81Q^6} \{ (3Qd^2x - Rdx)^2 + \lambda dx^2 + (3Qd^2y - Rdy)^2 + \lambda dy^2 \} \\ &= \frac{\lambda}{81Q^6P} \{ 9Q^4 + (3QQ_1 - RP)^2 + \lambda P^2 \} \\ \frac{1}{a^2b^2} &= \frac{\lambda^2}{81^2 Q^{12}} [\{ 3Qd^2x - Rdx \}^2 + \lambda dx^2 \} \{ (3Qd^2y - Rdy)^2 + \lambda dy^2 \} \\ &\quad - \{ (3Qd^2x - Rdx)(3Qd^2y - Rdy) + \lambda dx dy \}^2] \\ &= \frac{\lambda^5}{81^2 Q^{12}} \{ (3Qd^2y - Rdy) dx - (3Qd^2x - Rdx) dy \}^2 \\ &= \frac{\lambda^3}{27^2 Q^3} \end{aligned}$$

Therefore, $a^2 + b^2 = \frac{9Q^2}{\lambda^2 P} \{ 9Q^4 + (3QQ_1 - RP)^2 + \lambda P^2 \}$ (72)

$$ab = \frac{27Q^4}{\lambda^{\frac{3}{2}}}$$

If CD be the diameter conjugate to CP , then from (69) and (72)

$$\left. \begin{aligned} CD^2 &= a^2 + b^2 - CP^2 = \frac{9Q^2P}{\lambda} \\ \frac{CP^2}{CD^2} &= \frac{9Q^4 + (3QQ_1 - RP)^2}{\lambda P^2} \\ \frac{CD^2}{CP} &= \frac{3QP^{\frac{3}{2}}}{\{9Q^4 + (3QQ_1 - RP)^2\}^{\frac{1}{2}}} = \rho \cos \psi \end{aligned} \right\} (73)$$

The equation of the director circle, deduced from (68) and (72), is

$$\lambda \{ (X-x)^2 + (Y-y)^2 \} - 6Q \{ (X-x)(3Qd^2x - Rdx) + (Y-y)(3Qd^2y - Rdy) + \frac{2}{3}QP \} = 0 \quad (74)$$

Thus the director circles of the system of conics of four-pointic contact, form a co-axial system, of which the radical axis is

$$(X-x)(3Qd^2x - Rdx) + (Y-y)(3Qd^2y - Rdy) + \frac{3}{2}QP = 0 \quad (75)$$

This radical axis is the directrix of the osculating parabola.

21. The condition that the osculating conic may be an equilateral hyperbola is $a^2 + b^2 = 0$. Therefore, from (72)

$$\left. \begin{aligned} \lambda &= -\frac{9Q^3 + (3QQ_1 - RP)^2}{P^2} \\ \text{and } \alpha^2 &= \frac{27Q^3P^3}{\{9Q^3 + (3QQ_1 - RP)^2\}^{\frac{3}{2}}} = \rho^2 \cos^2 \psi \end{aligned} \right\} (76)$$

where α is the semi-axis of the osculating equilateral hyperbola.

The co-ordinates of the point, where the normal at the point of contact meets the equilateral hyperbola again, are found to be

$$\left. \begin{aligned} X &= x + \frac{2Pdy}{Q} \\ Y &= y - \frac{2Pdx}{Q} \end{aligned} \right\} (77)$$

But the co-ordinates of the centre of curvature are (11)

$$X = x - \frac{Pdy}{Q} \quad Y = y + \frac{Pdx}{Q}$$

Therefore, the osculating equilateral hyperbola meets the normal again, towards the convex side of the curve, at a distance from the point of contact equal to twice the radius of curvature.

Again, as the co-ordinates (77) do not involve higher differentials than the second, we conclude that all equilateral hyperbolas of three-pointic contact pass through the same point (77).

Further, as two consecutive osculating equilateral hyperbolas may be conceived to possess three consecutive points common, they intersect again at (77), and, therefore, the *envelope* of the further branch of the osculating equilateral hyperbola is the locus of the point given by (77).

22. The equation of the osculating parabola, obtained from (56) by putting $\lambda = 0$ is

$$\begin{aligned} \{ &(Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy) \}^2 \\ &= 18Q^3 \{ (Y-y) dx - (X-x) dy \} \end{aligned} \quad (78)$$

The diameter through point of contact is (66)

$(Y-y)(3Qd^2x - Rdx) - (X-x)(3Qd^2y - Rdy) = 0$ and the directrix is (75)

$$(Y-y)(3Qd^2y - Rdy) + (X-x)(3Qd^2x - Rdx) + \frac{3}{2}QP = 0.$$

The co-ordinates of the point of intersection, of the diameter through point of contact with directrix, are

$$\left. \begin{aligned} X_1 &= x - \frac{3}{2}QP^2 \frac{3Qd^2x - Rdx}{9Q^4 + (3QQ_1 - RP)^2} \\ Y_1 &= y - \frac{3}{2}QP^2 \frac{3Qd^2y - Rdy}{9Q^4 + (3QQ_1 - RP)^2} \end{aligned} \right\} (79)$$

If (α, β) be the focus, then the join of (α, β) and (X_1, Y_1) is bisected at right angles by the tangent at (x, y) , hence

$$\left. \begin{aligned} \alpha &= X_1 - udy \quad \beta = Y_1 + udx \\ \text{where } u &= \frac{9Q^3P}{9Q^4 + (3QQ_1 - RP)^2} \end{aligned} \right\} (80)$$

The semi-latus rectum (l) is the perpendicular from focus on the directrix. Therefore

$$l = \frac{27Q^5 P^{\frac{3}{2}}}{\{9Q^4 + (3QQ_1 - RP)^2\}^{\frac{3}{2}}} = \rho \cos^3 \psi \quad (81)$$

The focal distance of (x, y) is equal to the distance of (x, y) from directrix

$$= \frac{\frac{3}{2}Q P^{\frac{3}{2}}}{\{9Q^4 + (3QQ_1 - RP)^2\}^{\frac{1}{2}}} = \frac{\rho}{2} \cos \psi. \quad (82)$$

The axis passes through (α, β) and is, therefore,

$$\begin{aligned} (Y - y)(3Qd^2x - Rdx) - (X - x)(3Qd^2y - Rdy) \\ = \frac{9Q^3P(3QQ_1 - RP)}{9Q^4 + (3QQ_1 - RP)^2} \end{aligned} \quad (83)$$

The normal at the point of contact meets the axis (83) at

$$X = x - ndy \quad Y = y + udx \quad (84)$$

The distance of this point, from point of contact, is

$$uP^{\frac{1}{2}} = \frac{9Q^3P^{\frac{3}{2}}}{9Q^4 + (3QQ_1 - RP)^2} = \rho \cos^2 \psi \quad (85)$$

The co-ordinates of the intersection of the directrix with the normal at the point of contact are

$$X = x + \frac{Pdy}{2Q} \quad Y = y - \frac{Pdx}{2Q} \quad (86)$$

Therefore the directrix of the osculating parabola meets the normal, towards the convex side of the curve, at a distance from the point of contact equal to half the radius of curvature.

Again, as the co-ordinates (86) do not involve higher differentials than the second, we conclude that the directrices of

all parabolas of three-pointic contact, pass through the same point (86).

Further, as two consecutive parabolas, of four-pointic contact, may be conceived to possess three consecutive points common, their directrices meet at (86), and, therefore, the *envelope* of the directrix of the osculating parabola is the locus of the point (86).

23. If a and b be the semi-axis of any ellipse of the system of conics of four-pointic contact (56), then from (72)

$$\begin{aligned} \frac{a}{b} + \frac{b}{a} &= \frac{1}{3\lambda^{\frac{1}{2}}Q^2P} \{9Q^4 + 3(QQ_1 - RP)^2 + P\lambda\} \\ &= \frac{3Q^2}{P\lambda^{\frac{1}{2}}} \sec^2\psi + \frac{P\lambda^{\frac{1}{2}}}{3Q^2} \end{aligned} \quad (87)$$

But $\left(\frac{a}{b} + \frac{b}{a}\right)^2 = 4 + \frac{e^4}{1-e^2}$

Therefore $\frac{a}{b} + \frac{b}{a}$ is a minimum when e is a minimum.

Hence, the ellipse of minimum eccentricity of the system (56) is determined by

$$\left. \begin{aligned} \lambda &= \frac{9Q^4 + (3QQ_1 - RP)^2}{P^2} \\ \frac{a}{b} + \frac{b}{a} &= \frac{2}{\cos\psi} \end{aligned} \right\} (88)$$

Therefore, the centre of the osculating ellipse, of minimum eccentricity, is a point, on the line of centres, towards the concave side, at the same distance, from the point of contact, as the centre of the osculating equilateral hyperbola. Here, evidently $CP = CD = \rho \cos\psi$.

Again, if λ_1 and λ_2 correspond to equal values of the eccentricity, and, therefore, to equal values of $\frac{a}{b} + \frac{b}{a}$, then from (87)

$$\sqrt{\lambda_1 \lambda_2} = \frac{9Q^4 + (3QQ_1 - RP)^2}{P^2} \quad (89)$$

Therefore, if C, C_1, C_2 be the centres of the ellipse of minimum eccentricity and of any two ellipses of equal eccentricity, then, from (69)

$$C_1P \cdot C_2P = CP^2 \quad (90)$$

where P is the point of contact.

Analogous results hold for the system of hyperbolas of four-pointic contact.

If Q be the centre of the osculating equilateral hyperbola, and Q_1, Q_2 the centres of any two osculating hyperbolas whose

asymptotic angles are supplementary, then we can prove in the same way

$$Q_1 P \cdot Q_2 P = Q P^2 \tag{91}$$

Again, if (a_1, b_1) and (a_2, b_2) be semi-axis corresponding to λ_1 and λ_2 , then by (72)

$$a_1 b_1 = \frac{27 Q^4}{\lambda_1^{\frac{3}{2}}} a_2 b_2 = \frac{27 Q^4}{\lambda_2^{\frac{3}{2}}}$$

$$\text{Therefore, } a_1 b_1 a_2 b_2 = \frac{27^2 Q^3 P^6}{\{9 Q^3 + (3 Q Q_1 - B P)^2\}^{\frac{3}{2}}} = a^4 \tag{92}$$

where a is the semi-axis of the osculating equilateral hyperbola.

24. The system of simple binomial differential quantities $P, Q, R, S, T, Q_1, R', S'$, which have been introduced in the preceding investigations, can, of course, be taken with any independent variable. Of the eight quantities only the first five may be looked upon as primary, and the rest as dependent auxiliaries. If we take x as the independent variable, then dx is constant, and therefore, d^2x, d^3x, d^4x, d^5x all vanish. The quantities P, Q, R, S, T, Q_1 are, in this case, equal to $(1+p^2)dx^2, qdx^3, rdx^4, sdx^5, tdx^6, pqdx^3$, respectively. R' and S' evidently vanish.

If we take the arc (s) as the independent variable, then

$$P = dx^2 + dy^2 = ds^2 = \text{constant}$$

$$\text{Therefore, } Q_1 = dx d^2x + dy d^2y = \frac{1}{2} dP = 0$$

$$(d^2x)^2 + (d^2y)^2 = \frac{Q^2 + Q_1^2}{P} = \frac{Q^2}{P} \tag{93}$$

$$\text{Again } dQ_1 = (d^2x)^2 + (d^2y)^2 + dx d^3x + dy d^3y = \frac{1}{2} d^2P = 0$$

$$\text{Therefore, } dx d^3x + dy d^3y = -\frac{Q^2}{P} \tag{94}$$

$$\text{Also, } dx R' - d^3x R + d^3x Q = 0$$

$$dy R' - d^3y R + d^3y Q = 0$$

$$\text{Therefore } PR' - BQ_1 + (dx d^3x + dy d^3y) Q = 0$$

$$\text{Hence } R' = \frac{Q^3}{P^2} \tag{95}$$

$$\text{Also, } S' = dR' = \frac{3Q^2 R}{P^3} \tag{96}$$

The general differential equation (54) of the conic, if s be the independent variable, therefore, becomes

$$40 R^3 + 9Q^2 T = 45 QR \left(S - \frac{Q^3}{P^2} \right) \tag{97}$$

Again let $\rho, \rho', \rho'', \rho'''$ be the radius of curvature and its three successive differentials, on the supposition that the arc is the independent variable.

Then by (11), (95) and (96)

$$Q = P^{\frac{3}{2}} \frac{1}{\rho}, R = dQ = -\frac{P^{\frac{3}{2}} \rho'}{\rho^2}, R' = \frac{P^{\frac{5}{2}}}{\rho^3}, S' = 3 \frac{P^{\frac{3}{2}} \rho'}{\rho^4} \quad (98)$$

$$\left. \begin{aligned} \text{Also } S + R' = dR = P \left(\frac{2\rho'^2}{\rho^3} - \frac{\rho''}{\rho^2} \right) \\ T + 2S' = d^2R = P^{\frac{3}{2}} \left(-\frac{6\rho'^3}{\rho^4} + \frac{6\rho'\rho''}{\rho^3} - \frac{\rho'''}{\rho^2} \right) \end{aligned} \right\} (99)$$

By the above substitutions (98), (99) any expression in P, Q, R, S , &c., can be readily converted into another in P, ρ, ρ', ρ'' and ρ''' .

$$\text{Thus, } 9Q^4 + (3QQ_1 - PR)^2 = \frac{P^6}{\rho^4} \left(9 + \frac{\rho'^2}{P} \right) \quad (100)$$

$$3QS - 5R^2 + 12QR' = \frac{P^4}{\rho^4} \left(9 + \frac{\rho'^3}{P} - \frac{3\rho\rho''}{P} \right) \quad (101)$$

$$\begin{aligned} 40R^3 - 45QRS + 9Q^2T - 90QRR' + 45Q^2S' \\ = -\frac{P^{\frac{9}{2}}}{\rho^6} \left\{ 4\rho'^3 - 9\rho\rho'\rho'' + 9\rho^2\rho''' + 36P\rho' \right\} \end{aligned} \quad (102)$$

Therefore the differential equation of a conic in ρ and s is

$$4\rho'^3 - 9\rho\rho'\rho'' + 9\rho^2\rho''' + 36P\rho' = 0$$

or,

$$4\left(\frac{d\rho}{ds}\right)^3 - 9\rho\frac{d\rho}{ds}\frac{d^2\rho}{ds^2} + 9\rho^2\frac{d^3\rho}{ds^3} + 36\frac{d\rho}{ds} = 0 \quad (103)$$



52. The Later Mughals (1707-1803).

By WILLIAM IRVINE, *Bengal Civil Service* (Retired).

[In continuation of article in Part I of the *Journal* for 1904, Vol. LXXIII, pp. 28-59 (Extra Number).]

CHAPTER VII (*continued*)—MUHAMMAD SHĀH (1719-1748).

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L'ENVOI.

SECTION 5.—CHABELAH RĀM AND GIRDHAR BAHĀDUR AT ALLAHĀBĀD.

Chabelah Rām, Nāgar, owed his fortunes entirely to 'Azīm-shāh, fighting for whom his brother, Dyā Rām, was killed in 1124 H., 1712, at Lāhor. He had been one of the earliest to declare himself in Farrukhsiyar's favour, after that prince's cause had been espoused by the Sayyid brothers. In reward for this zeal he had obtained high rank and various important appointments. He had never been well affected to the Sayyids, and had made a good deal of underhand complaint about them to Farrukhsiyar. At the time of that emperor's deposition, he was governor of

the Allahābād province. The downfall of his patron was distinctly opposed to his interests; but, as the saying is, "the earth is hard and the sky far off."¹ From that moment he stood aloof from the Sayyids, in an attitude not far removed from rebellion; and his name was mixed up with all the rumoured projects having for their object the rescue of the late sovereign from the hands of the Sayyid ministers. His declared revolt against them may be dated from the middle of Ramazān 1131 H., (August 1719), just a little before the time that Āgrah fort was re-captured and the movement in favour of Nekūsiyar suppressed. Troubles raised by Jasan Singh, zamindar of Kālpi, instigated by Muḥammad Khān, Bangash, and his agent, Rustam Khān, Afridi of Mau-Shamsābād, had kept Chabelah Rām busily occupied within his own province, and had prevented his marching to Āgrah. As the fort at that place had now been recovered and Jai Singh, Sawāe, bought off, it was necessary to deal next with Chabelah Rām, more especially as his contumacy barred the road to a remittance from Bengal, which had been detained at Patnah.²

His nephew, Girdhar Bahādur, son of the late Dyā Rām, had been summoned to Dibli just before Farrukhsiyar's removal from the throne; and after that event, Chabelah Rām's discontent becoming known, Girdhar Bahādur was detained at the capital in a sort of honorable captivity. When the *Wazir* started for Āgrah with the emperor, Rafi'-ud-daulah, Girdhar Bahādur was placed in charge of Luṭfullah Khān, Sādiq, and by him entrusted to his son, Hidāyat 'Alī Khān.³ This custodian visited his prisoner daily. On one occasion he happened to mention that Ḥusain 'Alī Khān would soon march to Allahābād, and put an end to Chabelah Rām and his opposition. That very night Girdhar Bahādur fled, having bought over his guard. At dawn fifty horsemen started in pursuit, but no trace of the fugitive could be discovered. Soon it was learnt that he had reached Allahābād and joined his uncle, Chabelah Rām.⁴

Girdhar Bahādur was sent out from Allahābād with a fresh force against Jasan Singh of Kālpi; and after that rebel had been repeatedly defeated, the parties came to an agreement and Girdhar Bahādur returned to Allahābād. This place was already seriously threatened. Sayyid 'Abdullah Khān had detached 'Abd-un-nabi Khān against it with six thousand horsemen; and on Ḥusain 'Alī Khān's part, Dāūd Khān, deputy of Muḥammad Khān at Gwāliyār, was ordered on the same service at the head of three thousand men, with whom he marched through Karrah to Allahābād. Diler Khān, a slave of the Bangash chief, joined 'Abd-un-nabi Khān at Itāwah with fifteen hundred men.⁵

¹ *Zamīn sukht wa asmān dūr*, Khushhāl Cand, Berlin MS. 495, fol. 998^a.

² *Khushhāl Cand*, Berlin MS. 495, fol. 999^a.

³ Or Hidāyat-ullah Khān. He was the second son and died in 1177 H. (1763-4). Muḥammad 'Alī Khān, author of the *Tārīkh-i-Muzaffarī*, was this man's sixth son (see that work under the sixth year of Aḥmad Shāh).

⁴ *Siwānīh-i-Khizri*, Irvine MS., p. 7.

⁵ *Siwānīh-i-Khizri*, p. 8.

[N.S.]

Chabelah Rām, leaving his nephew in charge of Allahābād fort, came out several *kos* and entrenched himself. The two forces were not yet in sight of each other, when Chabelah Rām was seized with paralysis and died before he could reach Allahābād.¹ His death took place in Zu, 1 Hījjah 1131 H. (November 1719). The two brothers looked on this death as a special interposition of Providence, receiving the news with every demonstration of joy; and they at once sent off a robe of honour for Girdhar Bahādur, with a request for the surrender of the fort of Allahābād. Active hostilities had meanwhile been suspended. 'Abd-un-nabi Khān, as soon as he heard of Chabelah Rām's death, halted at Shāh-zādpur² for further orders, and conveyed to Girdhar Bahādur the *Wazir's* offer that if he would come peaceably out of Allahābād, he should forthwith receive the province of Audh with the *faujdar*-ships of Lakhnau and Gorakhpur.

Girdhar Bahādur, however, rejected all overtures. His excuse, an obviously insufficient one, was that he had not yet finished the funeral obsequies of his uncle, which could only be completed at the holy Tribeni (that is, Allahābād, *alias* Pryāg), where the Ganges, Jamnah and Sārsūti are supposed to meet. For one year he would not be at liberty to leave the place. He employed this breathing space in active preparations for a siege, and in the accumulation of ample supplies within the fort walls. He is said to have dug a trench from the Ganges to the Jamnah and filled it with water from those rivers, thus protecting the fort on its most vulnerable side, that towards the west. Outside this channel he erected a number of small earthen forts.³

At this time the Bundelahs were active and troublesome, both to the south of their country on the borders of the Mālwah, and to the north of it between Allahābād and Āgrah. With regard to the first of these outbreaks, Nizām-ul-mulk, the *Subahdar* of Mālwah, was written to. For the protection of the country near the Jamnah, a force was ordered to assemble under Muḥammad Khān, Bangash, 'Aziz Khān, Dā'ūdai, Ḥasan Khān, *faujdar* of Korah Jahānābād, and other *jāgirdars*. They were to await orders on the south of the Jamnah. Sa'adat Khān, Burhān-ul-mulk (who had been recently, 6th October 1719, appointed *faujdar* of Hindaun and Biānah) was designated as commander of the imperial vanguard. About this time Mir Jumlah, Tarkhān, who had lately made his peace with the Sayyids, had been nominated (8th Zu, 1 Hījjah 1131 H., 21st October 1719) to the office of *Sadr-us-sudūr*, or superintendent of endowments, but found a difficulty in obtaining the issue of his patent of appointment, owing to the

¹ Khushhāl Cand, Berlin MS., No. 495, fol. 999^a, reports that some men suggested foul play. Their story was that "a letter arrived from the Sayyids, and as soon as he (C. R.) had opened the envelope, he gave up the ghost."

² In the Cawnpore district, lat., 26°77', long. 80°2', Thornton, "Gazetteer," 881.

³ *Siwānīh-i-Khizri*, p. 8; Kāmwar Khān, entry of 25th Zu, 1 Hījjah; the *Tārīkh-i-Muḥammadi* places the death of C. R. "at the end of the year 1131"; Muḥammad Qāsim, Lāhori, 300, 301, 302; Shih Dās, f. 33^a.

obstructive action of Rājah Ratn Cand. Mir Jumlah invoked the aid of Sa'ādat Khān who spoke to Husain 'Ali Khān. Ratn Cand was displeased, and soon succeeded in alienating 'Abdullah Khān from Sa'ādat Khān. The command of the vanguard was taken from him and given to Haidar Quli Khān.¹

With reference to Ratn Cand's interference, even in matters belonging to other departments, they tell the following story: One day Ratn Cand brought to 'Abdullah Khān a man whom he wished to be made a *qāzī*. 'Abdullah Khān said with a smile to a bystander: "Ratn Cand now nominates the *qāzīs*." The courier replied: "He has got everything he wants in this world, why should he not now look after the other world?"² Or, as Fakhr-ud-dīn Khān, son of Shekh 'Abd-ul-'aziz, remarked one day to 'Abdullah Khān: "Now-a-days, through your favour, Ratn Cand is as great a man as was Himū, the shopkeeper."³

Haidar Quli Khān started for Allahābād on the 1st Muḥarram 1132 H., 13th November 1719. On the way he was joined by Sher Afkan Khān, Pānīpati, *faujdar* of Karrah.⁴ After a halt near Karrah, they advanced to a place twenty-five *kos* from Allahābād. At this stage Shāh 'Ali Khān arrived, bringing with him Dā'ūd Khān, an officer sent by Muḥammad Khān, Bangash. Shāh 'Ali Khān was a Bārḥah Sayyid who had been deputed by the *wazīr* and his brother to represent their interests.⁵ Muḥammad Khān, Bangash, excused himself from personal attendance, the Rājput clan of the Bamtelahs having risen and tried to destroy the newly-founded town of Farrukhābād. But he vouched for the zeal and energy of his officers, Dā'ūd Khān and Diler Khān.⁶

By this time, at the instigation of Budh Singh of Bondi, a large number of Bundelahs had taken the field. These men harassed 'Abd-un-nabī Khān and Diler Khān in their advance. One day 'Abd-un-nabī Khān was taken prisoner, but rescued by Diler Khān after a severe struggle. Before the fight could be renewed on the following morning, Fahavvar 'Ali Khān marched

¹ Kāmwar Khān, entries of 23rd Zu'l-Qa'dah and 8th Zu'l-Hijjah 1131 H., Khizir Khān, p. 10, Shih Dās, 33. Korah Jabānābād is in the Fatehpur District, Thornton, 522; Hindaun (in Jaipur territory), lat. 26°41', long. 77°16'; Bānāh (in Bhartpur territory), lat. 26°57', long. 77°20', Thornton, 387, 119.

² An allusion, no doubt, to the lines which Sa'ādat Yār Khān (Rangin) in *Majālis-i-rangin*, Irvine MS. 263, f. 2^a, attributes to Fardausi-i-Tūsi: —

Tū kār-i-zamīn nikū sākhtū

Kih bar āsmān niz pardākhtū?

"Have you done so well on earth

"That you try to regulate the heavens?"

³ *Tārīkh-i-muzaffarī*, Irvine MS., p. 167, Khūshhāl Cand, Berlin MS. 495, f. 1,000^b. Himū, Dhūsar, *wazīr* of 'Adil Shāh, Sūr, was defeated and taken prisoner in Muḥarram 964 H., November 1556, Beale, 160.

⁴ This man was the brother of Lutfullah Khān, Sādiq. The *Tārīkh-i-Muzaffarī*, 170, has Korah, instead of Karrah.

⁵ According to Khūshhāl Cand, Berlin MS. No. 495, f. 999^a, this man had been promised the succession to the governorship, if successful in ejecting Girdhar Bahādur. He had 4,000 men with him.

⁶ Khizir Khān, *Siwānū-i-Khizri*, p. 11.

in with two thousand men sent by Dilāwar 'Ali Khān. The Bundelāhs now avoided a renewal of the engagement, but Tahavvar 'Ali Khān, out of bravado, disregarding 'Abd-un-nabi Khān's advice, took the initiative. Diler Khān, scornful to be left behind, followed in his wake, and 'Abd-un-nabi Khān felt bound to support them. The Afghāns, when near enough, began to shout out abusive words until Bhagwant Singh, the Bundelāh leader, stung by these taunts, broke off his holy thread,¹ put it on the point of his sword, and swore an oath to die or be revenged. Spurring his mare into the space between the armies, he selected Tahavvar 'Ali Khān as his opponent. Riding up to that officer's elephant, he brought down the driver with one arrow and pierced Tahavvar 'Ali Khān's arm with another. Diler Khān now attempted to take the Bundelāhs in the rear. Bhagwant Singh with two hundred men turned to face him. Diler Khān did not flinch, and after three quarters of an hour's desperate fighting, Bhagwant Singh was cut down by the Pathān. The Bundelāhs dispersed and were pursued for two or three *kos* by the Afghān horse. 'Abd-un-nabi Khān and his companions then rejoined Haidar Quli Khān by forced marches.²

All the reinforcements having now reached him, Haidar Quli Khān divided his army into three divisions: one under his own orders; one under Sher Afkan Khān, Pānipatī, Bahādur Khān and Dā,ūd Khān; one under Shāh 'Ali Khān, Bārhaḥ, and 'Abd-un-nabi Khān.³ An advance was then made. When the imperialists were five *kos* from the fort, the Candelāh zamīndārs who had joined Girdhar Bahādur came out to oppose them, and a sharp engagement ensued. The Candelāhs forced their way into the ranks of the second division, and the newly recruited men gave way, Shāh 'Ali Khān being so severely wounded that he fell from his elephant. His troops fled in disorder. But Dā,ūd Khān, calling on his Afghāns, maintained the struggle as long as there was any daylight, and during the night the third division reached the spot. The enemy being now out-numbered, took to their heels and retreated within shelter of the trenches outside the fort.⁴

Haidar Quli Khān hurried up with his own division, and two days were spent in restoring order in the force. On the third day he marched close up to the entrenchments with his whole army. As soon as they came in sight, they were received with a heavy fire of cannon and rockets, and from afternoon to sunset the fight continued. Girdhar Bahādur in person issued from his trenches and created a diversion by a bold attack. At length, owing to the darkness, they could no longer distinguish friend from foe, and each army returned to its own quarters. Fighting went on

¹ The *janeo* or Brahminical thread, worn across one shoulder by the higher or "twice-born" castes.

² *Khizr Khān*, p. 11.

³ *Khūshḥāl Cand*, Berlin MS. No. 495, f. 999^b, names also Mir Kallū, son of Mir Mushrif.

⁴ *Khizr Khān*, p. 13.

daily for two or three days. One night an attack was made on 'Abd-un-nabi Khān's camp, and great damage was done before Sher Afkan Khān could arrive, when they jointly drove back the assailants to the very ditches of their entrenchments. Two men were taken alive. Their story was that within the fort there were food and supplies enough to last for ten years; Girdhar Bahādur's own men numbered ten thousand, and there were as many more belonging to Budh Singh, Haḍa, Chattarsāl, Bundelah, and the Hindū landholders of the adjacent country. Haidar Quli Khān reported all this to Husain 'Ali Khān, and asked for reinforcements.¹

Nor did the commanders of the investing force act in unison. 'Abd-un-nabi Khān declared that he would behead the two prisoners in retaliation for the loss of men that he had suffered. Haidar Quli Khān refused his consent. He said that he required these men in order to find out from them the condition of the fort and its defenders, subsequently, whatever order was given in regard to the prisoners by Husain 'Ali Khān, Amir-ul-umarā, would be carried out. Beginning with civil words, the discussion was prolonged until they spoke harshly to each other. 'Abd-un-nabi Khān thereupon withdrew his troops from the investment of the northern bastion, and that very night a reinforcement sent by Budh Singh, Haḍā, passed through the abandoned post and entered the fort without let or hindrance.

As already stated, Husain 'Ali Khān, as soon as he learnt of Budh Singh's encouragement of the Bundelaha and of Girdhar Bahādur's resistance, detached Dilāwar 'Ali Khān and others into the Kotah-Bondī country. At the same time Muḥammad Khān, Bangash, who had obeyed the command to proceed to Allahābād by sending some of the officers, was pressed to take the field in person. Accordingly, he soon arrived at Allahābād, and occupied the position vacated by 'Abd-un-nabi Khān. One night, shortly after his arrival, two thousand men, an hour or two before dawn, made a sudden attack on him. The Nawab, whose eyes were inflamed, was unable to take the command himself, but Diler Khān, for whom an urgent message had been sent, was soon on the spot. In the confusion and darkness, some two hundred of the retreating enemy lost their way and fell into the river; while Sālim Singh, their leader, was wounded and made a prisoner by Nūr Khān, Khatak. But before he was recognized, he yielded up his accoutrements, his sword, his turban, and all that he had of value, and was allowed to go his way. Diler Khān received two severe wounds in the back, but escaped with his life.²

The morning after this night surprise, Haidar Quli Khān ordered a general assault from two directions. One force he took command of himself, the other was led by Sher Afkan Khān, Dā'ūd Khān, Bangash, and Shāh 'Ali Khān, Bārha. After repeated attacks, Haidar Quli Khān cleared the enemy out of the

¹ *Khizr Khān*, p. 14.

² *Khizr Khān*, p. 17.

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entrenchments at the foot of the north side of the fort. In the same way, Shāh 'Ali Khān and the leaders with him drove those in front of them back to the very foot of the walls. Dā'ūd Khān, accompanied by Sher Afkan Khān, brought up the scaling ladders, hoping to make an entry, but after much struggle and effort he was compelled to abandon the att-mpt. Since the river flows close under the fort, and a number of boats were moored below the walls, it was feared that if the enemy saw the day going against them, they would use this means of escape. To prevent this manœuvre, Muḥammad Khān sent out his men and took possession of all the boats.

For three days the fighting continued. By the fourth day the imperial army had worked its way close to the fort and began to mine under the walls. Girdhar Bahādur, believing the day was lost, made overtures through Muḥammad Khān; in these negotiations a long time was consumed. Girdhar Bahādur then found out that Muḥammad Khān had received a promise of the Allahābād province, if he, Girdhar Bahādur, could be ousted from it. Ceasing to believe any longer in that noble's impartiality, Girdhar Bahādur said he would treat through no one but Ratn Cand.

The retention of Allahābād in hostile hands was most detrimental to the Sayyids' power. It formed a centre round which disaffection could rally and grow troublesome. In itself it was as strong a fortress as Akbarābād, but in other ways many times more difficult to overcome. Instead of a revolted garrison having no competent leaders, it was held by a well-trying and valiant soldier at the head of a well-disciplined force; instead of a miserably provisioned stronghold there was one with sufficient supplies for many years. Obviously some great effort must be made.

Ḥusain 'Ali Khān ordered a bridge of boats to be thrown across the Jamnah at Āgrah, and sent his troops to the other side as a preliminary to his own advance down the Dūabah. He had no reverence for the prognostications of astrologers, saying: "Whatever is chosen by the Eternal Felicity is felicitous; whatever is not adopted by Him is devoid of felicity." On the 3rd Šafar (15th December 1719) he quitted his camp at Bāgh Dahr-Ārāe, and proceeded by boat to the garden of Jahān-ārāe Begam. Negotiations continued at Allahābād; day and night camel riders came and went. But Girdhar Bahādur persisted that he had no faith in the Sayyids and could not trust their honour, or give up the place of refuge that he held. Several months elapsed, but no settlement was arrived at.¹

At length, on the 23rd Jamādā I, 1132 H. (1st April 1720), Ḥusain 'Ali Khān resolved to march on Allahābād; and quitting the garden of Jahān-ārāe, his tents were put up on the grazing grounds of Bāgh Buland.² But 'Abdullah Khān did not approve

¹ Muḥammad Qasim, Lāhori, 303.

² Khushḥāl Cand, Berlin MS. No. 495, f. 1,000*, names Moti Bāgh, across the river, opposite the fort, as the place of encampment.

of this move. A few weeks before this, on the 1st Rabi' II. 1132 H. (10th February 1720) the emperor's advance tents had been sent off towards Dilli, but no start followed; and on the 1st Jamādā I (10th March 1720), they were brought back from Sikandrah Itālah.¹ About this time the quarrel over the Āgrah booty broke out afresh between 'Abdullah Khān and his younger brother, and it was only through the strenuous exertions of Ratn Cand that a settlement was made; and these differences were prevented from reaching the public ear. Still sore at the rôle played by his brother at Āgrah, 'Abdullah Khān, directly Husain 'Ali Khān moved towards Allahābād, swore that he would not be defrauded a second time. If Husain 'Ali Khān had appropriated the booty of Āgrah, he would take that of Allahābād. In short, he insisted on his right as *wazir* to assume the supreme command. At length, a middle course was hit upon, both brothers remained at Āgrah, and Ratn Cand went as their emissary to Allahābād.²

On the 25th Jamādā I, 1132 H. (3rd April 1720)³ Ratn Cand started with many nobles in his train, and sixty large guns each drawn by one hundred to two hundred oxen and three or four elephants. On his way the *faujdar*s, the agents of the *jāgirdar*s, and the *zamindar*s flocked to his standard. The rājah camped two kos from Allahābād fort and sent a message to Girdhar Bahādur that he had come thus far to see him, and was anxiously awaiting an interview. Rājah Girdhar Bahādur returned answer that to meet him was a pleasure, but the period set apart for mourning on account of Chabelah Rām's death not having yet expired, he must trouble his visitor to come and see him, which would also accord with the usages observed at condolences upon a death. Rājah Ratn Cand, leaving everybody behind him except Muḥammad Khān, Bangash, Ḥaidar Qulī Khān, and one or two of his most trusted subordinates, went into the fort. Rājah Girdhar Bahādur came as far as the door of his dwelling, and Ratn Cand on meeting him offered the usual condolences. Gifts were brought forward, of which Ratn Cand accepted an elephant and two horses; then, having sat a moment, he left for his quarters. Next day Girdhar Bahādur came in full state to return the visit. Ratn Cand met him at the tent door and seated him on the right hand upon his own carpet (*masnad*), offering one elephant and five horses with rich trappings. Girdhar Bahādur, too, refused all except the elephant and two horses.⁴

After they had exchanged some conciliatory words in public, they sat apart and consulted. The terms offered were the

¹ Apparently the place west of Āgrah, and the site of Akbar's mausoleum, is intended.

² Muḥammad Qāsim, Lāhori, 306; Kamwar Khān, 220, Khāfi Khān, II, 845.

³ Khāfi Khān, II, 846, has "end of Rabi' II," which is a month earlier.

⁴ Kamwar Khān, 219; Shiū Dās, f. 34^a; Khūshāl Cand, Berlin MS. No. 495, f. 1000^b.

government of Andh with all the divisions (*sarkārs*) dependent thereon, and the right to appoint all the military and civil subordinate officers (*i.e.*, the *faujḍārs* and *ḍivāns*), Mir Mushrif, the former governor, and the other officials being removed. To these appointments was added a gift of thirty *lakhs* of rupees, payable from the Bengal treasure remittance, to replace the expenditure on his army and the defence of the fort, together with a jewelled turban ornament, a special dress of honour and an elephant from the emperor. This conference took place upon the 25th Jamādā II, 1132 H. (3rd May 1720).¹

After binding oaths on Ganges water had been exchanged, Girdhar Bahādur accepted the above terms, and, with all his family and their belongings, his treasure and his goods, marched out of the fort on the 4th Rajab (11th May 1720);² whereupon Aḥmad Khān, a brother of Muḥammad Khān, Bangash, entered with five hundred men and occupied the place. Leaving Shāh 'Alī Khān in charge of Allahābād, Ratn Cand started on his return to Agrah. The Bengal treasure, until now delayed at Patnah, was sent for, orders being left that out of the total sum thirty *lakhs* should be paid over to Rājah Girdhar Bahādur, and the balance sent on to headquarters.

On the 9th Rajab, upon the receipt of Ratn Cand's report, 'Abdullah Khān attended audience, where he had not been for some time, and received the emperor's permission to beat the drums in honour of a victory. On the 16th Rajab (23rd May 1720) Husain 'Alī Khān recrossed the Jamnah and took up his old station in Bāgh Dahrah as before. Ratn Cand, on his arrival on the 2nd Sha'bān, 8th June 1720, was warmly congratulated by the two brothers and promoted to 5,000 *zāt*, 5,000 horse, receiving a special robe and a very valuable pearl necklace. Haidar Qulī Khān received 50,000 rupees and a robe of honour; Muḥammad Khān, Bangash, and Sher Afkan Khān, each twenty-five thousand rupees and a necklace of pearls. During this period the emperor had moved once (14th Jamādā II, 22nd April 1720) to the village of Mumtāzābād, in order to pay a visit to Shāhjahān's tomb; on the 17th of the same month (25th April 1720) the camp was brought back to Tālāb Khelā Nāth.³

6. FLIGHT OF NIZĀM-UL-MULK FROM MĀLWAH TO THE DAKHIN.

Between Nizām-ul-mulk and the Sayyids there were many reasons for mutual distrust. Spoiled in earlier years by the exceptional favour with which he and his father were honoured during the last part of 'Ālamgir's reign, Nizām-ul-mulk was ever afterwards discontented with the treatment he received from that monarch's successors. In Bahādur Shāh's reign he

¹ Khizr Khān, p. 19; Shiū Dās, f. 35^a; Khāfi Khān, II, 846.

² Khāfi Khān, II, 846, has Jamādā I, of the 2nd year (*i.e.*, 1132 H.).

³ Kāmwar Khān, 220; Shiū Dās, 35^b; *Bayān-i-wāqa'* 406; Khushḥāl Cand, Berlin MS. No. 495, f. 1,000^b; Khizr Khān, p. 20. Seventy-five *lakhs*

served grudgingly, more than once sending in his resignation. It was the same in Jahāndār Shāh's reign. His services to Farrukhsiyar at the time of Jahāndār Shāh's overthrow secured him the government of the Dakhin, a region in regard to which, as there can be no doubt, he had cherished secret projects ever since the death of 'Alamgir. Nizām-ul-mulk, like his father, had won his spurs in the Dakhin campaigns, and, as Zulfqār Khān unquestionably did, he must have seen that it offered a splendid opening for acquiring partial, perhaps even complete, independence of Dihlī and its sovereign. He had held the six *ṣūbahs* for hardly more than two years, when he was superseded by Husain 'Ali Khān.

This supersession rankled apparently in his mind, for he withdrew to his new appointment at Murādābād, and only returned to the capital at Farrukhsiyar's urgent request. Unable to work with Farrukhsiyar, he went over nominally, as we have seen, to the faction of the *wazīr* and his brother. Being anxious to secure his absence from Dihlī, they offered him the government of Bihār, a difficult charge which they hoped would fully employ, even if it did not exhaust, his strength. Before Nizām-ul-mulk had started for Patnah Farrukhsiyar had been dethroned, and Mālwah being then vacant was offered to him. The brothers thought that as their own nominees and relations held Akbarābād on the one side, and the Dakhin on the other, any danger from this able man's intrigues would be obviated by thus placing him between two fires. Remembering how short his tenure of the Dakhin had been, Nizām-ul-mulk made his acceptance of Mālwah conditional on a solemn agreement that he should not be removed again. The promise was given and the Nawāb started for Ujjain on the 24th Rabi' II, 1131 H. (15th March 1719), a few days after the accession of Rafi'-ud-darajāt, taking the precaution to remove the whole of his family and possessions, thus leaving no hostages behind him in the Sayyids' hands.

Ever since his departure rumours had been rife that he had helped to instigate the abortive rising at Āgrah. Although he was guilty of no overt act of hostility, he failed in some matters to study the susceptibilities of Husain 'Ali Khān. Owing to a slight offered by him to Khān¹ Husain 'Ali Khān, Marāḥmat had been superseded in his command at Māndū by Khawājā Qulī Khān.² Difficulties arose about giving over that fort, and after these had been overcome, Marāḥmat Khān, instead of being removed by Nizām-ul-mulk, was employed in ejecting Jai Cand, Bun-

of treasure from Bengal were received at Āgrah on the 19th Rajab (24th May 1720).

¹ Mir Ibrāhīm, Marāḥmat Khān, belonged to a distinguished family. He was the third son of Amīr Khān, Kābūlī. (d. 1109 H.). son of Khalīlullah Khān, Yazdī, Nī'matīlahī. He died while governor of Patnah on the 17th Muḥarram 1138 H., 24th September 1725, aged 45. *Ma'āqir-ul-umarā*. III, 713, and *Tārīkh-i-Muḥammadi* (1138 H.) Instead of Rānagarh the *Tārīkh-i-Muzafarī*, p. 173, has Rājgarh, and adds that *parganah Canderi* was invaded.

² Khawājā Qulī Khān (originally Beglar Begī Khān) was the son of a Turānī, Najār Be, who had come as an ambassador to 'Alamgir's court. On

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delah, from Rāmgarh. The Nawāb then applied for the offender's pardon. Ḥusain 'Ali Khān disregarded these requests in favour of Marāḥmat Khān. Soon afterwards the news-writers reported to headquarters that Nizām-ul-mulk was enlisting men and collecting *matériel* of war in excess of his requirements as a provincial governor.

On receipt of these reports, Ḥusain 'Ali Khān sent for the agent who represented Nizām-ul-mulk at court, and, after abusing him and his master, told him to report to his employer what had been said to him; the grievances alleged being the above-mentioned matter of Marāḥmat Khān, the removal of a *zamīndār* in *parganaḥ* Nalām,¹ and some other disputes about lands. Nizām-ul-mulk acknowledged the letter by writing direct to Ḥusain 'Ali Khān. After complaining of the enmity of the official reporters, he points out that people who had never been in Mālwah, could not know its condition; but Ḥusain 'Ali Khān having lately passed through it must know the facts well. The Mahrattahs, with over fifty thousand horsemen, were harrying it; if troops in large numbers were not entertained, what hope was there of defending the country from their ravages? For this reason he had added to his resources in men and *matériel*. He also objected to giving up Mālwah just as the instalments of the *Rubī* harvest were falling due, this being the time when most of the revenue was paid, forming his only hope of getting back his heavy expenditure. None but his evilwishers could have accused him of intending adverse action. If that had been his wish he could have gratified it when at Āgrah, where several times messengers came to him from Nikūsiyar. He had no such purposes in his heart, and his detractors ought to be silenced. The allusion to what he could have done at Āgrah, if he had chosen, only incensed Ḥusain 'Ali Khān still more against him.²

A *farmān* was now issued to Nizām-ul-mulk recalling him from Mālwah, on the plea that it was necessary for the protection of the Dakhin that Ḥusain 'Ali Khān should take charge of that province. He was offered the choice of any one out of the four provinces of Akbarābād, Allahābād, Multān, or Burhānpur. This was a distinct breach of faith, and no doubt confirmed Nizām-ul-mulk in the belief that he was to be destroyed. He had already some reason for apprehension, due to the movements of Ḥusain 'Ali Khān's *bakhshī*, Dilāwar 'Ali Khān, who was hovering on the western border of Mālwah, attended by Rājah Bhīm Singh of Bondi, Rājah Gaj Singh of Narwar, and other

his father's death, he was brought as a child to India and made over to his elder brother, Yūlbaras Khān. The *Tārīkh-i-Muḥammadi* states that this Khwājā Qulī Khān died at Māndū on the 19th Rajab 1136 H. (12th April 1724). If so, the man who went to the Dakhin with Nizām-ul-mulk, and died there in 1170 H. (1756-7) or 1179 H. (1765-6), is probably a son and not the same individual. See *M-ul-u*, I, 834, and *Mirāt-ū-shajfā*, B.M. 6540, f. 101^a.

¹ Probably a misprint for Talām, *sarkār* Sārangpur, *Ājīn* II, 203.

² Khāfi Khān, II, 851; *Tārīkh-i-Muzaffari*, p. 174.

chiefs. The secret instructions of these generals were that after they had settled the matter of Salīm Singh who, with the connivance of Rājah Jai Singh, Sawāe, had attempted to usurp Bondi, they should keep the proceedings of Nizām-ul-mulk under observation and await further orders. Dilāwar 'Alī Khān was told to announce publicly that he had a commission to proceed to Aurangābād in the Dakhin, to conduct thence the family of Nawāb Husain 'Alī Khān.

This movement could not be construed otherwise than unfavourably by Nizām-ul-mulk. Nor was other instigation to action wanting. His cousin, Muḥammad Amīn Khān, wrote from Agra that the Sayyids were only waiting for the suppression of the Nikūsiyar party and the recovery of Allahābād, when their next task would be to uproot and destroy him, Nizām-ul-mulk. With his own letter Muḥammad Amīn Khān sent one written by Muḥammad Shāh's own hand, and one bearing the seal of that emperor's mother. These letters complained of the Sayyids, of their entire usurpation of authority, of their leaving no personal liberty to the emperor; and called on Nizām-ul-mulk to espouse his cause and effect his deliverance.¹

Further details of Nizām-ul-mulk's stay in Mālwah are obtained from another source. The night following his arrival at Ujjain there was heavy rain; "this was, indeed, to him God's gracious rain, for from that day he never ceased to prosper." Ujjain became to him in fact as well as name the *Dār-ul-fath*, the Abode of Victory. After the rains (of 1719) had ended, he set out to reduce his province to order. It was then that the friends of Husain 'Alī Khān wrote alarming letters about the strength of his army and complained that mischief was brewing, as he was tampering with the court intelligencer's reports. Upon hearing this Husain 'Alī Khān broke out into strong language. He asserted that Nizām-ul-mulk should never have been allowed to leave the court, and now one "Nizām-ul-mulk" had multiplied into a thousand; it would be found as difficult to deal with him as to tackle a young tiger in an open plain.

To this Quṭb-ul-mulk ('Abdullah Khān) replied with the saying, "The past is beyond remedy, fate does its own pleasure." Some way must be devised. After many consultations, a *farmān* of recall was despatched by the hands of mace-bearers, while a force was moved across the Chambal. If the governor submitted, all would be well; if not, they could still fight or negotiate. If he fled to the south, their general could pursue. 'Alim 'Alī Khān at Aurangābād was warned to be on the alert. Thus Nizām-ul-mulk would inevitably be caught between two fires.

It had already been a subject of remark at Nizām-ul-mulk's *darbār* that disturbed times were at hand, that probably the first difficulty would arise in Mālwah. Nizām-ul-mulk began to prepare for an emergency, as the only hope of being left undisturbed. He argued that, though in position a great noble, Husain

¹ Khāfi Khān, II, 850, 851, 852; Muḥammad Qāsim, Lāhori 307.

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'Ali Khān was in character a mere soldier, who, as soon as he hears anything unfavourable, burns with anger and becomes at once an enemy. In that case, "the Lord be our keeper." There is nothing for it but to make ready to fight.

When the advance of Sayyid Dilāwar 'Ali Khān was announced, Nizām-ul-mulk consulted his most trusted officer, Muḥammad Ghiyās Khān. This man said there was no use in losing one's head, the matter could easily be carried through. Fortune had always been favourable, and to resist was best. The Nawāb rejoined: "Why speak thus! Still, I am in perplexity; that I have done no wrong is plain, nor need I feel ashamed. I have lived respected from the days of the late 'Ālamgir until now, and for the few more days that may be vouchsafed me, I trust I may be saved from dishonour. Why do these *parvenus* try to harm me, merely because they are puffed up by their sudden elevation. Such an attitude is becoming in an emperor; if others gain a little rise in life, why need they lose their heads. Thanks to God on High, who is there that shall not himself receive what he has done to others. But it is not for me to begin. If in spite of my quiescence they attack me, there is no help for it. After all, I am human. What man is there holding my high station who would not defend his honour? Victory lies hidden from us, it is the gift of the Most High, and is not gained by the greatness of a host. I swear by the God that made me, that they may bring all Hindūstān against me and I will still resist undaunted. If longer life has been decreed me, no harm will arrive; if the hour of departure is at hand, nothing can avail me."

Ghiyās Khān approved these words, pointing out that he had only meant to suggest that preparation was necessary, "a blow after the fight"¹ meant mere dishonour. The Nawāb's kinsmen approved, and preparation was decided on. Ghiyās Khān proposed a march from Mandeshar to Ujjain, where they should await the *farmān* and leave in safety their superfluous baggage. The *farmān* ought to be received with outward honour, to be followed by a march towards the capital. If they were to fight, they could fight as well there as here; nay, at court the position was better. When men have once resolved on death they can fight even against heaven; as to any other low wretches, of what account were they? The Sayyids were not angels having wings and able to take flight; men with bodies, however much fenced in, can be reached. Right was on their side. If a gracious God shielded them, Right would triumph. If, before they reached the vicinity of Sironj, things took another turn, what would it matter? On hearing of their ostensible return to the capital, would not their opponents be forthwith put off their guard. Muḥammad Amin Khān, Hāmid Khān and others at court should be addressed, as also 'Iwaz Khān and others in the Dakhin. The commandant of Asirgarh should be gained over, money might be

¹ *Musht ba'd as jang.*

offered him for the cession of that fortress. That place could be easily reached from Sironj, "and when Asir is ours, God has given us the key of the kingdom of the Dakhin." Ra'āyat Khān, 'Abdurrahīm Khān, Qādir Dād Khān and Mutawaṣṣal Khān supported Muḥammad Ghīyāṣ.

Letters were written in all directions, as agreed on, and after a delay of two or three days they started in the direction of Dihli. Of this move the news-reporters immediately sent off announcements to the court. Stage by stage they advanced as far as Dorāhah. Letters came from the chief men in the Dakhin, but no fresh orders were issued, and the soldiers rejoiced at being on their way to Hindūstān. Suddenly they were marched back by the way that they had come; the men were amazed, but the secret was well kept, and at last, by a night march on the 8th May 1720, they reached and crossed the Narbadā.¹

Nizām-ul-mulk had heard that mace-bearers were on their way to enforce his return to the capital. A *farmān* to this effect had indeed been sent, in which it was added that the province of Akbarābād would be given to him as soon as he arrived. On the 9th Rajab 1132 H. (16th May 1720), news came to Āgrah that he had left Mālwah. It was then reported that in the middle of Jamādā II, 1132 H. (about the 23rd April 1720), at the head of five or six thousand horsemen, and attended by 'Abd-ur-rahīm Khān, Marāḥmat Khān, Ra'āyat Khān, Qādir Dād Khān, Rausshāni, Mutawaṣṣal Khān, grandson of Sa'dullah Khān, *wazīr*, 'Ināyat Khān and others, Nizām-ul-mulk had left Mandeshar and marched back to Ujjain. There, giving out that he was on his way to Sironj, one or two marches were made as far as the village of Kāyath; thence he made straight for the Narbadā, which he crossed on the 1st Rajab 1132 H. (8th May 1720) by the ford of Akbarpur.²

Husain 'Ali Khān was for immediate action; he wished to go in person. On the other hand, 'Abdullah Khān and Ṣamsām-ud-dāuiah (Khān Daurān) counselled delay; for, as the saying is, "Delay is of God; haste, of the Devil."³ Sayyid Dilāwar 'Ali Khān and the officers with him, in one direction, and 'Alim 'Ali Khān, in the other, would suffice to retrieve everything. Even if Asir fort had been taken, there had been no time to place it in a state of defence and it could be easily recovered; "cleverness is a good thing, be you as strong as Rustam."⁴

Husain 'Ali Khān continued unappeased and blamed his brother's want of energy. The latter stuck to his own opinion and protested that it was not adopted through want of courage. He was surprised at being called a coward, "Am I not your brother? Am not I, too, a Sayyid?" Let his brother be a little reasonable, and he would agree to anything. He had said over

¹ *Aḥwāl-ul-Khawāqin*, f. 155b.

² *Khāfi Khān*, II, 852, 860, 861; Muḥammad Qāsim, *Lāhorī*, 308; *Kāmwār Khān*, 221.

³ *Ul-tā-khīr min ur-Rahmān*, *ul ta'ajjul min ush-shaifān*.

⁴ *Aql chis-i-sharifast*, *go kih Rustam-tawān bāshad*.

and over again that the imprisonment of Farrukhsiyar was a mistake. But his words were put aside, and his brother had done his own pleasure. They could but reap what they had sown, and this rising of Nizām-ul-mulk was only the first-fruits. In the end the brothers sent off urgent orders to Sayyid Dilāwar 'Alī Khān to follow instantly in pursuit, taking with him Rāo Bhīm Singh, Hadā, Rājah Gaj Singh, Narwarī, Dost Muḥammad Khān, Afghān, and others. In anticipation of some such movement, these men were already close to the borders of Mālwah, and were thus able to start without delay. 'Alīm 'Alī Khān, a youth about twenty years of age and a nephew of the Sayyids, who was acting at Aurangābād as deputy governor of the Dakhin, received orders to bar the way to the Nawāb's advance.¹

One of Nizām-ul-mulk's first acts was an attempt to buy over the garrison of the strong fortress of Asirgarh, which lies about forty-five miles south of the Narbadā and not far from Burhānpur. Khusrāu, one of his slaves, had a friend in the garrison named 'Uṣmān Khān, Qādīrī, to whom he was sent with overtures. The very day that the Nawāb crossed the Narbadā, Khusrāu came back with 'Uṣmān Khān, who stipulated that he should be appointed to the command of the fort. Money for paying to the garrison the arrears of two years' pay was provided, and 'Uṣmān Khān, accompanied by Hafizullah Khān, *bakhshtī*, and the Nawāb's eldest son, Ghāzī-ud-dīn Khān, Firūz Jang, returned to Asirgarh. Nizām-ul-mulk followed as quickly as possible by way of Bijāgarh Kahrgānw. The fort was delivered up on the 13th Rajab 1132 H. (20th May 1720), and the commandant, a very old man named Abū Tālib Khān, was made a prisoner. About this time Rustam Beg Khān of Kahrgānw and Faṭh Singh, Rājah of Makrāe, came in and joined. Ghīyās Khān was sent on to occupy the town of Burhānpur, lying at a distance of about twelve miles. After a visit to Asirgarh, to the top of which he ascended, Nizām-ul-mulk, leaving behind him his two sons and his spare baggage, followed to Burhānpur and encamped in the Lāl Bāgh at that place.²

Hearing that Nizām-ul-mulk had crossed the Narbadā 'Alīm 'Alī Khān sent off Anwar Khān, Quṭb-ud-daulah,³ *fauj-dār* of Burhānpur, who was then on leave at Aurangābād. With him was joined Rāo Rambhā Nimbālkar, a Mahrattah leader who

¹ *Aḥwāl-ul-khawāqin*, f. 157^b; Kāmwar Khān. 221.

² Khāfi Khān, II, 853, 865; *Tārīkh-i-Muzaffarī*, p. 180, and *Sivānīh-i-Dakhin* by Mun'im Khān, Aurangābādī, Irvine MS. No. 396, ff. 131 and 152. The *Burhān-ul-futūḥ*, 167^b, gives Islāmullah, Hazārī, as the name of the man who was treated with, and that of Sharf Khān as the new commandant. According to this author the surrender took place on the 15th Rajab. Kahrgānw is about 55 miles N.-W. of Burhānpur, and Makrāe is about 70 miles N.-E. of the same place. Lāl Bāgh, about two miles north of the town, is close to the present railway station, "Bombay Gazetteer" (Khāndesh), pp. 589, 591.

³ Shekh Anwar Khān, Pīrzādah, a protégé of Sayyid 'Abdullah Khān, had been brought to the Dakhin by Husain 'Alī Khān and appointed in Rafī'ud-darajāt's reign to the high office of governor at Bijāpur.

owed his release from imprisonment at Dihli to the intercession of that officer. They were at 'Ādilābād,¹ twelve *kos* south of Burhānpur, when they heard that Ghīyās Khān was already there and preparing to invest the town of which Nūrullah Khān, *divān* of the province and brother of Anwar Khān, was in charge. Ghīyās Khān tried to intercept the relieving force by sending troops across the Tapti; but, favoured by the darkness of the night, they evaded his men and taking to by-paths passed in to the town, their litters (*pālki*s) and other property falling into the hands of plunderers. Soon after the *faujdār*'s arrival, the citizens assembled and protested against a resistance for which they alone would suffer. The walls would be escaladed by Ghīyās Khān, their lives endangered, and their property destroyed. The *faujdār* was advised by them to fight outside in the open, for, if he did not, the city would be surrendered by the citizens to his opponents. Anwar Khān, who was far from courageous, lost his head altogether, and on the 16th 'Rajab (23rd May 1720) applied to Ghīyās Khān for terms. The next day Nizām-ul-mulk arrived in person. Anwar Khān and Nūrullah Khān, with all the officials and citizens, attended and made their submission. The town and citadel were then occupied. By the acquisition of Asirgarh and Burhānpur, Nizām-ul-mulk's position was rendered very strong.²

At this time the mother of Sayyid Saif-ud-dīn 'Alī Khān, Bārhaḥ, younger brother of the *wazir*, had reached Burhānpur with her grand-children on her way from Aurangābād to rejoin her son at Murādābād, *ṣubāh* Dihli, where he was now *faujdār*. When Nizām-ul-mulk appeared and occupied the town, the men of her escort were overcome with terror, and proposed to send to the Nāwāb all the jewels and valuable property which they had in their charge, on condition that the family honour was saved and their lives guaranteed. Nizām-ul-mulk refused to accept the offer of the property, spoke kindly to Muḥammad 'Alī, the Begam's agent, conferred on him a dress of honour, and sent him back with a present of fruit for the children. The Begam was then allowed to depart, an escort of two hundred horsemen going with her as far as the banks of the Nārbadā.³

As soon as 'Alīm 'Alī Khān received at Aurangābād the letters sent by his uncles, 'Abdullah Khān and Ḥusain 'Alī Khān, he set to work to collect an army of Mahrattahs and of new men. All the neighbouring *faujdār*s were called in to the capital. His idea was that when Dilāwar 'Alī Khān appeared from the north, he would march from the south, thus taking Nizām-ul-mulk between two fires. To encourage his men he gave liberal promotions, and tried in every way to win over the people of town and

¹ It is in the Khāndesh district, and is spelt Edilabad in "Bombay Gazetteer," XII, 447; it lies about 15 miles N.-E. of the Bhusāwal station of the G.I.P. Railway.

² Khāfi Khān, III, 853, 871, 872; *Burhān-ul-futūḥ*, 168a; *Tārīkh-i-Muzaf-fari*, p. 181.

³ Khāfi Khān, II, 873.

country. 'Alim 'Alī Khān then reported to head-quarters at Āgrāh that he had seven thousand cavalry of his old establishment, two to three thousand men brought in by the *faujīdārs* and zamindārs, and more than six thousand newly entertained men. In addition he counted on the aid of about fifteen to sixteen thousand Mahrattah horsemen sent by Rājāh Sāhū. Amin Khān, late governor of Nāder, *i.e.*, Barār, although he had previously expressed great enmity towards Ḥusain 'Alī Khān, was bought over by gifts of money, elephants and jewels.¹ Altogether 'Alim 'Alī Khān reckoned his army at thirty thousand horsemen, of whom he intended to take command in person. He commenced his march early in Sha'bān (1st = 7th June 1720).²

On his side Nizām-ul-mulk had proposed to suspend further active operations until the cessation of the rains, the interval being passed at Deogarh in an attempt to gain over or conquer the zamindārs of that place. But, as it was pointed out, it would be difficult to keep the troops together for four months without more money than was available. In consequence, immediate action was resolved on. When Nizām-ul-mulk heard that 'Alim 'Alī Khān had sent his tents out from Aurangābād, he marched from the Lāl Bāgh on the north of Burhānpur, crossed the Taptī, and pitched his camp on the east side of the town. But at the end of Rajab (30th = 6th June 1720) he learnt that Dilāwar 'Alī Khān, following in hot pursuit, had crossed the Narbadā somewhere about Hāndiyā.³ Dilāwar 'Alī Khān had got as far as Ḥusainpur in the Hāndiyā *sarkār*, about fourteen *kos* from Burhānpur. Considering this opponent to be the more formidable, Nizām-ul-mulk decided to encounter him first.⁴

It seems that the Sayyids had sent their general a letter in which they accused him of cowardice. Stung by the imputation, he wrote to Nizām-ul-mulk when drunk, as he often was, in the following strain: "What manly virtue is there, nay is it not a death-blow to honour, thus to flee from death; and for the sake of saving this paltry life, to climb so many mountains and cross so many deserts? Would it not be well to confide in the All Powerful and come out to meet the writer, so that side by side we might return to the Presence, where exceeding exertion will be made for the pardon of that exalted one. Otherwise, be it thoroughly understood, this slave at the head of twenty thousand horsemen thirsting for blood, follows like a wind that brings a destructive tempest; and if imitating a deer of the plains you escape and flee to the mountains, this pursuer will,

¹ Amin Khān was a brother of Khān 'Alam, Dakhinī; he was killed in 1187 H. (1724), fighting under Mubārīz Khān against Nizām-ul-mulk. *Ma'āqir-ul-umarā*, I, 352.

² Khāfī Khān, II, 874.

³ In the Hoshangābād district, on the south bank of the Narbadā, about 92 miles N. E. of Burhānpur. It is on the old high road from the Dakhin to Agrāh, "Central Provinces Gazetteer," 201.

⁴ Khāfī Khān, II, 875; *Ahwāl-ul-Khawāqīn*, f. 160^a; *Tārīkh-i-Muzaffarī*, 181.

“like a panther, spring on your back and make wet the teeth
“of desire with the blood of his enemy.” Unable to bear the
provocative language of this letter, Nizām-ul-mulk had begun to
retrace his steps.¹

Nizām-ul-mulk marched northwards early in Sha‘bān (1st =
7th June 1720), sending his family and dependents together with
his heavy baggage for safety to Asirgarh.² Ahead of him went
his artillery under Ghiyās Khān and Shekh Muḥammad Shāh,
Fārūqi; he soon followed in person (9th Sha‘bān, 15th June).
When they had gone sixteen or seventeen kos from Burhānpur,
and were within two or three kos of Ratnpur, belonging to the
Rājah of Makrāe,³ he encamped. Dilāwar ‘Alī Khān’s camp was
then at a distance of two or three kos from him. Nizām-ul-mulk
proposed an amicable arrangement, but Dilāwar ‘Alī Khān reject-
ed all his overtures.⁴

Dilāwar ‘Alī Khān’s force, although not a very large one,
consisted of thoroughly tried and well-equipped men. As he was
the *bakhshī*, or paymaster, he knew the quality of all the Sayyid’s
troops; and when he was sent on this enterprise, he had selected
six thousand of the best armed and best mounted horsemen out
of seventeen or eighteen thousand who were present with the
Sayyid. They were mostly Bārhaḥ Sayyids, Hindūstānis, and
Afghāns. Two of the chief men placed under him were Bābar
Khān and Sayyid Shamsheer Khān,⁵ cousin of the two Sayyids.
There were also the mail-clad Rājput̄s of Mahārāo Bhīm Singh,
of Bondi, and Rājah Gaj Singh, son of Anūp Singh, of Narwar.
The latter chief brought between two and three thousand men.
Dost Muḥammad Khān, Rohelah (afterwards of Bhopāl),⁶ also
joined with three thousand five hundred men. The total force
could not have been less than thirteen thousand, and may have
amounted to eighteen thousand men.⁷

7. DEFEAT AND DEATH OF DILĀWAR ‘ALĪ KHĀN.

On the 13th Sha‘bān 1132 H. (19th June 1720), Nizām-ul-
mulk marched four kos, then drew up his army ready to give

¹ Wārid, 159^b, 160^a.

² Or to Burhānpur, as stated on fol. 132^b of the *Gulshan-i-‘ajāib*.

³ A small independent chieftainship in the Hāndiyā sub-division of the
Hoshangabād district; its present area is 215 square miles. Makrāe itself is
about 30 miles S. of Hāndiyā, “Central Provinces Gazetteer,” 256.

⁴ Khāfi Khān, II, 875; Khushūl Cand, Berlin MS. No. 495, f. 1002^a;
Mhd. Qāsim, Lāhori, 311; *Bayān-i-wāqī‘*, Irvine MS., f. 406. The *Siwānīh-i-
Dakhin*, p. 163, says the site of the battle was near Rāipur in parganah
Chārdah of sarkār Hāndiyā, and twelve kos to the south of the Narbadā.

⁵ Elsewhere, II, 879, Khāfi Khān has “Sher Khān,” which is also in
the copy of Nizām-ul-mulk’s *tūmār* (despatch) in Šāhib Rāe, *Khujistah-
kalām*, where the name of Farḥat Khān is added.

⁶ The *Burhān-ul-futūḥ*, f. 168^a, calls him the “Zamīndār of Bhākrah.”
This is a place in sarkār Kānauj, *Subah Mālwah, Ā’in*, II, 200. On the other
hand Malcolm, “Central India,” 1st ed., 231, says Mir Muḥammad Khān, a
brother, was in command and was slain.

⁷ Khāfi Khān, II, 877.

[N.S.]

battle. Ghiyās Khān was placed in command of the vanguard, having under him Shekh Muḥammad Shāh¹ and his brother, Nūrullah, Fārūqī, heads of the artillery. In the right centre was 'Iwāz Khān, *uāzīm* of Barār (Illichpur) and the Nawāb's uncle by marriage,² with his son, Jamālullah Khān, Anwar Khān, Hakīm Muḥammad Murtazā and others. Marāḥmat Khān, Fil Jāng, was on the left centre. To the right wing was posted 'Aziz Beg Khān, Hārīṣī; and to the left, 'Abd-ur-rahīm Khān (uncle of Nizām-ul-mulk) and Qādir Dād Khān, Raushānī; while Mutawassīl Khān (grandson of Sa'dullah Khān),³ Isma'il Khān, Khweshgi, Kāmyāb Khān⁴ and Dārāb Khān,⁴ Sa'd-ud-dīn Khān and Mir Ahsān, *bakhshī*, took their place in the centre. Ra'ayat Khān, Nizām-ul-mulk's first cousin and the brother of Muḥammad Amin Khān, Civ, was left in charge of the town of Burhānpur, while Rustam Beg Khān was told off to protect the rear of the army. Fathullah Khān, Khostī, and Rāo Rambhā Nimbālkar, the Mahrattah, with five hundred men, acted as skirmishers.⁵

The site of the battle, as we are told, was in the hilly country called Pāndhār⁶ between Burhānpur and the Narbadā, and Nizām-ul-mulk himself says that he had marched forty *kos* from Burhānpur. He moved out four *kos* from his last camp before he met the enemy, and the battle did not begin until the afternoon (13th Sha'bān 1132 H., 19th June 1720). Dilāwar 'Alī Khān had occupied a rising ground to the east of the Nawāb. Leaving his baggage at the foot of this hillock, Dilāwar 'Alī Khān sent out his advanced guard, consisting of some three

¹ For this man see *Ma'āṣir-ul-umarā* II, 708, under his title, Shujā'at Khān; he was killed in 1150 H., 1737-8.

² Mhd Kamāl, 'Azd-ud-daulah, 'Iwāz Khān, Bahādur. Qaswar Jang, died on the 25th Zu'l Hijjah 1142 H., 10th July 1730, aged over seventy years. He was also related to his father-in-law, Mir 'Abid, Qilich Khān, Nizām-ul-mulk's grandfather. *M-ul-u.*, II, 832, and *Tārikh-i-Muhammadi* (year 1142).

³ His father was Hifzullah Khān, second son of Sa'dullah Khān. *M-ul-u.*, II, 520. He was thus a cousin of Nizām-ul-mulk, who was also a grandson, on his mother's side, of Sa'dullah Khān, Shāhjahān's *wazīr*.

⁴ These two men were sons of Jān Niṣār Khān, *M-ul-u.*, I, 537. Dārāb Khān, afterwards Jān Niṣār Khān, became *faujdar* of Korā Jahānābād (*ṣubah* Allahābād), where he was murdered in Ramazān 1144 H. (March 1732).

⁵ Khāfi Khān, II, 876; *Ma'āṣir-ul-umarā*, III, 877; *Aḥwāl-ut khawāqin*, 154b; Kāmwar Khān, entry of 17th Sha'bān; *Gulshan-i-'ajāib*, 132b. The date is the 11th (17th June) in *Khushhāl Cand*, Berlin MS. 495, f. 1002a, and in *Burhān-ul-futūḥ*, f. 168a.

⁶ For the position of Pāndhār, and its possible connection with the Pindharies, see my article in the *Indian Antiquary* for May 1900. Rustam 'Alī. *Tārikh-i-hindī*, 240b, says the battle was fought near Qasbah Khandwā, which is not far from Asir. This place is about 32 miles N. of Burhānpur and about 60 miles S.-W. of Hāndiyā. It is now the civil station of the Nīmār district of the Central Provinces (C.P. Gazetteer, 383). The *Tārikh-i-muzaffarī*, p. 181, has "Hussainpur, 14 *kos* from Burhānpur," which is also the name in the "Asiatic Miscellany" (1785), an account of Āṣaf Jāh (Nizām-ul-mulk) translated by Henry Vansittart (the younger) from a Persian work, of which the title is not given.

thousand horsemen and about eight thousand matchlockmen, under the command of Sayyid Sher **Khān** and Bābar **Khān**. Then, surrounded by his principal officers on their elephants, he followed in person at the head of the main body.¹

The action began after midday with artillery fire and the discharge of rockets. Ghiyās **Khān** and 'Iwaz **Khān** advanced from two different directions to attack Dilāwar 'Alī **Khān**. They were unable, however, to effect a junction, and 'Iwaz **Khān** was left to meet alone the full force of the Sayyid, Rājput, and Afghān onset. In spite of his elephant turning round and the flight of many of his men, 'Iwaz **Khān** kept the field manfully until he was severely wounded and forced to retire. With shouts of exultation, Sayyid Sher **Khān** and Bābar **Khān**, riding rein to rein, started in pursuit. Qādir Dad **Khān** in spite of his wounds fought on, 'Aziz Beg **Khān** and his brother were also wounded. Then 'Azmat **Khān**, one of the principal officers under 'Iwaz **Khān**, dismounted and continued the contest on foot. Mutawaṣṣil **Khān** now brought up reinforcements. Thus one attack followed another and the fortunes of the day varied at every turn. At length, both Sayyid Sher **Khān** and Bābar **Khān** were cut down.²

Dilāwar 'Alī **Khān** in person now led an attack on the centre. Here he was struck in the chest by a bullet and killed, many of the Bārḥah Sayyids losing their lives at his side. Rāo Bhim Singh and Rājah Gaj Singh still kept the field. Soon Bhim Singh was shot.³ Then Gaj Singh of Narwar, a fine-looking young man, dismounted with forty or fifty of his brethren, and attacked at close quarters. Taking sword and shield in hand, they pressed the Nawāb's vanguard very hard. But Marāḥmat **Khān** charged them vigorously from the left. In the end, after the death of the remaining Rājput chief, four hundred Rājputs and many Bārḥah officers, and in all some four thousand soldiers, fell a prey to the arrows, spears, and swords of their opponents. The broken remnant of survivors, among them Dost Muhammad **Khān**, Afghān, withdrew from the field and made good their retreat into Mālwah, pursued and plundered by the Mahrattah auxiliaries of Nizām-ul-mulk. This somewhat unexpected victory gives an opening to one author to quote the lines:

¹ Kāmwar **Khān**, 223; **Khāfi Khān**, II, 876. The *tūmār* says it was a Thursday.

² Farāḥ **Khān** was killed on Dilāwar 'Alī **Khān**'s side. See *Aḥwāl-ul-khawāqin*, 159 a; it is "Farḥad" **Khān** in *Gulshan-i-'ajāib*, 132b.

³ Tod's account of Bhim Singh's death, II, 487, affords us a more than usually noticeable instance of his flagrant inaccuracy. The fight is made out to be undertaken by Bhim Singh without allies, while the scene is laid in the broken ground along the Sind river, near the town of Kurwai Borāsū. An additional touch of grotesque error is given by the assertion that Jai Singh, Kachhwāhah, of Amber, gave the order to Bhim Singh and Gaj Singh to bar Nizām-ul-mulk's road! The town referred to is evidently Kurwai in Mālwah (Thornton, 520) on the right or east bank of the Betwā, with Borāsū immediately opposite. A slight misreading of Khandwā, the true place, may have given the hint to connect the battle with Kurwai Borāsū.

Bakht bāwur gar-bavad,
sindān zi dandān bi-shkanad,
Ṭālī-i-bargashtah rā
jalūdah dandān bi-shkanad.

“The fates aiding, you may bite a bit off an anvil,
 “With the stars against you, your teeth break over flummery.”¹

Nizām-ul-mulk ordered his drums to beat for victory. On his side the losses were few, the only men of any note who fell being Badakhshī Khān and Diler Khān, an officer serving under ‘Iwaz Khān. Among the wounded were ‘Iwaz Khān himself and Ghiyās Khān. In addition to the guns and elephants appropriated by Nizām-ul-mulk to his own use, much booty fell into the hands of the soldiers and plunderers. The victors encamped where they were, the night being disturbed by a false alarm caused by an unruly elephant which broke from his chains and rushed about the camp, destroying as he went, until his progress was arrested by an arrow from the bow of Mutawaṣṣil Khān.²

The above is the official account and is, no doubt, the one most favourable to Nizām-ul-mulk and his army. Other writers describe the event differently and tell us of an ambush. Such a device would not only accord with Nizām-ul-mulk’s scheming habits, but would also more satisfactorily account for the great loss sustained by the other side, more especially among its leaders. From these other sources we learn that between the two forces lay deep ravines where a large army could have been effectually concealed. Nizām-ul-mulk sent out his guns and placed them in position so as to command from both sides the only road across this ravine. His advanced guard was concealed in the hollows on each side. Then two or three men, closely resembling the Nawāb in beard, features and age were dressed up, placed on elephants, and sent out to represent Nizām-ul-mulk at the head of his main body, which showed itself beyond the entrance to the ravine. Dilāwar ‘Alī Khān’s men came straight at their foe, and were drawn on and on by a simulated retreat. Anxious to slay

¹ *Tārīkh-i-muzaffarī*, f. 183. We have Nizām-ul-mulk’s official report or *tūmār* of the battle in Ṣāhib Bāe’s *Khujistah-kalām* (Irvine MS., p. 323). A copy was sent to Muḥammad Khān, Bangash, of Farrukhābād, under cover of an exulting letter. The report ends with the lines:

As dast o zabāne kih bar-āyad,
Kī, z ‘uhdah-i-shukr-ash ba-dar-āyad.
 (Sa’dī, *Gulistan*, Introduction).

“Who can succeed with hand and tongue
 “To pay his debt of thanks to God?”

A verse of which Nizām-ul-mulk or his *munshī* was very fond, as it occurs many times in his letters, see *Gulshan-i-‘ajāib*, c. 1161 H. (B.M. additional MS. 26,236) by *Munshī Rām Singh*, f. 62a. The above *tūmār* is also in this collection, f. 132a. In *Ma,āṣir-ul-umarā*, III, 370, we find an incident of this battle: ‘Azmat Khān, grandfather of Ismā‘il Khān, Pannī, marched on foot in front of ‘Iwaz Khān’s elephant and was killed.

² *Khāfī Khān*, II, 881.

or capture the opposite leader, who, as they believed, was in command, they pursued steadily, disposing on their way of several of the pretended Nizām-ul-mulks. When Sayyid Sher Khān at length brought his elephant close to that of 'Iwaz Khān, the Mughal, by a sign, caused his elephant to kneel, and by this trick escaped with his life. The ravine having been reached, the guns did their work; and their leaders having been killed, the rest of Dilāwar 'Ali Khān's army dispersed.¹

The morning after the battle the bodies of Dilāwar 'Ali Khān and of Sayyid Sher Khān were prepared for burial and despatched to Aurangābād, where the sons of the former were serving with 'Alim 'Ali Khān. The same day a report was brought in that 'Alim 'Ali Khān had arrived at Tālāb Hartālah,² seventeen kos to the south of Burhānpur, and Mutawaṣṣil Khān was sent off at once with three thousand horsemen to reinforce the garrison and protect that town, where the families of many of the men had been left. Mutawaṣṣil Khān marched forty kos in one day and thus prevented the surprise of Burhānpur. 'Alim 'Ali Khān, who had not anticipated such a prompt movement, was perplexed and therefore halted where he was.³

NOTE.—Another version of the fight taken from the "*Aḥwāl-ul-Khawāqin*," f. 162^a.

Dilāwar 'Ali Khān, after crossing the Nabadā, made four or five marches till he was near to Nakti Bhawānī. As the *Shab-i-barāt* (14th Sha'bān, 20th June 1720) approached, they made three or four halts, intending to resume their advance when that festival was over. But hearing of Nizām-ul-mulk's movement in their direction, the Sayyid came out and ranged his men in battle order one kos from his camp.

Nizām-ul-mulk's scouts reported that the Sayyid was facing eastwards, with his guns in front. Nizām-ul-mulk thinking a frontal attack dangerous, enquired if the rear could be reached. The scouts said that by a *détour* of six kos this could be effected; the sun was not yet in the meridian, they had time to make the movement. Changing direction they arrived at the Sayyid's rear in about three hours and were then at a distance of one kos.

When Nizām-ul-mulk's standards began to show faintly in the distance, Sayyid Dilāwar 'Ali Khān was amazed and accused his head spy of treachery. This accusation the man, an old Bārḥah Sayyid, vigorously repudiated. As there was no help for it in this sudden emergency, the artillery was left behind, and the front changed to meet the enemy. The artillery was ordered to follow as quickly as it could.

¹ Shīu Dās, 37^b; Mhd Qāsim, Lāhori, 314; *Tārīkh-i-muzaffarī*, 183.

² Hartālah, a lake of 440 acres on a tributary of the Tapti, four miles S. W. of Edilābād in the Bhusāwal subdivision, Khāndesh district. Edilābād is about 30 miles south of Burhānpur, *Bombay Gazetteer*, XII, vi, 142, 449.

³ Mhd Qāsim, Lāhori, 318; Khāfi Khān, II, 881.

Ghiyās *Khān*, commanding Nizām-ul-mulk's vanguard, was attacked by Bhīm Singh, Gaj Singh, and "Be-dost Rohelah" (Dost Muḥammad *Khān*); while Sayyid Sher *Khān*, Babar *Khān* and Farāḥ *Khān* turned against 'Iwāz *Khān*. Gaj Singh and Bhīm Singh, Hādā, dismounted and at the head of two thousand Rājput̄s fought hand to hand, breast to breast. Quresh Beg, *Khawājah* Ma'sūm, and a few others resisted, but they were hardly more than a pinch of salt in flour. Against two thousand mail-clad Rājput̄s what were forty men! Bhīm Singh and Quresh Beg fought in single combat; then some forty Rājput̄s attacked the latter. In spite of these odds the Beg succeeded in killing Bhīm Singh before he fell himself under numberless wounds. The bodies of the Rājput̄s lay piled on the top of each other.

Meanwhile 'Iwāz *Khān* was engaged with Sher *Khān* and Bābar *Khān*. The fighting was so hot that it was like the coming of the Day of Judgment. It went on for two hours, and the Sayyid's men did their best, until he and four thousand five hundred of his men were killed. Dost Muḥammad *Khān*. Rohelah, was the only one who turned and fled.

Nizām-ul-mulk was not even wounded, but *Khawājah* Ma'sūm, Mirzā Na'im and others of his men were killed. Sayyid Muṣāfir *Khān* especially distinguished himself in repulsing an attack on Ghiyās *Khān*, in which he was greatly aided by Yalras *Khān*, *Khawājah* 'Abd-ul-ḥamān, Mir Quṭb-ud-dīn, *Khawājah* Ibrāhīm and some others, one hundred and twenty-five men in all. Some of the Pannī Afghāns, too, were killed and wounded while defending 'Iwāz *Khān*. Altogether some thirty men were killed and about one hundred wounded on that side; while of the Sayyid's army four thousand five hundred were killed and the number of wounded was not known.

Nizām-ul-mulk's officers asked for orders to pursue, but he refused. He collected the wounded near his tent and sent them surgeons, healing salves and clothes. For some he provided horses, for some palankins, for some litters. On their recovery he asked them to enlist with him. As their master, Ḥusain 'Alī *Khān*, was still alive, they refused; their road expenses were then paid and they departed. The body of Dilāwar 'Alī *Khān* was decently buried; those of the Hindūs were burnt under the supervision of Rājah Indar Singh. Nizām-ul-mulk and his troops returned to Burhānpur.

8. PERPLEXITY OF THE SAYYID BROTHERS.

By the end of Sha'bān (29th = 5th July 1720) 'Abdullah *Khān* and his brother received intelligence of the disaster which had befallen them in *Khāndesh*. Not only had they failed to arrest Nizām-ul-mulk's progress, not only had they lost a general and an army, but the whole of Ḥusain 'Alī *Khān*'s family was likely to fall into the victor's hands. Saif-ud-dīn 'Alī *Khān*'s children had been intercepted, as we have seen, at Burhānpur, though they were passed on in safety; but Ḥusain 'Alī *Khān*

had left his wife and family behind him when he quitted the Dakhin, and they were still at Aurangābād. At all hazards, the family name and fame must be preserved. Both brothers agreed to write again to 'Ālim 'Alī Khān and also try to pacify Nizām-ul-mulk. To the former they wrote ordering him to delay any decisive action until the women were safe and Husain 'Alī Khān had arrived.

As we learn from a statement of Diyānat Khān, once *dīwān* of the Dakhin, but at this time a semi-prisoner in the custody of Husain 'Alī Khān, overtures to Nizām-ul-mulk were very reluctantly undertaken. On the day that the disastrous news arrived, Husain 'Alī Khān professed to seek Diyānat Khān's advice in this difficult conjuncture. This noble, referring to a Hindi proverb, which tells you to draw your hand out gently if it is caught beneath a stone, said that in this case the Nawāb's own head was in danger, for was not his family in peril? They should, without an instant's delay, issue a patent for the government of the whole Dakhin in favour of Nizām-ul-mulk and thus conciliate him, leaving warfare and revenge until a better opportunity.

Glancing towards Rājah Ratn Caud with a sneering smile, Husain 'Alī Khān said: "I have sent sums of money to the East. From this place (Āgrah) to the Dakhin, crowd after crowd of swift horses will be laid out at every stage. I will have ready twelve thousand torch bearers. Not for one instant, neither by day nor by night, will I stay my course or cease to gallop on." Diyānat Khān admitted that the Nawāb's strength would enable him to undergo even more than that exertion, but in this hasty advance how many troops would keep up, and even then, what strength would be left in man or horse? Knitting his brows, Husain 'Alī Khān replied: "The summit of a soldier's ambition is to die. Alas for us! when a leader with a reputation like yours speaks cowardly words, and is like a man who has lost all heart." The Khān retorted with an Arabic saying equivalent to "Man proposes, God disposes." In the end these heroics were seen to be out of place, and other means were tried. To Nizām-ul-mulk they enclosed a *farmān* in a long letter, both of which I proceed to give.¹

The *farmān* began by expressing His Majesty's surprise at hearing that the Nawab had left Mālwah without orders. What could be the cause? What apprehensions had he? Why had he not submitted a representation to the Throne, and acted according to the reply that he might receive? In what matter had his requests ever been refused? If he longed to travel and shoot in the Dakhin, how was it possible that such a request should not be granted, or if he had asked for it, the government would have been made over to him. A patent would have reached him, so that he might not be exposed to censure from evil-speakers.

¹ *Ma'āqir-ul-umarā*, II, 75, which places the incident after the death of 'Ālim 'Alī Khān.

[N.S.]

His Majesty was in no way ill-disposed towards him, but he should have avoided the appearance of offence. "As the disorders of the Dakhin are frequently reported to him, His Majesty contemplated making over to you all the *sūbahs* of that country. Praise the Lord; this purpose has come to pass of itself, and by God's help, His Majesty's intention and your desire will both be satisfied. 'Heart finds its way to heart under this vault of heaven.'¹ A formal patent is in preparation. When you have taken charge you will send off 'Ālim 'Alī *Khān* and the family of the *Bakhshī-ul-mamālik*, *Amīr-ul-umarā*, from whom he has been long separated, granting them a proper escort and seeing to their safety."²

With the *farmān* was a letter from Ḥusain 'Alī *Khān*. He wrote that Dilāwar 'Alī *Khān* had been sent to Aurangābād to escort the writer's family to Hindūstān. It was now reported that, pretending orders for which there was no foundation, the said Dilāwar 'Alī *Khān* had interfered with Nizām-ul-mulk, but the Lord be praised, had only received what he deserved. It was also said that several persons, led by love of mischief-making and devilish devices (*shaitānat*), had written untruly of several matters in a manner likely to sow discord between them. Alas! that such suspicious should arise between old friends! Envious persons, by sowing dissension, hope to open a way for themselves. If, which the Lord forbid, the writer had a grievance, he would have written direct. "No doubt, many things had been brought up, which might have angered His Majesty; and short-sighted men had tried to impress him unfavourably, but the writer, knowing your loyalty, made a detailed representation. By this means, I am thankful to say, your enemies were cast down and your friends made happy. His Majesty has graciously resolved to issue to you a patent for the government of the Dakhin. Accept my congratulations. 'Ālim 'Alī *Khān*, my (adopted) son, and my family propose to return to this country; kindly furnish them with an escort and see that they are not molested on the way."³

Such was the state of consternation into which the Sayyids had been thrown, that every day produced some new plan of action, only to be discarded in its turn for one still more new. First, they resolved to march together to the Dakhin with the emperor; then, that Ḥusain 'Alī *Khān* should go with Muḥammad Shāh, while 'Abdullah *Khān* returned to Dihli; next, that Muḥammad Shāh should return with the *wazīr* to the capital. At another time, they thought they would make terms with Nizām-ul-mulk, as in the letter just quoted, and postpone an attack upon him to a more favourable opportunity. According to these varying decisions, the advance tents of the emperor and of the two ministers were sent out first in one direction and then in another.

¹ (Verse) *Dil rā ba dil nāh ast, dar īn gumbas-i-sīpihr.*

² *Farmān* and letter in Shīū Dās, 33b, 39a. ³ Shīū Dās, f. 39a.

9. ATTACKS ON MUHAMMAD AMĪN KHĀN.

One of the Sayyids' main difficulties was the strength of the Mughal element in their own army. They did not know what to do with Muhammad Amīn Khān, cousin of Nizām-ul-mulk and head of the Mughal soldiery. At one time they thought of leaving him behind, at another of taking him with them. By some accounts they tried to poison him. However much Muhammad Amīn Khān may have rejoiced inwardly at the troubles now accumulating on the luckless Sayyids' heads, he continued to attend their *darbārs*, and spoke there freely of the wickedness of Nizām-ul-mulk's conduct.¹

It is said Muhammad Amīn Khān had taken the Sayyids' part for fear of losing his great wealth. He also had a very high idea of his own superiority to everybody else, and his power of finally coming out the victor. After he had become very intimate with Husain 'Alī Khān, the latter's friends warned him that Muhammad Amīn Khān was acting in a double-faced manner. The Sayyid answered: "What power has he to fight against me! "And at the worst, I shall easily escape from his clutches."

Muhammad Amīn Khān carried at once to Husain 'Alī Khān every insulting story he heard, hoping that the Sayyid, being put off his guard, might give him a chance of plunging a dagger into him. But Husain 'Alī Khān was suspicious of his covetous Mongol eyes. In spite of this, Muhammad Amīn Khān continued assiduous in his attendance. Those who prided themselves on their strength of understanding said, over and over again, that he was at the root of all the trouble and the real cause of Farrukhsiyar's deposition. "The truth or falsehood of this rests on the relater! The author must record the essential facts, though his enemies may taunt him. If he should turn evil into good, the whole story would become faulty, but only the Knower of all hidden things can reveal the true kernel of the matter."²

But at length the Sayyids were supposed to have decided to rid themselves of this "old wolf," also of 'Abd-us-ṣamad Khān, governor of Lāhor, another strong pillar of the Mughal faction, and connected by marriage with Muhammad Amīn Khān. 'Abd-us-ṣamad Khān they intended to exile to Balkh or Bukhārā. Informers told Muhammad Amīn Khān of his danger, and one day his soldiers thought he had been seized or killed in the *darbār*. They raised a disturbance, which was not allayed until they saw their general come forth unmolested. He was spared chiefly on the advice of Ikhlas Khān, whose opinion had great weight with both brothers, but more especially with Husain 'Alī Khān. Ikhlas Khān argued that his removal would stir up a spirit of revenge among a set of men who were not easy to appease. The clan of which he was the head was a large one, and if this "wasps' nest" was disturbed, there would be no one

¹ *Bayān-i-vāq'ī* (Mhd. Karīm), 319, Khāfi Khān, II. 882, Shū Dās. 45a.

² *Aḥwāl-ul-khawāqīn*, 146b.

left to pacify or soothe them after Muḥammad Amīn *Khān* was killed.

But before a reconciliation in accordance with this advice had been effected, the Sayyids attempted to fight the matter out with the *Mughals*. The dispute was brought to a crisis by the news of Sayyid 'Alīm 'Alī *Khān*'s defeat and death, under the circumstances which will be related presently. Camel-riders brought the news of this catastrophe to Āgrah on the 22nd Shawwāl (26th August 1720), sixteen days after the date of the battle. In their rage the Sayyids resolved to wreak their vengeance on Muḥammad Amīn *Khān*. At once M. Amīn *Khān* fortified the house which he occupied in the quarter of Rājah Bhoj in Āgrah city. On one side of it the *Jannah* flowed; on the other three sides he dug a ditch. Husain 'Alī *Khān* held his troops in readiness for an attack, but was dissuaded from carrying the idea into execution. Then Muḥammad Amīn *Khān*, when he heard this, came out at the head of his men and sent a challenge to the brothers, that if they wanted him he was there and willing to meet them. But the Sayyids now denied that they had intended to harm him.¹

On another day they planned to send the emperor to the *Tāj* accompanied by a large force, the house occupied by Muḥammad Amīn *Khān* being not far from *Tājganj*. They gave out that His Majesty had only come to visit the tombs and spend a day or two in recreation. As is well known, it was the custom for nobles to take it in turn to mount guard. The brothers agreed that when their turn came they would proceed to *Tājganj* with their troops, ostensibly upon this duty only, but in reality with the intention, after having placed the emperor in safety within the mausoleum, of leading their troops against Muḥammad Amīn *Khān*. That noble must have received some hint of what was in the air, for, seizing all the boats to be found on the *Jannah*, he crossed the river and camped on the other bank, leaving enough men to defend his house. More moderate counsels now prevailed, *Ikhlas Khān* was listened to, and 'Abdullah *Khān* dissuaded his brother from further violence, pointing out the danger to themselves that might result. Muḥammad Amīn *Khān* was invited to a feast, they all ate together, and an understanding, at any rate outwardly, was arrived at.

10. NIZĀM-UL-MULK'S CONTEST WITH 'ĀLIM 'ALĪ *KHĀN*.

Having disposed of Sayyid Dilāwar 'Alī *Khān* and his army Nizām-ul-mulk reached again the *Lāl Bāgh*² at Burhānpur on the 21st Sha'bān 1132 H. (27th June 1720). In regard to his negotiations with 'Alīm 'Alī *Khān*, we are told that Nizām-ul-mulk informed him that as he refused to yield him possession, he

¹ *Shiū Dās*, 45a.

² It lies two miles north of the town, and is now the site of a station on the Great India Peninsular Railway, *Bombay Gazetteer*, XII (*Khāndesh*), 589.

would go instead on a pilgrimage to Mecca. Accordingly he had turned off towards Sūrat and pretended to have discharged his men, leaving two to three hundred of them behind him at every town or village. By a public order he directed his cavalry to go wherever they pleased and take service where they could. But secretly they were instructed to halt where they were or go over to the enemy. When he wanted them they must either return to his standard, or desert him in the battle. He proceeded on his journey like a mere traveller or the member of a caravan. Induced by reports that Nizām-ul-mulk was almost alone, 'Ālim 'Alī Khān came out to bar his way. Nizām-ul-mulk admonished him, writing that his heart was now cold for worldly things, he knew nothing of public place or power, and only dreaded the unjust shedding of Mahomedan blood. At length when these remonstrances were not listened to, he determined to fight and recalled his troops.¹

As already stated, 'Ālim 'Alī Khān, when he heard of the approach of Sayyid Dilāwar 'Alī Khān, set up his tents in the Muḥamdi Bāgh on the 12th Rajab (19th May 1720²) and left the city of Aurangābād at the head of thirty thousand horsemen. He marched *viā* Phulmari.³ Early in Ramazān (May 1720) on reaching the pass of Fardāpur,⁴ which is half-way between Aurangābād and Burhānpur, he provided for the transport of his artillery through the pass, and sent an advance guard beyond it. The Mahrattahs and some troops under Tahavvar Khān, with half his guns only, were through the pass when two thousand or more Bārḥah Sayyids, fugitives from the late Dilāwar 'Alī Khān's army, made their appearance, bringing the disturbing intelligence of that officer's defeat and death. Most of the Mahrattahs and some of his own officers counselled 'Ālim 'Alī Khān, under these circumstances, to retreat Aurangābād or even Aḥmadnagar, there to await the arrival of Ḥusain 'Alī Khān, leaving the Mahrattahs outside to harass Nizām-ul-mulk's army by the methods of which they were such perfect masters.⁵

'Ālim 'Alī Khān, looking on a retreat as a disgrace, brought the rest of his army through the pass. Nizām-ul-mulk, on hearing of this movement, sent him the biers of Sayyid Dilāwar 'Alī

¹ Yahyā Khān, 126a.

² As the *Jangnāmāh* of Sudisht says, line 137 :—

Kaho : " Jāc devā deo maidān moṇ,
" Nazik Muḥamdi Bāgh, unchān moṇ."

Athi bārviṇ (12) māh-i-Rajab kā chānd,
Chalā ghar tān, shamsheer baktar koṇ bāndh.

Indian Antiquary, XXXIII (1904), p. 5.

³ A town 16 miles N.E. of Aurangābād, see Hossain Bilgrami and Willmott, "Sketch of Nizām's Dominions," II, 705.

⁴ A village at the northern foot of the Ajunta *ghāt*, 20 miles south of Pachoda station on the G.I.P. Railway; see S. Hossain and C. Willmott, II, 467, and Constable's "Hand Atlas," plate 31.

⁵ *Burhān-ul-futūḥ*, 166 a; *Aḥwāl-ul-khawāqin* 165b—170 a; Khāfi Khān, II, 885; *Tārīkh-i-muzaffari*, p. 186.

[N.S.]

Khān and Sayyid Sher **Khān**; and along with them a letter advising him to cease resistance and march off to join his two uncles with the ladies of the family. This communication produced no effect. After this Nizām-ul-mulk marched out of Burhānpur to the banks of the Pūrṇā river, which flows some sixteen or seventeen *kos* to the south and south-east of Burhānpur. There he encamped. From the other direction came 'Alim 'Ali **Khān** and pitched his camp at Tālāb Hartālab, which is not far from the same river.¹

They remained in these positions for several days. The constant rain, the muddy roads, the flooded river and the absence of means to cross (a bridge of boats having been swept away) made it impossible for either side to move. Then Nizām-ul-mulk finding it necessary to change his place of encampment, made several marches up the stream towards Malkāpur² in Barār, with the hope of finding a ford. At length, after eight marches, 'Iwāz **Khān** succeeded in obtaining through some neighbouring landlords information of a crossing-place at a distance of about fourteen or fifteen *kos*, in the direction of the district of Bālāpur³ in *ṣūbah* Barār. 'Alim 'Ali **Khān** had followed along the other bank, and shots had been exchanged daily across the river. In the middle of Ramazān (15th—20th July, 1720) Nizām-ul-mulk crossed with his whole army to the opposite or south side of the river. Although in places the water was up to the men's waists, or even to their chests, no lives were lost or baggage swept away by the current. For one day they encamped on the river bank to allow the camp followers to assemble. Then the following day they started to find a favourable position for giving battle. The camp was pitched and entrenched in a precipitous position full of thorny scrub close to Seogānw, a village in *ṣūbah* Barār.⁴

Exposed to incessant rain and living in the middle of deep black mud, they passed several days in extreme discomfort. First, owing to the heavy rain and the swollen streams, no supplies

¹ **Khāfi Khān**, II, 886; Kāmwar **Khān**, 226. For Hartālab see *ante*; it is close to Edilābād (**Khāndesh** district), which is on the south or left bank of the Pūrṇā. That river enters the Taptī on its left bank, about 16 miles after the latter river has crossed the boundary of the **Khāndesh** district, *Bombay Gazetteer* XI (**Khāndesh**), 7, 8, and *Berar Gazetteer*, 35. The Pūrṇā, the main river of the Akolā district, flows from east to west. At the nearest point of its course it is fully 20 miles south of Burhānpur.

² Malkāpur lies about 40 miles south of Burhānpur. It is on the Nāgpur branch of the G.I.P. Railway, and some miles south of the Pūrṇā.—Constable's *Hand Atlas*, plate 31.

³ Bālāpur is 16 miles west of Akolā, 16 to 18 miles south of the Pūrṇā river, and about 72 miles east (up stream) from Edilābād. The field of battle lies between the villages of Kolhari and Pimpri Gauli, about 65 miles S.-E. of Burhānpur and about the same distance N.-E. of Aurangābād—*Berar Gazetteer*, 163.

⁴ Seogānw is in the Akolā district; it is now a station on the Nāgpur branch of the G.I.P. Railway, and is about ten miles south of the left bank of the Pūrṇā, and 11 miles N.-W. of Bālāpur, *Berar Gazetteer*, 164; **Khāfi Khān** II, 887; Kāmwar **Khān**, 226; *Burhān-ul-fatūh*, 168a; M. Qāsim, Lāhori, 327.

could arrive from either Khāndesh or Barār. Secondly, the Mahrattahs of Nāgpur, who had crossed over from 'Ālim 'Alī Khān's army, were plundering all round the camp; not a single camel or bullock could be sent out to graze, much less could any supplies be brought in. Prices rose until for thirteen or fourteen days there was nothing left to feed the cattle but the leaves and young shoots of trees, which were pounded with stones and given them as forage. "The smell even of grass or grain did not reach the four-footed animals." Many of them, standing up to their shoulders in mire, starved to death. As for food, it could only be obtained by the wealthy, who paid one rupee for two to four pounds of flour. Many soldiers of small resources left the army and returned to their homes.¹

Many things contributed to the confusion in the camp—the rising of the streams, the hunger of the soldiers, the falling of tents, and the incursions of the Mahrattahs, who ventured themselves as far even as the edge of the camp market. Seeing that their soldiers were worn out and dispirited, the officers made complaints. Accordingly, when the rain held off for a little, the army marched to a deserted village three *kos* from Bālāpur, and there encamped again. As the Mahrattahs had become exceedingly troublesome, 'Iwaz Khān, Ghiyaṣ Khān and Rambhā Nimbālkar,² were sent against them. After some fighting the Mahrattahs were driven off, leaving behind them many of their mares, spears and umbrella standards. They were pursued for three or four *kos*.³

The festival of the 'Id (1st Shawwāl 1132 H., 5th August 1720) was celebrated at this new place, where supplies of grain arrived in sufficient quantity; but grass could not be got for the horses. It was as dear as saffron; if any camp-follower went out to gather it, he came back with his nose cut off. A further march became imperative. Before they moved away, several large cannon were buried here, the muddy roads and the bad condition of the draught oxen rendering their removal an impossibility. The next camp was at Bālāpur itself, where supplies were plentiful. A halt of three days was made to allow the troops to rest and recruit their strength.⁴

['ĀLIM 'ALĪ KHĀN'S PREPARATIONS.]

Instructions had been received by 'Ālim 'Alī Khān from his uncles to collect a strong force, and prevent their family and dependents from falling into Nizām-ul-mulk's hands. Money, they wrote, must be liberally spent, and rank and promotion accorded freely. The measures he took to carry out these orders had soon resulted in the assembling of a large army round his standards.

¹ Khāfi Khān, II, 888; *Ahwāl-ul-khawāqin*, 166b.

² Dowson transliterates Nimbālkar, while the text has clearly Binālkar. But from Grant Duff I gather that Nimbālkar would be correct.

³ Khāfi Khān, II, 888. ⁴ Khāfi Khān, 889; *Ahwāl-ul-khawāqin*, 167a.

[N.S.]

As he had been married to a young girl nearly related to the late Dā,ūd Khān, Pannī, the partisan leaders of that clan, who were very numerous in the Dakhin, readily joined him; even 'Umar Khān, the nephew or cousin¹ of that deceased noble, attended, although Dā,ūd Khān's blood still cried for vengeance. Other leaders of note were Johar Khān and Muḥamdi Beg. The latter had long been deputy *fanjdar* of Gulshanābād,² and when Nizām-ul-mulk previously held rule in the six *sūbahs*, he had been put in fetters and imprisoned by that governor as a punishment for his exactions. Subsequently he was pardoned and appointed to a subordinate post in the Nawāb's army. At this time 'Ālim 'Alī Khān bought him over with an absurdly high title, the rank of 5,000, and the right to beat kettle-drums. Others gained over in a similar manner were Matti Khān, his brother Laṭif Khān, Banwār, and his nephews Sayyid Wali Muḥammad and Muḥammad Ashraf of Nazarbār.³ These were all promoted to the rank of 5,000, and were placed under Tahavvar Khān,⁴ commanding the vanguard. Ghālīb Khān, son of Rustam Khān,⁵ whose family had been for generations in the Dakhin, joined along with Āpā Paṇḍit, his *diwān* or chief official.⁶

Others were Mirzā 'Alī, a noted warrior, and Sayyid 'Ālam, Bārhal. Among the rest came Amin Khān,⁷ the brother of Khān 'Ālam, Dakhinī. This man was very ill-disposed towards the Sayyids, owing to the injury caused to him a few years before, at the time he was deputy governor of the Bidar *sūbah*, when at Husain 'Alī Khān's instigation, he was suddenly attacked by the adopted son of Rajah Sāhū, the head of the Mahrattahs. Amin Khān, propitiated by the gift of money and of two or three elephants, now became a doubtful ally in the campaign. Other half-hearted adherents were Turktāz Khān and Fidāe Khān, *diwān*, both secret adherents of Nizām-ul-mulk. Among the other leaders were Ashraf Khān, *bakhs̄hī* of the Dakhin, Rāfiḥat Ṭalab Khān,⁸ Khwājah Raḥmatullah Khān (Shujā'at Khān), commander of 'Ālim 'Alī Khān's artillery, and Shams̄her Khān. The Mahrattah commanders were Santā Jī Sendhiāh, Khāndū Jī Dhabāriyah, the *senāpatī* or Mahrattah Commander-in-Chief

¹ The *Tārīkh-i-muzaffarī*, 186, says he was a *Bin-i-'annm* or cousin.

² This is a Mahomedan name for Nāsik.

³ Or Nandurbār, part of Baglānāh, now in the Khāndesh district—*Bombay Gazetteer*, XII, 379.

⁴ As to this Tahavvar or Mutahavvar Khān (died 1156, H. 1743), formerly Raḥmat Khān, son of Mutahavvar Khān, Bahādur. Khweshgī (died 1119 H., 1707), see *Ma.āṣir ul-umarā*. III, 787. A brother, Tahavvar Dil Khān, was killed in this battle. id. 788.

⁵ Possibly the Rustam Dil Khān of *Ma.āṣir ul-umarā*, II, 323. The *Tārīkh-i-Muḥammadī* (year 1132 H.) mentions a Ghālīb Khān, son of Rustam, a Dakhinī Sayyid, rank 5,000.

⁶ Shū Dās. 40; M. Qāsim, Lāhorī, 325; Khāfi Khān, II, 890.

⁷ The son of Khān Zamān. Shekh Nizām, Dakhinī; he was killed in battle on the side of Mubārīz Khān, 23rd Muḥarram 1137 H., October 15th, 1724, *M. ul-U* I, 352, and *Tārīkh-i-Muḥammadī* year 1137 H.).

⁸ The *Tārīkh-i-muzaffarī*, 187, has Rafāhat 'Alī Khān.

sent from Satārah, Sankrā Ji, Mulhār,¹ Kānū Ji and others. Rājah Sāhū had sent some of these men at the head of seventeen to eighteen thousand horsemen, and they all proclaimed themselves sworn friends of Ḥusain 'Alī Khān. Anwar Khān, acting the part of a double traitor, wrote to 'Ālim 'Alī Khān from Nizām-ul-mulk's camp, pointing out that the latter's strength being as yet unconsolidated, now was the time to strike a blow, and the sooner it was done the better. The letter was intercepted and the result was the disgrace of Anwar Khān, followed by his imprisonment and the confiscation of all his property.²

[NIZĀM-UL-MULK REPLIES TO THE LETTERS FROM ĀGRAH.]

Nizām-ul-mulk, with his usual ability in such matters, soon sowed dissension and distrust in the huge but badly wielded force opposed to him. The letter from Ḥusain 'Alī Khān, forwarding a patent for the government of the Dakhīn, was received with all due form and ceremonial; a special enclosure was erected, the Nawāb rode out to meet the bearer of it, and it was publicly read with the proper observances and the beating of drums. These documents were at once put to a use that had not been foreseen when they were despatched. A copy of the *farmān*, duly attested by a *qāzi*'s seal, was sent to 'Ālim 'Alī Khān, and a letter informed him that, since Nizām-ul-mulk was now appointed governor, it was useless for him to keep in the field. He ought to disband his troops at once and relieve himself of that unnecessary expense. Should he desire to return to Hindūstān, Nizām-ul-mulk would furnish him with as many men as were necessary. The news of Nizām-ul-mulk's appointment took the heart out of the local leaders and the newly enlisted soldiers, who sought their own safety either by flight to their homes or by joining the new *šubahdār*. Or, as one writer puts it: "On the way many of the idle boasters and valiant trencher-men deserted." In short, Nizām-ul-mulk, up to this time a fugitive and a rebel, henceforth assumed, in full reliance on the *farmān*, the attitude of a

¹ The *Burhān-ul-jutūh*, 167^a, and Khūshhāl Cand, Berlin MS. 495, f. 1.003^a, say that all power in the Dakhīn under 'Ālim 'Alī Khān had centred in Shankrā Ji, who had lately come back from Dihlī. Grant Duff 206, says he was at Aurangābād as the envoy of Rājah Sāhū. He was originally a clerk (*kārkhān*) under Shivā Ji, subsequently in 1690 appointed by Rām Rājā to be *Suchoo* (formerly called *Sūrnīs*). This was one of the eight principal offices of the Mahrattah state, with the duties of record-keeper and examiner of letters. He retired from office during the siege of Jinjī, 1698, and went to Benares. Although an old man, he grew tired of this idle life and entered the service of Husain 'Alī Khān when he came to the Dakhīn. Grant Duff, 105, 164, 171, 197, 198.

² *Tārīkh-i-muzaffarī*, 186, Khāfī Khān, II, 899. The *Gulshan-i-'ajāib*, 130^b, adds some other Mahrattah names: Bābā Ji (Bājī Rāo?) son of Bālā Ji Bishwanāth, the Peshwā; Tūkū Ji, Gūjar; Pilā, Jādū; Dāwal Ji, Samūsiya; Jamnā Ji, Damor (or Dhor); Mānkā Ji, Danah. The names in Khūshhāl Cand, 1003^a, are Kanhā Ji, Bālā Ji, Pilā Ji and Sankara, Brahman. Grant Duff, 206, has in addition Haibat Rāo Nimbālkar.

[N.S.]

legally appointed governor, loyally fighting for his sovereign's rights.¹

Long answers were sent to the emperor's *farmān* and to Ḥusain 'Ali Khān's letter. As usual in such cases, the comedy of outward deference was played through unblushingly to the end. After thanks for his new appointment, he met the accusation that he had left Mālwah without orders, by the audacious assertion that his action was due to the disorders caused by the Mahrattahs round Aurangābād, which led him to fear for the safety of Burhānpur and even of Mālwah; still more, for the safety of the family of the Amir-ul-umarā, Ḥusain 'Ali Khān. The great distance precluded his asking for orders or awaiting an answer, and for this reason he had marched at once, and the Mahrattahs had dispersed at his approach. His acts had been misrepresented. Newly-risen men, who had not yet learnt the reverence due to His Majesty's high rank,² might be guilty of such things; to ancient servants like himself, whose every limb and very bones were built up of the salt that he had eaten, they were impossible. His Majesty knew the disordered state of the Dakhin, in spite of all that the Dweller in Paradise ('Ālamgir) had done. As it was now devoid of a ruler, what more likely than that some disaster should happen there? The only remedy was a hasty advance. It had been his desire, for many a day, to make a pilgrimage to the holy Ka'bah, and he had meant, as soon as he had defeated the Mahrattahs, to ask for leave of absence. But now, his appointment to the Dakhin having been sent, he could not dream of disobeying orders; to carry out his sovereign's wishes he held to be far above the worship of God, he would soon be on the spot, and by God's help and His Majesty's good fortune, would carry out the necessary measures.³

To the Amir-ul-umarā, Ḥusain 'Ali Khān, after quoting the letter sent to him, in which he was told that Dilāwar 'Ali Khān had been sent only to fetch the Sayyid's family from Aurangābād, he wrote: "Nawāb Amir-ul-umarā! May you be preserved! In spite of his knowing your kindness and friendly feeling, and of my writing several times and my sending trusty messengers, the said Khān (Dilāwar 'Ali) would not listen to reason, and in the end brought on himself what happened to him. My feelings of friendship to you remain unchanged." He then repeats the story about marching to the Dakhin merely to protect Aurangābād and save the Amir-ul-umarā's family from dishonour, the latter involving the suggestion, a very galling one to a proud and high-placed man like Ḥusain 'Ali Khān, that he was too weak to protect them himself. "Praise be to God! all has passed off harmlessly. As soon as my troops arrived the rebels, making no stand, fled in all directions. The envious have

¹ Shiū Dās, 40^b; Mhd Qāsim, Lāhorī, 327.

² This is perhaps intended as a covert sneer at the Sayyids.

³ Shiū Dās, 41^a.

“ represented the matter contrary to the truth and induced His Majesty to be displeased with me. I thank God that the truth has been re-established and my word accepted. A report in answer to the *farmān* is enclosed, and I trust it may be brought forward at a proper moment. By God’s aid I will soon reach Aurangābād, whence I will forward your family and your other belongings with the greatest care.”¹

[THE BATTLE WITH ‘ĀLIM ‘ĀLĪ KHĀN.]

On the 5th Shawwāl (9th August 1720), leaving his baggage in Bālāpur, Nizām-ul-mulk ranged his army in order of battle at a distance of two or three *kos* from that town.² To the advanced guard were appointed Mhd. Ghiyās Khān, Muḥammad Shāh, commanding the artillery, Shekh Nūrullah, his brother, Yalburz Khān, Aghariyāh, Anwar Khān and others.³ On the right, where the opposing Mahrattahs showed in the greatest strength, were posted ‘Iwaz Khān and Jamālullah Khān, his son. With the main body and left wing were Ghāzi-ud-dīn Khān, the Nawāb’s eldest son, Marāḥmat Khān, Ni‘mat-ilāhī, ‘Abd-ur-raḥīm Khān (Ra‘āyat Khān), Mutawaṣṣil Khān, Sa‘īd-ud-dīn Khān,⁴ Qādir Dād Khān, Dārāb Khān and Kāmyāb Khān (two sons of Jān Niṣār Khān), Ikhtisās Khān (grand-nephew of Khān ‘Ālam, Dakhini), Rūḥullah Khān, Mutahavvar Khān, with many other nobles and Rājput chiefs. The command of the rear guard, with charge of the baggage, was made over to Rambhā, Nimbālkar, and Ambū Ji, the *desmukh* of *parganah* Sanesar.⁵

On the other side ‘Ālim ‘Āli Khān, mounting his elephant and taking his own place in the centre, with Ghiyās-ud-dīn Khān in the seat behind him, sent forward his artillery, supported by fourteen or fifteen thousand horsemen from the Karnātik. The battle began on the 6th Shawwāl 1132 H. (10th August 1720), the first movement being made by Nizām-ul-mulk. ‘Ālim ‘Āli Khān replied by two or three shots from his guns, which fell to the ground without hitting any one. The first shot returned by Nizām-ul-mulk fell close to the elephant on which Latīf Khān

¹ Shiū Dās, 42a.

² The *Berar Gazetteer*, 163, says the battle-field lies between the villages of Kolhari and Pimpri Gaudi, close to Bālāpur town (Akolā district), long. 75° 80', lat. 20° 4'. The *Sincinih-i-Dakhin*, 133, describes it as in the *talūqah* of Pāin Ghāt in Subāh Barār Kāmyār Khān, 226, says it was *dar savād-i-Bālāghāt*. According to the *Berar Gazetteer*, Berār Bālāghāt is the country above the Ajantā ridge, sloping down south to the *ghāts* or passes which lead up to it, while Barār Pāinghāt lies between the Gaurigarh hills on the north and the outer scarps of the Ajantā hills on the south.

³ For Muḥammad Shāh (wounded) and his brother Nūrullah (killed), see *M-ul-U*, II, 708, under Shujāt Khān (Mhd Shāh, Fārūqī, killed 1150 1737). Yalburz Khān is possibly the elder brother of Khwājā Qulī Khān, see *M-ul-U*, I, 834.

⁴ According to Ghulām ‘Āli Khān, *Muqaddamah-i-Shāh ‘Ālam-nāmah*, j. 345, this man was the father of Sa‘d-ud-dīn Khān, who was Khānsāmān and Mir Atash in the reign of ‘Ālamgir Sāni. The latter was Ghulām ‘Āli Khān’s own father-in-law.

⁵ Khāfī Khān, II, 889.

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was riding, the *haudah* was upset and the rider thrown to the ground. Before the smoke could disperse, Mutahavvar Khān, who commanded 'Ālim 'Alī Khān's vanguard, followed by seventeen or eighteen elephants and fourteen to fifteen thousand horsemen, fell suddenly on Nizām-ul-mulk's vanguard and caused many of the Mughals to give way. When Muḥammad Shāh, Nizām-ul-mulk's general of artillery, saw the day going against them, he, his brother Nūrullah, and his other officers, following the usage of Hindūstān, dismounted and continued the contest on foot. Nizām-ul-mulk's vanguard had been thrown into great disorder. Shekh Nūrullah was slain and Muḥammad Shāh wounded. Muḥammad Ghiyās Khān, who commanded it and was already blind of one eye, received a wound in his other eye. Yalburz Khān, Āghariyah, and other leaders were also wounded. The division retreated.¹

At this moment the other divisions from the right and left of Nizām-ul-mulk's army advanced to the attack and closed upon the enemy. 'Ālim 'Alī Khān, with the chiefs immediately under his orders, hurried forward the centre of his army with such rapidity that a portion of his division was outstripped and left behind. 'Iwāz Khān, Marāḥmat Khān, and Qādir Dād Khān met and repelled him wherever he turned. But 'Ālim 'Alī Khān though wounded kept the field. Then Mutawassil Khān,² a youth of 'Ālim 'Alī Khān's own age, drove his elephant to close quarters with that of the Bārḥah leader. He assailed Johar Khān,³ and the other eight or nine chiefs on elephants who accompanied 'Ālim 'Alī Khān. He fought on until compelled to retire by wounds and loss of blood. Qādir Dād Khān supported him bravely in this mêlée.⁴

'Ālim 'Alī Khān's elephant-driver, who was the brother-in-law of Mutahavvar Khān, was killed; Ghiyās-ud-din Khān commanding his artillery had fallen; so also had Ghālib Khān⁵ and Āpā Jī, that officer's *duwān*, Shamsher Khān, Sayyid Wālī and Sayyid 'Ālam Bārḥah: in all eight or nine of the chief men. The Mahrattahs, however, had reached Nizām ul-mulk's baggage and carried off some of his treasure of gold coins. At one time 'Ālim 'Alī Khān's elephant had stuck in a marshy place, from which it extricated itself with great difficulty and came out on the farther side alone. The first thing its rider saw was the

¹ Khāfi Khān, II, 891, 893; Ghulām 'Alī Khān. *Muqaddamah*, 34^b, speaks of Ghiyās Khān as *Yak-chashm* (one-eyed); Khūshḥāl Cand. Berlin MS. 495, f 100^{ab} mentions Mutahavvar Khān's receiving a musket wound.

² The grandson of Sa'dullah Khān, *Wazīr*, and therefore Nizām-ul-mulk's cousin.

³ According to the *Aḥwāl-ul-Khawāqīn*, f. 168, this man had borne the first brunt of the attack, the first shot knocked over his elephant-driver and carried away half his *haudah*.

⁴ Khāfi Khān, II, 814. Other commanders named in the *Tārīkh-i-Muznf-jarī*, 188 are Aqibat Khān, Ghiyās-ud-din Khān, Shamsher Khān, Ashraf Khān, Khawajah Raḥmānullah Khān, Nathe Khān, and Muḥamdi Beg.

⁵ The son of Rustām Khān, a Dakhni Sayyid, rank 5,000; see *Tārīkh-i-Muḥammadī*.

dead body of Mutahavvar Khān. Then between thirty and forty Bārhab Sayyids, sword in hand, forced their horses through the mud and rejoined their leader.

Soon afterwards the elephant ridden by 'Ālim 'Ali Khān turned tail, unable to bear any longer the rain of arrows. But 'Ālim 'Ali Khān, his wounds dripping blood, persisted and turning round in his seat continued to face his foe, exclaiming: "The elephant may turn to flee, but I do not." Three times did he succeed in renewing the attack, seeking everywhere for the invisible Nizām-ul-mulk; and unsuccessful in his search, was forced to beat a retreat. His stock of arrows being exhausted, he drew out those sticking in his face or his body or in the elephant trappings, and shot them resolutely at his opponents. At length Ikhtisās Khān disabled him by a sword stroke, which cut to the bone the fingers of his right hand. A fourth time he renewed his challenge to Nizām-ul-mulk, calling out how strange it was that the leader kept out of the way. Nizām-ul-mulk drew his bow to the full and shouting, "I am Nizām-ul-mulk," let his arrow fly. 'Ālim 'Ali was again wounded, he was surrounded, and Ikhtisās Khān cut off his head. Thus at the age of twenty-two he bravely gave up his life, a sacrifice on behalf of his two uncles.¹

Altogether seventeen or eighteen noted chiefs, "riders on elephants," and a large number of men fell in the battle; while many more were wounded. Amīn Khān, 'Umar Khān, Turktāz Khān, Fidāe Khān, *diwān* of the Dakhīn, and some other men of note transferred their services at once to Nizām-ul-mulk. Sankrā Jī, the chief officer of Rajah Sāhū, Mahrattah, was wounded² and taken prisoner. The elephants and artillery of the defeated army became the property of the victorious general; the rest of their equipage was given up to plunder. The drums were then beaten to announce the victory. Muḥammad Qāsim, Aurangābādī, thinks that Nizām-ul-mulk's case was desperate, if 'Ālim 'Ali Khān had not been killed. The Mahrattahs were in his rear, and against his ten thousand were ranged fully eighty thousand men. Six hundred and thirty-four Mahrattahs were killed.³

Except Sayyid Sulaimān (known as the grandson of the saint Ghāṣ-ūl-'azīm⁴) Shekh Nūrullah, and two or three less important men, no one was killed in the army of Nizām-ul-mulk. 'Iwaz Khān was slightly wounded, and the other principal men among the wounded were Mutawassil Khān, Qādir Dād

¹ Khāfi Khān, II. 894; *Tārīkh-i-Muzaffarī*. 189; *Muqaddimah* by Ghulām 'Alī Khān 34^b; Khūshhāl Cand, Berlin MS. 495, f. 1005^a. Yahyā Khān, f. 126^b, says the Sayyid was struck in the forehead by a musket ball. His head was laid before Nizām-ul-mulk, and after being identified and displayed in public, it was forwarded to the Emperor. As Sudisht says, line 541:

To ise moṅ ā ek golī lagī.

² "Mortally" wounded, Grant Duff, 247, line 6.

³ Khāfi Khān, II. 895; *Aḥwāl-ul-Khuroqīn*, 169^a.

⁴ Mūd Ghāṣ, Gwāliyāri, died 970 H. (1562-3), must be the saint intended, Beale, p. 177.

Khān, Mhd. **Ghiyās Khān**, Muḥammad Shāh and Kāmyāb Khān. When the fatal news reached Aurangābād, the ladies of Ḥusain 'Alī Khān's family and those dependent on 'Alim 'Alī Khān became afraid, and asked for shelter from the commandant of the Daulatābād fortress, some ten miles north-west of the town. This man was descended from Murtaẓā Khān and Sayyid Mubārīk, relations of Sayyid Jalāl of Bukhārā; and his family had held the appointment from the reign of Shāhjahān (1627-1658). In spite of the fact that Ḥusain 'Alī Khān had reduced him in rank and appointed others in his place, this officer gave the ladies a refuge with all their property. A few days after the battle, Mubārīz Khān, governor of Haidarābād, and his brother, Dilāwar Khān, who had announced that they were marching to the aid of the Sayyids, came in and joined Nizām-ul-mulk. With their adhesion to his cause ended all possibility of further danger to the usurper, so far as any opponent in the Dakhin itself was concerned.¹

SECTION 11.—THE NEWS FROM THE DAKHIN REACHES ĀGRAH.

Swift camel-riders reached Āgrah on the 22nd Shawwāl (26th August 1720), bringing information of the defeat and death of 'Alim 'Alī Khān near Bālāpur. Four days before this date Ḥusain 'Alī Khān's advance tents had gone out to Kurāoli, seventeen or eighteen miles from Āgrah, as a preliminary to his starting for the Dakhin. One encampment was formed at the village of Sihārā near Sarāe Khojah, five kos from Āgrah, there being a good supply of sweet water from a masonry tank or reservoir.²

The new disaster threw the Sayyids into a state of consternation. When the letters were put into 'Abdullah Khān's hand, he was so agitated that he was unable to read them, and could do no more than gather the facts from the oral statements of the messengers. He then broke forth into lamentation. Ḥusain 'Alī Khān bore the blow with more outward calm, though he was not completely successful in suppressing all signs of grief. Both brothers at once quitted their public audience room. Ḥusain 'Alī Khān really felt the blow more acutely than his brother, nor did he recover his equanimity until he heard about a week afterwards that his women with their property had received a refuge in the fort of Daulatābād. Consultation now succeeded consultation, plan followed upon plan. As already described, they had made an attempt to rid themselves of Muḥammad Amin Khān, head of the powerful clan to which Nizām-ul-mulk belonged. But finding that they were not strong enough to effect their purpose, they did their best to make friends with this important chief. On his side, Muḥammad Amin Khān had endeavoured to lull their suspicions to sleep by talking loudly in *darbār*

¹ Khāfi Khān, II, 896, 897; Wārid, 161a. For Daulatābād, see Syed Hossain and C. Willmott, II, 397; it is in Lat. 19° 57', Long. 77° 18'.

² Sihāre ki Sarāe, Indian Atlas Sheet 50, about 7½ miles from the city on the way to Kurāoli and Fatḥpur.

of the baseness of Nizām-ul-mulk's conduct and his wickedness generally.¹

At length it was decided that Muḥammad Shāh in person, with the imperial artillery and all head officials, should proceed to the Dakhīn in charge of Ḥusain 'Alī Khān; while 'Abdullah Khān returned to Dihli to maintain order in the northern half of the empire. Ḥusain 'Alī Khān, who had quite outstripped his elder brother in real power, had insisted on taking with him the offices and establishments of *diwān*, *bakhshī*, and *ṣadr-us-ṣudūr* for all the twenty-two provinces, with the two head *Diwāns*, leaving to 'Abdullah Khān only a small office staff. 'Abdullah Khān objected, but the dispute was kept secret, and at last it was arranged that the complete establishment of four *ṣubahs* only in Hindustān, that is Akbarābad, Aḥmadābād, Ājmer and Mālwah, and of all the six Dakhīn *ṣubahs*, with a small staff for the other provinces, should accompany His Majesty and Ḥusain 'Alī Khān.² Taking his imagery from the game of draughts, Yaḥyā Khān's comment on this separation of the two brothers is that, in the general opinion, the player had made a wrong move by scattering his men, and thenceforward his piece could not be protected; and so it turned out in the end.

Instead of the more direct road through Gwāliyār and Narwar, the longer route through Ājmer was chosen, with the object of meeting Rājah Ajit Singh and reinforcing the imperial army by his Rājputā. Accordingly the imperial tents were sent out to Sarāe Sahārā on the 1st Zu'l Qardāh 1132 H. (3rd September 1720), and on the 9th (11th September) the first march was made. On the 10th they moved to Kurāoli, the camp being pitched on a high mound beside a sheet of water. Here 'Abdullah Khān had his audience of leave-taking and departed for Dihli, Rājah Ratn Cand remaining at court as his agent and representative. The nobles who accompanied 'Abdullah Khān to Dihli were: Sayyid Salābat Khān, *Bakhshī*, Ghāzi-ud-dīn Khān Ghālib Jang, Ḥāmid Khān, Ḥamid-ud-dīn Khān, Ni'matullah Khān, Bairam Khān, Qilic Muḥammad Khān, Bāqir Khān (son of Rūḥullah Khān, deceased), Ḥafizullah Khān, Murid Khān, and Amir Khān.³

Outwardly the Sayyids strove to preserve an attitude of unconcern. When anyone condoled with them on the loss of their young nephew, they would say, "Praise be to God! no one of any importance has been lost," and express their joy that the youth had borne himself in a way to uphold the Sayyid name.

¹ Kāmwar Khān, 226; Khāfī Khān, II, 896; Mhd. Qāsim, Qāhori 319, 320; *Aḥwāl-ul-khawāqin*, 171^b

² Mhd. Qāsim, Lahori, 322; Khāfī Khān, II, 897, 898; Yaḥyā Khan, 127^b, 128^a.

³ Kāmwar Khān, 228; Khāfī Khān, II, 865, 898, 899; *Tarikh-i-Muzaffari*, 190. Bāqir Khān may be meant for Bairam Khān (Mhd. Bāqir), third son of Rūḥullah Khān, Ni'matullahi, see *Ma'āzīr-ul-umara'* II, 315; Wārid, 164^a. Qilic Muḥammad Khān may be identical with the brother of Mihr Parwar, widow of Bahādūr Shāh, *M-ul-U*, III, 780.

But some of their chief men began to lose heart, and on pleas of sickness or other lame excuses declined to go on active service, among these being Sayyid Firūz 'Alī Khān, uncle of 'Ālim 'Alī Khān. Husain 'Alī Khān, still full of confidence, thought nothing of these desertions, holding that his troops and those of his near relations were sufficient for every emergency. It was intended to raise the total numbers to 100,000 men; and urgent letters were sent by the hand of Sayyid Muḥammad Khān, son of Asadullah Khān, to the most noted of the Barhah Sayyids and the Afghans, calling upon them to join the column at once. But the numbers did not rise beyond fifty thousand men, including both the old and the new troops.¹

SECTION 12. THE EMPEROR'S ADVANCE TO THE DAKHIN.

On the 13th Zu'l Qa'dah (15th September 1720) the camp was at a place between Mahaur and Gopālpur; next day it was moved on to between Kanwāri and Mūminābād. Four days (15th to 18th) were spent in celebrating the anniversary of Muḥammad Shāh's enthronement, and on the 19th (21st September) a visit was made to the shrine of Shāh Salim, Cishti, at Fathpur Sikri. The succeeding marches were Jālwah (21st), Nabahrāh (23rd), Sālihabād (26th), Bajahrāh (28th), Bahādurpur (29th). At Qasbah Bahādurpur, about four miles north of Hindaun, the camp was under the shade of pleasant trees and the water was sweet and wholesome. In the two previous marches the rough country, full of thorny shrubs, and the want of water, had caused great suffering. Two days for rest were allowed. They marched thence on the 2nd Zu'l Hījjah (4th October 1720), and arrived at a place between Mahwah and Muḥkampur. Next they passed through the Lakhī darrah (or pass) and encamped at the foot of some hills in a very lonely and desolate country. Thence they marched on the 6th Zu'l Hījjah (8th October 1720) to a position between Jiund and Biünd, about two kos to the east of Todah Bhon (or Bhīm), a place now in Jaipur territory, about seventy-five miles south-west of Āgrah and about sixty miles east of Jaipur.²

During these marches there were, to all outward appearance, agreement and friendship between the Mir Bakhsī and his principal rival. Muḥammad Amin 'Khān tried to procure terms for Nizām-ul-mulk, offering himself as security that the Sayyid ladies and children would be brought home in safety. He

¹ Khafī Khān, II, 897; Mhd. Qāsim, Lāhori, 328.

² Kāmwar Khān, Mhd. Qāsim, Lāhori, 345, 346. Mhd. Qāsim was with the army and serving under Rāe Sūrāt Singh, Multāni. The map of the "Rajputana States," 1859, marks the pass as Kurrailee Ghāt, possibly the same as the Kariti of the Indian Atlas. Mahwah is on sheet 50 of the Indian Atlas, as Mhow, six miles west of Bahādurpur, on the Gambhir river. Jiund (Jond) is shown five miles N.-W. of Mhow, Biünd (Bond) about three miles N.-W. of "Jond" and Todah Bhon (Toda Bheem) seven miles W. of "Jond."

offered to send his own son, Qamar-ud-din Khān, to act as their escort. The proposed campaign would then be unnecessary. But Husain 'Alī Khān's pride debarred him from assenting to these proposals. Then Mhd. Amin Khān brought up the objection that the army, especially his division, was full of soldiers who had served for years under Nizām-ul-mulk. No loyal service could be looked for from these men, they would do harm instead of good, and it would be better to leave him and them behind. In secret, however, Muhammad Amin Khān said to his confidants that, in any case, he meant to strike at the Sayyids. If he were ordered to go on to the Dakhin, he would either seek an opportunity on the way, or withdraw from the battle-field when victory was trembling in the balance. If left behind, he would make certain that the two brothers never joined forces again. Husain 'Alī Khān, who was not altogether blind to the difficulty in which he was placed, for to take the Mughals on or to leave them behind was equally dangerous, exerted himself to the utmost to keep Mhd. Amin Khān in good humour, addressing him whenever they met as "Respected Uncle." A large sum of money was advanced to him by way of pay for his Mughals¹.

Haidar Quli Khān was also taken into special favour, and on the 4th Zul Qa'dah (6th September 1720), he replaced Sayyid Ghulām 'Alī Khān as *Mir Ātash*, or General-in-chief of the imperial artillery, of which there was a very large display, some sixteen-hundred cannon, large and small, besides *gajnaāl*, *shutar-nāl*, *kaharwāl* and rockets.² This man professed to be devoted heart and soul to the Sayyids, and Husain 'Alī Khān had formed a high opinion of his ability as an artillery officer. The men about the Mir Bakshī hardly shared his fancy for this man. They spoke scornfully of his "low stature but high fortune"³ and afterwards the line was applied to him, "Who would have thought this tempest could arise from an empty oven."⁴ Mu'azzam Khān, Afghān, Sayyid Ghairat Khān, Mir Mushrif, and others bade the Nawāb beware, for there was a plot on foot among the Mughals. He ought not, they said, to allow their officers to attend audience with a crowd of armed men. Husain 'Alī Khān retorted angrily that they were thwarting him in his effort to win over Mhd. Amin Khān, adding: "Who is there "who could raise a hand against me, what plot is there, what "reason for my assassination?" It only meant that they did

¹ Mhd. Qāsim, Lāhori, 324, 341.

² Khāfi Khān, II, 898, says the previous incumbent was Sayyid Khān Jahān. He had just died. Perhaps Ghulām 'Alī Khān was only his deputy. According to Rustam 'Alī, *Tārīkh-i-hīndī*, 242^b, Haidar Quli Khān was appointed during the halt at Bhoṣāwar, but that does not agree in date or place with Kāmwar Khān. Wārid, 161^b, calls Haidar Quli Khān a *Shirāzi*. He was really a native of Isfarāin, a town in *Khurāsān*; but he may have been for a time at Shirāz on his way to India. In one place he is called an *Isfahāni*.

³ *Kotah kadd o kōmat, darēz salāmat.*

⁴ *Kih mi-guft az tanūr-i-khām in tūfān shavvad paidā. Tanūr*, a portable oven of sheet iron, giving out, of course, a great sound when struck.

[N.S.]

not like to see the artillery pass from the hands of a Sayyid into those of a Mughal. Then he would launch forth in praise of Ḥaidar Quli Khān. The new general justified his appointment in the eyes of the army by the alterations which he at once introduced. Among other things he re-established the practice of former reigns, adopted from European models, of firing off a salute of ten to twenty field pieces (*rahkalahs*) whenever the emperor entered his quarters from a march or a hunting expedition. In this way notice of his Majesty's movements could be communicated to the whole camp.¹

Another new favourite was Sa'adat Khān, a Persian from Naishapur, then chiefly known as a relation of Ganj 'Alī Khān, lately deceased²; he had been appointed a few weeks before to be *faujdar* of Hindaun and Biyānah, some fifty to sixty miles southwest of Āgrah, and as the route of the army lay through his district, he remained in attendance. He paraded his troops daily before Ḥusain 'Alī Khān and made such a great show of zeal that his requests for more money and new *jāgīrs* were willingly complied with. Perhaps, in spite of the many favours now conferred by the Sayyid, he may have retained in his heart a grudge for the way in which he had been reprimanded only a little time before. A poor man's buffalo had been taken from him, the only thing he had in the world. On the march a report of this was brought to Ḥusain 'Alī Khān. The *faujdar's* agent at Court was sent for and warned that if an acquittance were not produced from the owner of the buffalo, it would not go well with his master. Sa'adat Khān thereupon told the peasant to take his buffalo and write his receipt. The man replied: "You took it forcibly, I am not content." "Take two buffaloes then." This offer also was refused, and in the end fifty buffaloes were given him before he would sign any paper. This interference may possibly have been rankling in Sa'adat Khān's heart; otherwise, being a Sayyid, a Shī'ah and a protégé of the Mir Bakhshī, it is surprising that he should have gone over to the other side. But being a pushing, energetic man, with his way still to make, he may have thought that there was more to gain on the side of the malcontent in the commotion attending a change of regime.³

SECTION 13.—ASSASSINATION OF ḤUSAIN 'ALĪ KHĀN.

During this time, between the 9th Zū, l Qa'dah (6th September 1720), the date of starting from Āgrah, and the 6th Zū, l

¹ Mhd Qāsim. Lāhori, 343, 344; Kāmwar Khān, *Khushhāl Cand*, Berlin MS. No. 495, f. 1007^a.

² For accounts of Sa'adat Khān see Khāfi Khān, II, 992, and *Mā āḡir-ul-umarā*, I, 463: as to his participation in these events, see *Khushhāl Cand*, Berlin MS 495 fol. 1010^a. The *Mājma'ul-akhbār*, B.M. Oriental 1624, f. 555, says he was son-in-law of Ganj 'Alī Khān. Yuhā Khān, 127^b, has *Ḥadiq Khān*, ba mulāzimat rasidah, ba *Khātib-i-Sa'adat Khān wa isāfah-i-manāḡab sar-afraz* shud.

³ Rustam 'Alī, 234^b.

Hijjah 1132 H. (8th October 1720), a plot had been hatching for the destruction of Husain 'Ali Khān. The chief conspirators were Muḥammad Amin Khān, Haidar Quli Khān, 'Abd-ul-ghaffūr and Mir Jumlah. It would be thought that the last-named, after his unfavourable experience in Farukhsiyar's reign, would have declined to enter into any more projects of this sort; and he does not figure as a very active sharer in the plot.¹ Sayyid Muḥammad Amin, Sa'adat Khān, the new *faujdar* of Biyānah, was also entrusted with the secret. A willing instrument was found in the person of Mir Haidar Beg, Dughlāt, a man from Kāshghar.² Muḥammad Amin Khān is reported to have made an appeal to the loyalty of his Mughals. Unable as they were to overcome Husain 'Ali Khān's army, would any brave man devote his life to the Mir Bakhshī's removal? If the assassin survived, the Nawāb would be his slave for life; if he were killed, his family should be liberally cared for. At first no one spoke. Then Mir Haidar Beg offered himself: "I am a Sayyid and he "is a Sayyid: if 'brother kill brother what matters it?"³

Communications were opened with Muḥammad Shāh's mother through Sadr-un-nissā, head duenna of the harem, the intermediary being one Shāh 'Abd-ul-ghaffūr, a faqir from Tattah in Sind, who passed to and fro disguised in woman's attire as a seller of milk. We shall hear more of this man later in the reign. Muḥammad Amin Khān also made hints several times to Muḥammad Shāh in the Turkī tongue, which they both understood. Once this was done in Husain 'Ali Khān's presence. He asked what had been said. Muḥammad Shāh replied that the noble had asked for leave to withdraw as he had a pain in his stomach. As Muḥammad Shāh thus kept his secret, Muḥammad Amin Khān inferred that he was not unfavourable to the plot. Once after they had left Fathpur Sikri behind, Sa'adat Khān, in the darkness of night, came to the tent of Mhd. Amin Khān, and it was decided that an attempt upon the life of Husain 'Ali Khān should be made next day while they were on the march. Bringing up their divisions on his right hand and on his left, they were to envelop him and his retinue, and slay him. Qamar-ud-din Khān supported this proposal warmly. But the next day it was found that Husain 'Ali Khān had descended from his horse and had mounted an elephant. An attack was thought inadvisable; and another plan was now devised.⁴

The day before his assassination Husain 'Ali Khān uttered a foolish speech about making an emperor of any one on whom he

¹ Khāfi Khām, II, 903, 905, denies that Haidar Quli Khān, Qamar-ud-din Khān, or the Emperor, knew anything; but this is more than doubtful.

² The brother of Snāpur Khān (Kāmwar Khān, 230). Khāfi Khām, II, 903, calls him of Chaghatāe race. His family bore the epithet of *Mir-i-shamsher*, and he was commonly called Mir Haidar Beg. Mirzā Haidar, governor of Kashmir and author of the *Tārikh-i-rashidi*, is said to have been his great-grandfather.

³ Khāfi Khām, II, 902, 903; *Ahwāl-ul-khawāqin*, 175a

⁴ Khāfi Khām, II, 903; Wārid, 42; *Tārikh-i-Shākir Khānī*, Yahyā Khān, 129a, Khushhāl Cand, Berlin MS. 495, f. 1009a.

chose to cast his shoe. That night Muḥammad Amin Khān and Haidar Quli Khān met, and it was decided that the next morning their plot should be carried into execution. It is said that when Mhd. Amin Khān had left, Ḥusain 'Ali Khān chanced to come on a visit to Haidar Quli Khān, and began to ask his advice on some point. Haidar Quli Khān, who was by nature a man of cunning, saw opening for securing his own safety whatever happened. He told Ḥusain 'Ali Khān that as a rumour prevailed through the camp of his (the speaker's) supersession in the command of the artillery, Mhd. Amin Khān proposed to come to his (Haidar Quli's) tent next morning. After he, the Mir Bakhshī, had escorted the emperor to the door of the female apartments, he could on his way to his quarters call at his, the Mir Ātash's, tents, and there through someone ready to risk life for him could procure the assassination of Mhd. Amin Khān. This plan having been agreed on, Ḥusain 'Ali Khān departed. Haidar Quli Khān's idea was that whichever side got the upper hand, the winner would be grateful to him for his suggestions and take him into special favour.¹

It was the custom for Nawāb Ḥusain 'Ali Khān to present himself before the emperor at the end of every march and make his morning obeisance. The ceremony was known by the Hindī name of the *Juhar*.² Accordingly on the morning of the 6th Zū.1 Hijjah 1132 H. (8th October 1720),³ on reaching the new camp pitched two *kos* to the east of Toḍah Bhīm,⁴ Ḥusain 'Ali Khān and other great nobles followed Muḥammad Shāh as usual to the entrance of his tents, made their bow and departed to their several camps. Ḥusain 'Ali Khān entered his litter within the imperial enclosure (*jālī*), having in attendance seven or eight servants and two relations. Muḥammad Amin Khān, Sa'adat Khān, and several others were present. Then Muḥam-

¹ Yahyā Khān, f. 128 a.

² Shakespear, 913; *Juhar*, a Hindū salutation; obeisance.

³ Khūshhāl Cand, Berlin MS. 495; f. 1007^b, is the only writer who has the 8th Zū.1 Hijjah.

⁴ Toḍah Bhīm (Indian Atlas, Sheet 50) lies about six miles west of a pass through the hills. Khāfi Khān, II, 903, calls the place Torah, and says it is 35 reputed *kos* from Fathpur Sikri. It is really about 45 miles S.-W in a straight line from that town. The British Museum MS. No. 1746, (Elliot collection) fixes the site at Ghāt Karbali (*query*: Karkari or Kareli), near the village Jondā (*query*: the Jon Bond of the Indian Atlas), in the district of Bhusāwar. This must be the village Kareli to the east of the pass (see "Map of Rājputanah States," 1859). The Indian Atlas, Sheet 50, has Kariti quite close to the pass, and the village Kharela about five miles north-east of it. Khūshhāl Cand, Berlin MS. 495, f. 1008 a, speaks of the *darrah* or pass of Lakhri. This name may be taken from the Laker ke purah of the Indian Atlas, which lies about two miles south of Kharelā. Bhusāwar was a *parganah* in Sarkār Āgrah of Subah Akbarābād, Jarrett, *Am.* II, 132. The town lies about 13 miles north-east of the pass (Indian Atlas, Sheet 50). Toḍah Bhīm was itself the chief town of a *parganah*. Jarrett, 133; Khūshhāl Cand, f. 1009 a, says that after leaving *parganah* Bhusāwar, camp was at Qaşbah Pāotah, which is eight miles north-east of Toḍah Bhīm, and five miles north of the pass.

mad Amin Khān, who is said to have filled his mouth beforehand with raw blood, put his fingers into his mouth, simulated vomiting, and complained of vertigo. He laid himself down full length on the ground. Husain 'Ali Khān sent for rose-water and a preparation made from an odoriferous willow (*bed-mushk*), supposed to be a restorative, and after these had been administered, Muḥammad Amin Khān made signs that they should carry him into Haidar Qulī Khān's tent, which by reason of his office of *Mir Ātash* was close to the imperial gateway. Round Husain 'Ali Khān there then remained no more than two or three persons. The time was about midday.¹

As the palanquin issued from the imperial precinct, Haidar Beg, Dughlāt, with one or two other Mughals, appeared on one side shouting, "A complaint! a complaint!" and drew from his sleeve a paper in the nature of a petition. As the *bakhshī* knew the man by sight, he was allowed to approach, when he launched forth into imprecations upon Muḥammad Amin Khān, the second *bakhshī*, who bore the deserved reputation of being exceedingly harsh and miserly. Coming closer, the man said that their general embezzled their pay and, with this Dakhin campaign before them, they were dying of hunger and their horses were at the last gasp. Would not the Nawāb, as chief *bakhshī* and noted for liberality to his troops, do something to help them? A body-servant advanced to take the petition, but the Mughal made a gesture of refusal. Husain 'Ali Khān, in his usual considerate way, said: "Come here and give it." The petitioner came close and put the paper into his hands. A pipe-bearer appeared at the other side of the palanquin; the Nawāb turned his head that way, took hold of the mouthpiece of the pipe-snake and began to read the petition. The *bakhshī's* attention being given to the reading of the paper, the assassin in an instant drew from his waistband a long dagger-like butcher's knife, and plunged it into Husain 'Ali Khān's side. The wounded man struck with his feet at his murderer's chest, so that he fell and his turban tumbled off; then exclaimed: "Bring a horse! I must mount." Recovering himself Haider Beg laid hold of the Nawāb's feet, dragged him from the palanquin to the ground, sat on his chest, and began to cut off his head.²

On foot near the palanquin was Sayyid Nūr 'Ali, entitled Nūrullah Khān, a boy of fourteen or fifteen years of age.³ He

¹ Mhd. Qāsim, Lāhori, 346, 347; Khāfī Khān, II, 903; Wārid, 161^b; Shīu Das, 49^b (*farmān* to Girdhar Bahādur).

² Mhd. Qāsim, Lāhori, 347; Khāfī Khān, II, 903; Khūshḥāl Cand, Berlin MS, 495, ff. 1008^a, 1009^b, Wārid, 162^a.

³ Kāmwar Khān, 230, calls him 'Aẓmatullah Khān, son of Asadullah Khān; but Khāfī Khān, II, 904, has Nūrullah Khān. Both the latter and Mirzā Muḥammad, *Tārīkh-i-Muḥammadi* (year 1146) describe him as uncle's son of Husain 'Ali Khān; Wārid, 162^a, has "Anwarullah," and calls him the son of Husain 'Ali Khān's paternal aunt; in B. V. Oriental MS., 1747, f. 207^b, he is said to be a maternal uncle's son. Khūshḥāl Cand, Berlin MS, 495, f. 1009^b, asserts that he was slain by Qamar-ud-din Khān (son of Mhd. Amin Khān).

[N.S.]

was the son of Asadullah Khān, Bahādūr, called Nawāb Auliā, and one of Husain 'Ali Khān's cousins. As soon as he saw what had happened, the boy shouted out, "The wretches have killed the Nawāb," quick as lightning drew a pistol¹ from his belt and with a shot from it wounded Haidar Beg. Then, with three blows from his sword, he stretched the murderer on the ground dead at the side of his victim. But, before the boy could escape, he was attacked by the other Mughals, and fell lifeless across the mangled body of his cousin. Husain 'Ali Khān's head was borne in triumph to the small tent (*rāwati*) of Haidar Quli Khān, whence he and Mhd. Amin Khān had hurriedly emerged barefoot when the shouting began.²

Muhammad Amin Khān made his way at once to the imperial quarters, and called on the emperor to come out and take command of his troops. The head of the murdered *bakhshī* was thrown at his feet in the space before his private tents. Muhammad Shāh, whether he had been in the secret or not, now showed some inclination to draw back, and began to remonstrate. His mother, too, though she had no doubt intrigued to get her son freed from the galling tutelage of the Sayyids, was now afraid for his personal safety and drew him back within the women's apartments. Then Sayyid Ghulām 'Ali Khān, cousin of the *wazīr* and of the *bakhshī*, and superintendent of the Privy Audience Chamber, who had come inside the private enclosure with Islām Quli, a slave, and some gunners (*ḥazārī*) in his pay, cut through the canvas walls and tried to obtain possession of the emperor's person. Muhammad Amin Khān and some Mughals drove them back, and Sa'adat Khān then captured and confined them.

Further delay was dangerous. Brushing aside all the restraints of etiquette, Sa'adat Khān threw a shawl over his head, pushed his way into the harem, took Muhammad Shāh in his arms, and dragged him by force to the scene of the assassination. It was still free of men. Elephants were called for and they mounted, Muhammad Shāh on Qamar-ud-din Khān's elephant, Buland Bakht, with Mhd. Amin Khān in the seat behind him. They took up their station at the gateway of the street of shops dependent on the guardhouse where the kettledrums were played. Husain 'Ali Khān's head was held aloft on the end of a long pole.

Orders were given for the general plunder of Husain 'Ali Khān's tents and treasure. There were at first only forty or fifty of Mhd Amin Khān's cavalry and some artillerymen present, between one and two hundred men altogether. Haidar Quli Khān sent urgent messengers to collect elephants, horses, and men, while Mhd. Amin Khān busied himself in writing

¹ Dowson (Elliot, VII, 572), reads *nimchah* and translates "short sword," but the I.O. Library MS. of Mhd Qāsim has *tamanchah* (pistol). Khāfi Khān, II. 904, refers to a "sword" (*shamsher*).

² Mhd. Qāsim, Lahori 349; Khāfi Khān, II. 904; Khūshhāl Cand, Berlin MS No 495, f. 1009a; Shākir Khān, 103. Mir Mushrif is said to have been present, to have killed one Mughal, and to have been wounded himself; but Khāfi Khān doubts this.

urgent notes to the various commanders. "Now is the time to display your friendship. He who comes now will do a great service and obtain great rewards." No man of any rank appeared; there were only Muhammad Amin Khān himself, Qamar-ud-din Khān, his son, Haidar Quli Khān, and Sa'adat Khān. The imperial artillery began to play upon the Sayyid's camp. Just before the fight was over Khān Daurān appeared on the scene with some troops, but Zafar Khān, Turrah-i-bāz, continued to keep discreetly out of the way of danger.¹

Unconscious of what was happening, the officers and soldiers of the Sayyid's army were engaged in putting up their tents or obtaining their supplies for the day. The sound of firing did not alarm them. It was, they assumed, nothing more than the usual salute notifying the emperor's arrival at his quarters. The first intimation of the assassination was brought to Sayyid Ghairat Khān, the nephew² of the victim, just as he had taken off his weapons and had begun to eat his breakfast. Putting back into the dish the morsel he had just taken up, and not even washing his hands, but wiping one hand upon the other, wearing nothing but a thin cotton coat, he ran out and mounted his elephant. He was followed by a few men, not more than forty or fifty altogether.³ The need of delay and caution was impressed on him by older men; but he would listen to no dissuasion. Like a roaring tiger just wounded by an arrow, he hurried on, venting loud oaths and curses, until he reached the imperial enclosure (*jāli*); and as he came face to face with the force drawn up there, most of his companions were shot down and he himself received two arrow wounds. In the struggle part of the canvas wall enclosing the emperor's camp was knocked down.

Seated alone in his iron-clad canopy, Ghairat Khān pressed on, shooting his arrows, until he came near the elephant of Haidar Quli Khān. Stinging reproaches for base ingratitude were hurled at the latter. On his side Haidar Quli Khān retorted: "O man, untrue to the salt you have eaten! descend from that elephant and submit, and I will obtain for you His Majesty's pardon." The young Sayyid advanced and shouted: "I await your commands," adding in the most scornful tone: "Fie upon your faithfulness and upon the quality of your friendship!" Ghairat Khān then shot an arrow which fixed itself so firmly in Haidar Quli Khān's bow, that after the fight it was withdrawn with difficulty. Behind Haidar Quli Khān

¹ Mhd. Qasim, Lāhorī, 350, 351; Khūshhāl Cand, Berlin MS. 495, f. 1010^a; *Bayān-i-wāqī'*, 424; Kāmwar Khān, 231; Wārid, 162^b; Khāfi Khān, II, 906, 907, 908; Shākīr Khān, 10^b.

² According to the *Tārīkh-i-Muḥammadi* his father was Sayyid Naṣrullah, Sādāt Khān, Bahādur, Bārḥah, and his mother was Husain 'Alī Khān's sister. The *Burhān-ul-futūḥ*, 168^b, calls him the son of Sayyid Khān Jahān, Bārḥah. Khāfi Khān, throughout this part of his story (pp. 901, 902, 905) distinguishes between Ghairat Khān and 'Izzat Khān; according to him 'Izzat Khān was killed and Ghairat Khān survived.

³ Khāfi Khān, II, 905, says there were four or five hundred.

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was an Abyssinian slave named Hājī Bashīr, holding a loaded European matchlock. His master turned and said angrily to him: "What are you waiting for?" The slave fired, the ball entered the breast of Ghairat Khān, and he fell from the elephant dead.¹

Sayyid Karimullah Khān, who had succeeded to Sayyid Dilāwar 'Alī Khān's office of *bakhshī*, headed another onset and reached the entrance of the imperial enclosure (*jāli*), but his men were soon killed. Shekh Najm-ud-din, entitled *Nek-andesh Khān*, Superintendent of the *Adālat*, also fought his way with five or six horsemen into the enclosure and tried to carry off the Amīr-ul-umārā's body. But, after receiving two or three wounds on the shoulder-blade and side, he fell down insensible and was carried away by Haidar Qulī Khān's men. Meanwhile, Rajah Muḥkam Singh himself, with a troop of his men, stood looking on as a mere spectator; but Curāman, Hazārī, a man long in the service of the Sayyids, did his duty well and forced his way to the private entrance (*deodhi*) of the emperor's tents, but could do nothing more. Khwājah Maqbūl Aḥmad the Sayyid's *nāzīr*, followed by a water-carrier and a sweeper, attacked the imperial group with drawn swords, and these three courageously made their way as far as the imperial chapel-tent (*tasbīḥ-khānah*) where they were cut down. The Khwājah died of his wounds three or four days afterwards. In another direction Mustafā Khān, the paymaster of Rajah Muḥkam Singh, without consulting his master, made his way with some men to the gate of the enclosure; repulsed there, he turned off and cut through the canvas walls of the Privy Audience Chamber, entering it with shouts and curses. But after losing a few men, he was ejected by the Mughals. During this scrimmage Muḥammad Shāh hid behind Ṣadr-un-nissā, wife of Rizā Qulī Khān, Jahāndār Shāhī²

Rāe Sūrat Singh,³ Multānī, and his son, Lālā Anand Singh,³ did nothing but provide for the safety of their own persons and property. Lālā Jaswant Rāe, son of Ṣahīb Rāe, Munshī, escaped by allowing his father's hoards and much of his own property to be plundered. Another man who escaped was Rāe Saroman Dās, Kāyath, wakil at Court on behalf of Sayyid 'Abdullah Khān. He shaved, rubbed his face with ashes, and turned himself into a *fūqīr*. Then, hiding a few valuables in his waist-cloth, he lay concealed in his friends' tents until he was able to escape to Sayyid 'Abdullah Khān. Mu'azzam Khān, a man from the east country, although of high rank did nothing, but 'Umar Khān, his brother, was killed by the plunderers. Sayyid Jān 'Alī, brother of Mir 'Alī Khān, Superintendent of horse-branding,

¹ Khūshḥāl Cand, Berlin MS. 495, f. 1010^a, says the slave handed the gun to his master. Mhd. Qāsim, Lāhori, 35¹. Khāfī Khān II, 905, 907, 908, Yahyā Khān, 12^a, Shakir Khān, 9^b. Wārid, 162^a and ^b

² Muḥammad Qāsim, Lāhori, 354, Khāfī Khān, II, 910 Ghulām 'Alī Khān, Muqaddamah, 37^a, Khūshḥāl Cand, Berlin MS 495, f. 1009^b.

³ The employers of Mhd. Qāsim, Lāhori, author of the *'Ibatnāmah*.

fought his best and lost his life; while his brother escaped for a time, only to be made a prisoner a few days afterwards.

The confusion lasted ten to twelve hours, and during this time countless treasure was plundered and much property was destroyed. The dead body of Husain 'Ali Khān was subjected to unspeakable indignities at the hands of the low scoundrels and hangers-on of the army. The event yielded striking evidence of the want of cohesion in an Indian army under the pressure of any sudden disaster. When the plundering was done, not a trace of the Sayyid's vast encampment or his mighty host could be seen. It was impossible to believe that there had ever been a heel-rope or a tent peg on that ground. Everything had been burnt or carried off, and the men had disappeared.

Muhammad Amin Khān held it wiser not to check the plundering, in which both friends and foes were busily occupied, for thereby the chance of any resistance was obviated. As an incident in this reckless plundering we are told that a common soldier carried off two bags of coin, and supposing them to be rupees, he took them to a money-changer, and asked for gold in exchange, as being lighter to carry. When the bags were opened they were found to be full of gold coins! Before the assassination the money-changers' shops, most of Husain 'Ali Khān's equipage, and carts said to contain a *kror* of rupees, had arrived in camp from the march. All these were plundered and carried off. But the Bakhshi's jewels and some money chests, which were still on the road, were saved and confiscated to His Majesty's use.¹

Rajah Ratn Cand, Banyā, who was much more hated by the general public than the Sayyids themselves, knew not which way to turn. The armed array of his foes barred his flight, and he was not the man to take the field and meet blow by blow. As the saying is: "A prancing ass and a shopkeeper are equally worthless."² He told the beads of his rosary³ with one hand and with the other used his handkerchief to wipe the tears from his eyes. 'Abd-ur-raḥmān Khān and other Afghāns of Sihriṅd offered to rescue him, saying: "Mount, Mount." He refused with idle phrases. All that he could do was to write a hurried note of a line or two to Sayyid 'Abdullah Khān, and send it off by a camel-rider. Soon Rajah Dyā Rām,⁴ the agent of Muhammad Amin Khān, came for him and he submitted at once. On the way some Mughals and low fellows from the bazārs surrounded his palanquin, dragged him out, beat, cuffed, and kicked him, and tore his

¹ Khāfi Khān II. 904, 905, 908, 909, 910, Ghulām 'Alī Khān, *Muqād-damah*, 37a. Khūshhāl Cand, Berlin MS 495, f. 1009^b, 1010^b, Yabyā Khān, 129^b, Wārid, 16. b, Shū Dās. 49a.

² *Kabgi-i-khar-na-bn kār-i-baqqāl*. I am not sure of the reading or the meaning; in any case it is meant to be derogatory.

³ The word used is *samarni*, "a small rosary or string of beads" (Shakespeare, 1315)

⁴ See Anand Rām Mukhlis's "Chamanistān," for a defence of this act of his uncle, Dyā Rām.

[N.S.]

clothes to tatters. Brought in this pitiable naked condition before the new *wazir*, he begged piteously that his life might be spared. Muḥammad Amin Khān, after sending for a suit of clothes, ordered the Rājah to be put in chains and kept a prisoner. His case was an example of the saying: "As you do, so shall it be done unto you."¹ In spite of all their efforts Ratn Cand made no disclosure of the Sayyid's treasure or buried hoards. A short time afterwards, while they were on the march, he tried to escape. The Mughals who were guarding him pursued him, cut him down, and would have liked to slay him. But he was reserved for formal execution.²

Muḥkmā, the son of Curā, Jāt, was brought in a prisoner, and in his despair offered to turn Mahomedan if his life were spared, but Muḥammad Shāh declined his offer and treating him kindly sent him away. Sayyid Asadullah Khān was also captured and was long kept in confinement, until he received permission to make the pilgrimage to Mecca and started for the Dakhīn. Ghulām 'Alī Khān, because he had been the emissary sent to Delhi to bring Muḥammad Shāh to Āgrah to be enthroned as emperor, was spared and protected; but in a few days made use of an opportunity, and escaped to 'Abdullah Khān.³

The death of such a highly placed and powerful noble as Ḥusain 'Alī Khān gave rise, as usual in such cases, to many myths and legends. One man said he dreamt that he was in the audience-hall of the Imām Ḥusain. Ḥusain 'Alī Khān, in blood-stained raiment, presented himself at the door. He was brought in with honour, the Imām greeting him with the words: *Balaghā wa'dakā, wa ghulaba 'aduka*. Strange to say these words yield, taken as two chronograms, the year of the Sayyid's martyrdom. Other chronograms were found, meaning "The month Muḥarram of Ḥusain arose anew" and "In the Indian Karbalā a second Ḥusain was martyred by a second Yazid."⁴

SECTION 14.—'ABDULLAH KHĀN HEARS OF HIS BROTHER'S DEATH.

As we have seen, 'Abdullah Khān left the imperial camp on the 12th Zu'l Qa'dah (14th September 1720) on his way to Dihli.

¹ Yabŷā Khān adds the trite quotation:—

*Bu yak lahzah, ba yak sāt, ba yak dam,
Dagar gūn mā-sharvad ahwāl-i-ālam:*

And Khushhāl Cand gives us a plagiarism of, or a misquotation from Sa'di's *Gulistān* (Lakhnan edition, 1291 H., p. 79).

*Cū būnd k, iqbal dast-ash girift,
Humah 'ālam-ash dast har sar nihand;
Cū qoh-i Ilāhī bur kasī-i ūftād,
Hamah 'ālam-ash pāe har sar nihand.*

² Mhd. Qāsim, Lāhori, 355, Shiū Dās, 48^a, Khushhāl Cand, Berlin MS. 495, f. 1010^b, Khāfi Khān, II, 919, Yabŷā Khān, 129^a.

³ Shiū Dās, 48^a, Khāfi Khān, II, 910. Asadullah Khān died 1146 H. (1733-4), *Tārīkh-i Mhd.*

⁴ *Muḥarram-i-Ḥusain tāzih shud* (1133), *Miftāh*, p. 307, at top, Ḥusain

He halted for a few days at Sikandrah near Āgrah. On the 7th Zu, l Hijjah (9th October 1720) he was at a halting place near Sarāe Chath, about forty-eight miles north-west of Āgrah and about sixty-four miles from Dihli, when at midnight, within eighteen hours of the event, a camel-rider brought the scrap of paper from Ratn Cand announcing the overwhelming news of Husain 'Alī Khān's assassination. Revenge was his only thought. Summoning to his presence the nobles in his train, he told them his heart-rending story, beseeching and imploring them to throw in their lot with him. Some from their hearts, others only out of prudence, agreed to stand by him.

A few of the more ardent spirits proposed an immediate trial of strength, before Muḥammad Shāh could be reinforced, or Husain 'Alī Khān's troops be bought over by him. But 'Abdullah Khān, reflecting that Muḥammad Shāh was in full possession of the throne, while his own army was out of heart, decided that to take the field without any claimant to the throne was undesirable. It was better, he thought, to proceed first to the capital, there to collect an army, select a candidate, and restore the confidence of his adherents.

That same day the march for Dihli was resumed. Disregarding the attacks of the Mewātis and the Jāts, who daily plundered their baggage and slew their camp-followers, they pushed on until they came to Faridābād, twenty-one miles from Dihli. Shujā'at-ullah Khān, son-in-law of 'Abdullah Khān, Mur-tazā Khān, and Sitā Rām, a man in the *wazīr's* confidence, were sent forward in haste to the capital with orders to consult Najm-ud-dīn 'Alī Khān, the *wazīr's* brother,² and select one of the imprisoned princes of the house of Taimūr for elevation to the throne. Disturbances had broken out at once in the *jāgīrs* held by the Sayyids, their agents were ejected, and the cultivators refused the instalments of rent due on the autumn harvest.³

having been killed in Muḥarram, which began three weeks after Husain 'Alī Khān's assassination. Wārid's lines, f. 165^b, are:—

Az rahlat-i-Husain 'Alī Khān-i-dīn panāh
Dar Hind g-isht waqī ah-i-Karbalā pudīd.
Tārīkh-i-rahlat-a-h kih gul-i-bāgh-i-jinnat ast,
Taba'am sīhr zi Hatīf-i-ghaib in nodā shunīd ;
Gufbund qulsīn ān kih : ' Yazīd-i-duyam nomūd
 " *Dar Karbalāe Hind Husain-i-duyam shahīd.*"

A *tārīkh* by 'Abd-ul-jalīl, Bilgrāmī, is given in the *Tabqirat-un-nāzīrīn* of his son. It runs to fifty lines, of which the last gives the date :

Qatl-i-Husain kard Yazīd i-la'in-i-Hind (1132). This fine poem, by its dirge like cadence, accords perfectly with its subject.

¹ From Toḍah Bhīm to Chāth is about 64 miles as the crow flies. Khushḥāl Cand, Berlin MS. 495. f. 1011^b says 'Abdullah Khān was in *parganaḥ* Hoḍāl and gives the date as the 8th Zu, l Hijjah. The town of that name is about 15 miles nearer Dihli than Chāth.

² Khān Jahān, the *wazīr's* uncle and *sūb-hdār* of Dihli, had died about the 12th Shawwāl 1132 H. (16th August 1720, Kāmwar Khān, 2:4

³ Kāmwar Khān, 214, 238, Khāfī Khān, II, 901, 911, 912, 913, Wārid, 163 a, Shīu Dās, 54 a.

SECTION 15.—MUHAMMAD SHĀH'S MOVEMENTS.

On the day following Husain 'Alī Khān's death a formal audience was held by Muhammad Shah. In the interval Muhammad Amin Khān had posted pickets of Mughals to arrest deserters, and instructions were given to the armed villagers to stop any one who tried to leave the camp. In this way many men, though partisans of the Sayyids and anxious to escape, were forced to remain. Muhammad Amin Khān went among them in person to try and secure their adhesion. In spite of his Mahomedan bigotry, he visited the quarters of Rājah Muḥkam Singh, one of the Sayyids' principal officers. As the Rājah saw he was in the Mughal's power, he made his submission and at his first audience was presented by Dyā Rām, the agent of Muhammad Amin Khān. He was promoted to the rank of 6,000 with the right to beat kettledrums. Mir Mushrif of Lakhnau, another of the Sayyids' chief men, after rejecting the first overtures made to him, was also propitiated and promoted. 'Ināyatullah Khān, Kashmiri, the *khānsāmān*, Rājah Gopāl Singh, Bhadauriyah, and twenty-one other nobles laid their offerings at the emperor's feet.

Muhammad Amin Khān was promoted to 8,000 *gāt* and was loaded with gifts. Khān Daurān, although at the critical moment his fear of the Sayyids had prevented his declaring himself, received the same exalted rank. The grade of seven thousand had been hitherto the limit for any person not of the blood royal. Qamar-ud-din Khān, Haidar Qulī Khān and Sa'adat Khān were made respectively 7,000, 6,000, and 5,000 in rank. Zafar Khān and Rājah Gopāl Singh, Bhadauriyah, also received promotion. To celebrate the emperor's emancipation from the Sayyid bondage, some poet found a chronogram:

“He was a bright star (*Roshan Akhtar*) and is now a moon;

“Like Joseph he left prison to become a king.”¹

The camp was about seventy two miles from Āgrah, about one hundred and twenty-eight miles from Dillī, and the nearest point on the Jamnah, to the north-east, was distant about sixty-eight miles. Under the altered circumstances any further advance in the direction of the Dakhin was useless. There was some doubt and debate as to whether they should return to Āgrah

¹ *Roshan-Akhtar hūd, iknūn māh shud*;
“*Yūsuf az zindān bar-ārud shāh shud.*” (1133).

Miftāh. 305, Shiū Dās. 496. The *Tārīkh-i-muzaffarī* says there is an excess of two years in the figures, though the chronogram was accepted from its appropriateness; but I make it come out right, if applied to this period (1133), and not to the date of accession (1131), as is commonly done. Khūshhāl Cand. Berlin MS. 495, f 997^b, says the author was a poet known as Ilqā (the inspired). Kāmwar Khān, 232, Mhd Qāsim, Lāhori, 366, Shiū Dās, 46^b, Khāfi Khān, II, 910.

or make for Dihli. At last it was decided to move northwards till they struck the Jamnah. Curāman, Jāt, although he owed a great deal to the Sayyid brothers, was for the moment persuaded by the offer of great rewards to join Muhammad Shāh with a large force. A cunning answer of his has been preserved. Muhammad Amīn Khān said to him: "Thou art a creature of the Sayyids, I have no reliance on thy service or good will." Swearing by his Hindū gods, he replied: "Nawāb Shāh! it is true that those great men have conferred on me such benefits that if I had a thousand lives and a thousand times my wealth, I would have offered up all, including my family and children, on their behalf. But now I am under the imperial flag, the true lodestone, and I swear by Bhagwān I will do such service on the day of battle that the Nawab himself will acknowledge it." He spoke the truth, for on the day of battle he plundered the imperial baggage and the goods of many others.¹

As the route chosen would have passed through Curāman's villages, he persuaded the emperor to change it. Leaving his own villages on the right, he led them across Jai Singh's territory, and took them over high hills and through thorny jungles. There was a great scarcity of water: it had to be brought immense distances and used most sparingly, as if it were oil and not water. Many were unable to quench their thirst and endured great hardships. On the 9th Zu, Hijjah (11th October 1720) the camp was moved to a place between Bhusāwar and Kharidā, where the festival of the Sacrifice was celebrated. In answer to a letter from Khān Daurān, written by the emperor's special order, Sayyid Naṣrat-yār Khān, Bārḥah, *jujūdār* of Mewāt, who was on his way to the army on a summons from Husain 'Ali Khān, presented himself and was well received, and promoted to the rank of 7,000. Šābit Jang (Ja'far Beg), a protégé of Khān Daurān's, was another valuable adhesion. He joined a little later, just before the battle of Husampur. When the dust raised by his march was seen across the Jamnah, all exclaimed: "Rājah Girdhar Bahādur has come!" He and his men then crossed the river by a ford. Dost 'Ali Khān, 'Abid Khān, and Ghālib Khān, formerly superintendent of branding for the emperor's own troops, all three officers of the late Husain 'Ali Khān's army, also came in, submitted, and were promoted.²

On the 11th (13th October 1720) there were many presentations with the attendant promotions and appointments; and on this day the biers of Husain 'Ali Khān, Gharat Khān, and Nārullah Khān, after the bodies had been wrapped in cloth of gold, were despatched for burial at Ajmer in the tomb of 'Abdullah Khān, the Nawāb's father, which lies outside the city wall close to 'Abdullahganj. At the time fixed, no bearers to carry the biers could be found; and after this difficulty had been over-

¹ Kāmwar Khān, 236, 237, Mhd. Qāsim, Lāhorī, 366.

² Muhammad Qāsim, Lāhorī, second recension, 429, Shū Das, 50, 51, 2a, Khāfi Khān, II, 910, 911, Khūshḥāl Cand, f. 1014a, Rustam 'Alī, f. 245c.

[N.S.]

come, robbers, believing that the coffins contained treasure, seized them, but finding nothing threw the bodies away. After a time they were recovered by the *fauj-dars* of those parts, and in the end, as was reported privately, they reached Ajmer and were buried.¹

The emperor's next stages were Rāmgarh (12th) and Gopalpur (13th). Here Sa'adat Khān was farther promoted to 6,000 and named to the government of Akbarābād. Other stages were Māndūgarh (15th), Malkahri (21st); next a place between Jalauri and Malikpur (22nd), then near Khori (23rd), Sālgānw (25th). Qasbah Kāmā (27th), and between Nandgānw and Barsānah (28th). All towns, such as Nārnol, Alwar, Tijārah and Kohari had been avoided.²

At Barsānah on the 2nd Muḥarram 1133 H. (2nd November 1720) Muḥammad Khān, Bangash, at the head of two or three thousand men, and 'Aziz Khān, Bahādur, Chaghataē, appeared from Akbarābād. Before Ḥusain 'Alī Khān's death, Muḥammad Khān had sought an interview with 'Abdullah Khān while he was still near Agrah, at which he demanded fifty thousand rupees in addition to previous advances. He then, though very reluctantly, marched professedly to join the imperial army already on its way to the Dakhin. Both officers had come as far as Sarāe Chāth on the direct road from Agrah to Dihli. Their attitude was doubtful; and if they were hostile, they could bar the emperor's way to Dihli. 'Abdullah Khān, who was Muḥammad Khān's patron, had also called to his mind the benefits he had received, trying to win him over thus to his cause.³ So grave were the apprehensions of the other side, that Ḥaidar Quli Khān and Qamar-ud-din Khān were sent to interview the Bangash chief. Their mission was successful, and they brought the two Afghān nobles into the imperial camp. In addition to promotion in rank, Muḥammad Khān received an assignment of four *krors* of *dāms* on the revenues of Allahābād. *Parganahs* Pālī, Bairah, and Bawan of *sarkār* Khurābad, and *parganah* Harhab and part of Sandīlah in *sarkār* Lakhnau, all in *ṣubah* Audh, were granted to 'Aziz Khān.

¹ Khāfi Khān, II, 910, on the authority of Sayyid 'Abdullah Khān himself, who made the statement several times in open audience in Khāfi Khān's hearing. See also *Jauhar-i-simgān*, B.M. Oriental MS. No. 1898, (Fuller's translation, MS 30,784, f. 79) and Rustam 'Alī, fol 244a. Mr. Eustace Kites, formerly Assistant Commissioner at Ajmer, informs me that 'Abdullahganj and the tombs lie outside the town to the east, not far from where the railway station now is; and a recent writer, Muḥammad 'Abbās, Shirwāni, *Tārīkh-i-dīlchūsp* (Dihli, 1313 H., 1895), p. 99, in describing Ajmer mentions among the notable buildings "the tomb of Nawāb Ḥusain 'Alī Khān."

² Kāmwar Khān, f. 236, Muḥammad Qāsim, Lāhori, 367. All the above places, except Māndūgarh and Sālgānw, will be found on the Indian Atlas Sheet No 50.

³ For the letter see Shāhib Rāe, Irvine MS. f. There is a detailed account of the adventures of 'Abdullah Khān's messengers in Siwāni-i-Khizri, Irvine MS. pp. 68—72.

At Pahāri, Sher Afkan Khān, Panīpaṭī, the *faujdār* of Korah and Jahānābād, *sūbah* Allahābād, also marched in and joined the imperialists. When near Āgrah, on his way from Allahābād to his *jāyirs* at Sikandrah, he had met some messengers riding from Court, and asked the news. They told him that two days previously Ḥusain 'Alī Khān had been killed. Khūshhāl Cand, who was near his elephant, saw his face flush with joy at the emancipation of Muḥammad Shāh, the son of his old master, Jahān Shāh. Not long after this, a letter came to him from Nawāb Qudsiyah, the emperor's mother, written by her own hand, in which he was distinguished with the epithet "brother." Other arrivals were Bāyazīd Khān, Mewāti, a powerful man in that country, and Khēmā. Jāt, one of 'Urāman's chief officers. This Jāt was placed in charge of the imperial rear guard.¹

One of Muḥammad Shāh's first task had been the issue of reassuring letters to the provincial governors, and demands for reinforcements from those known to be opposed to the Sayyid faction. Among those written to were Nizām-ul-mulk. Rājah Girdhar Bahādur, Rājah Jai Singh, Sawāe, and 'Abd-uṣ-ṣamad Khān, the governor of Lāhor. To a certain extent these letters were in identical terms,² and as was natural, a note of triumph is perceptible in them. "Praise be to God! Ḥusain 'Alī Khān has obtained the punishment of his deeds and the penalty for his acts; his suppression and removal, as my heart desired, has been effected in the easiest manner," and so on, in the same strain, then the date and place of assassination are given, with other details added, Ghairat Khān appearing as the "Devoid of Honour."³ Ḥusain 'Alī Khān's head was sent with the letter to Nizām-ul-mulk, and that noble was called upon to march at once to join His Majesty. Girdhar Bahādur, Jai Singh, and 'Abd-uṣ-ṣamad Khān were, in the same way, urged to join as soon as possible.⁴

In answer to these orders Rājah Jai Singh, instead of coming in person, sent his *diwān*, Jag Rām, with a force of three or four thousand men, horse and foot, and wrote that he was busy enlisting more men, and as soon as this was finished he would attend himself. 'Abd-uṣ-ṣamad Khān replied that without delay he had begun to prepare for a march. But lately he had been forced to suppress a revolt by Ḥusain Khān, head of the Afghāns of Qasūr, and for the pay of the troops he had enlisted on that service he still owed four *lakh*s of rupees. The soldiers had

¹ Kāmwar Khān, 237, Shih Dās, 57^b. Khāfi Khān, II, 900, 920, Khūshhāl Cand, Berlin MS. f. 1012^b. For the *parganas* named see *Ain*, II, 176, 177, 178, 179, and "Oudh Gazetteer, I, 274; II, 72; III, 50, 292.

² For one of these *farmāns* see *Majma'ul-inshā* (lithographed edition), p. 85, to the effect that H.A.K. was killed on the 6th Zil Hijjah of the 2nd year, when Ghairat Khān and Mir Mushrif attacked the imperial camp, but were repulsed and slain.

³ *Be-ghairat*, a play upon his name.

⁴ Shih Dās, 49^a *et seqq.* (where he gives the *farmāns* and replies in full).

[N.S.]

mutinied and hindered him from marching. The *diwān* of the province, in spite of his, the governor's, offering to execute a bond, would not disburse the money from the imperial treasury. Until some order was issued or provision made for the money, he was unable to move. Girdhar Bahādur promised a speedy arrival, and Nizām-ul-mulk reported that he was about to start.¹

SECTION 17.—‘ABDULLAH KHĀN REMONSTRATES.

As soon as he learnt of his brother's death, and before he resumed his march to Dihli, ‘Abdullah Khān addressed a letter of complaint to the emperor. It was couched in the customary language of respect. After referring to the disturbances in the Dakhin and Lāhor, reports of which had already been laid before His Majesty, and the arrangements made by which Husain ‘Ali Khān, his younger brother, undertook the former business and he himself had started to take charge of the capital, ‘Abdullah Khān goes on to say: “Although separation from my younger brother was distasteful to me, still in obedience to the exalted order, we “made no objection, and of the two brothers one set out for the “capital, the other for the Dakhin, in attendance on Your “Majesty. This faithful one was still on his journey and had “not yet arrived at Dihli, when finding their chance and seeing “my brother alone, men acting unfairly and without justification from the law, have done him, Ghairat Khān, and the son “of Nawāb Auliya, to death in Your Majesty's very encampment, “and all their goods and property have been plundered. O “*Qiblah*² of the world and its inhabitants! may you be preserved! “If so be that all this has been carried out by Your Majesty's “order, and these men have done all this harm, and spilt all this “blood, by your direction, there is nothing farther to be said. “What has a slave to say against the order of his master? But “if it was not done by your order, and they of themselves did “these vile deeds, I rely on your acting according to justice and “equity by ordering the murderers to be imprisoned, so that they “may not escape. This faithful one and the heirs of the “deceased are coming. We rest assured that this complaint will “be dealt with before Your Majesty according to the precepts of “the Holy Law. This devoted one's prayer is that until he “arrives they be not be released. If, by any chance, any one asks “for their release, let not the request be granted.”³

Muḥammad Shāh answered by asseverating his extreme grief and regret at recent events; God alone knew the extent to which he felt them. By God's help, Haidar Beg Khān, the culprit, had been killed on the spot. “By God's name I swear that “I knew absolutely nothing of this affair. When the outbreak

¹ Shū Dās, 49^a, et. seq., Khāfi Khān, II, 921.

² *Qiblah*, the point or place towards which the faithful turn at time of prayer; *qiblah-i-‘alam*, an honorific epithet of a king.

³ Shū Dās, 54^a.

“ occurred, strict injunctions, such as were appropriate, were
 “ issued; but as that wretch had carried out his purpose, they
 “ were of no avail. Haidar Beg Khān is dead, the names of the
 “ others are not known, nor do you give those names. If you
 “ write precise details, action will be taken. The extreme loyalty
 “ and the clearness of the thoughts of that Pillar of the State
 “ are more evident than the sun itself, and are impressed on my
 “ heart. By the aid of God I, too, will soon reach that place;
 “ that Loyal One also purposes to come to the Presence. If it
 “ please the Lord Most High, this matter will then be decided
 “ in the most perfect and satisfactory manner according to the
 “ Holy Law and to Justice.”¹

After a little time had elapsed, and the rumours of ‘Abdul-
 lah Khān’s preparations grew louder, the emperor addressed a
farmān to him. His Majesty was still awaiting his arrival at
 Court, as promised in his letter, and had looked for him every
 day. “ Now comes the unexpected report that he has hurried off
 “ to Dihli, has brought a royal prince from the State prison, has
 “ placed him on the throne and enlisted a great army. If the
 “ cause of this conduct be the death of his brother, (although
 “ against God’s decrees man is helpless), the Holy Law provides
 “ for retaliation (*qisās*). Through God’s favour the man in fault
 “ has received his punishment. If at first, owing to human
 “ weakness, angry thoughts arose, he must now submit himself
 “ to God’s decrees. To place reliance on an army and cannon is
 “ not only to resist God’s vicegerent, but is unfitted to the
 “ character of such a mighty noble. Let him come himself to
 “ the Presence, and whatever he wishes shall be done. He has
 “ not made any application. Let him come without delay and
 “ lay his case, in his own way, before His Majesty. His Majesty
 “ has no other thought than his subjects’ welfare, and his heart-
 “ felt desire is that such a nobleman may not come to be evil-
 “ spoken of among the people. Thus it is fitting for him to give
 “ attentive ear to these words; and having understood them and
 “ well reflected, let him act accordingly.”²

To this admonishment ‘Abdullah Khān sent a final answer.
 “ Certainly this true one’s arrival in the presence of that Source
 “ of Beneficence will be to him a joy equal to that of the worship
 “ of God. But the things which happened to *Amir-ul-umārā*,
 “ the brother of this one of lowliest qualities, are apparent to
 “ Your Majesty. If this faithful slave had been at court, he,
 “ too, would have undergone the same; nay, God alone knows
 “ what might have occurred. From these causes, this slave sees
 “ no safe course or refuge for himself except in turning his face
 “ away from Your Majesty’s presence. Although a sovereign is
 “ God’s vicegerent upon earth, still that power is deputed to him
 “ only for the welfare and protection of created beings. If there
 “ were safety where Your Majesty is, how were it possible for a
 “ lowly thing like me to disobey the exalted order. Guardian of

¹ Shih Dās, 55a.² Shih Dās, 56a.

[N.S.]

“the Realm! Muḥammad Ibrāhīm, too, is of Your Majesty’s family and brethren. Yea verily, in him I have provided an instrument for my safety. If it please the Most High God, in a short time, attending on his stirrup, we shall be honoured with the felicity of an audience, and the true state of the matter will be laid before you. To say more would be to transgress the rules of politeness.” In these more or less ironical terms the gauntlet was thrown down by ‘Abdullah Khān before Muḥammad Shāh and his supporters.¹

SECTION 18.—PRINCE MUḤAMMAD IBRĀHĪM RAISED TO THE THRONE.

‘Abdullah Khān’s letter to his brother, Najm-ud-dīn ‘Alī Khān, instructing him to begin enlistments, reached Dihli late on the 8th Zūl Hījjah 1132 H. (October 10th, 1720). Before the bad news could spread, he gave out a report the very contrary of the truth, and sent the head of the police with cavalry and infantry to the house of Muḥammad Amin Khān. By midnight the house had been surrounded. But Muḥammad Amin Khān’s people had by this time learnt the truth, and, erecting defences, had made ready for resistance, rejoicing and singing all the while, and announcing to everybody what had really happened.

The news spread like wildfire through every street and lane of the city. Soon, either a note came from ‘Abdullah Khān forbidding interference with the women and family of Muḥammad Amin Khān, or else Najm-ud-dīn ‘Alī Khān changed his mind. At any rate, the troops investing the house were withdrawn. During the night the death occurred of Kesū Rāe, husband of Ratn Cand’s sister, and himself chief official of the Dihli *sūbahdār*; and although he had been then on his death-bed for several days, it was given out that he had poisoned himself. On the day of the ‘Īd (10th Zūl Hījjah, October 12th, 1720), Najm-ud-dīn ‘Alī Khān attended the great mosque, his eyes full of tears, and as he was returning home ‘Abdullah Khān’s emissaries greeted him.²

Forthwith he repaired to the prison-house of the princes and sent men to the dwelling of Jahāndār Shāh’s sons. At first the princes shut their gates in the faces of the messengers, but after a long altercation, admission was accorded. On learning their purpose, the princes gave a harshly expressed refusal. Some say the messengers next addressed themselves to Nekūsiyar, and were again repulsed. Lastly, proposals were made to Prince Ibrāhīm, from whom they met with a more favourable reception.³

Before ‘Abdullah Khān arrived at Dihli, Prince Ibrāhīm was brought out of prison and placed upon the throne, the *khutbah* was recited with the titles Abū, l Fath, Zāhīr-ud-dīn, Muḥammad Ibrāhīm, and coin was issued in his name. On the latter the inscription was :—

¹ *Shih Dās*, 56b.² *Khāfi Khān*, II, 913.³ *Khāfi Khān*, II, 914.

Sikkah bar sīm zad dar jahān
Ba fazl-i-Muḥammad Ibrāhīm, Shāh-i-shahān.

Silver was stamped in the world
 By favour of Muḥammad Ibrāhīm, king of kings.¹

This enthronement took place on the 15th Zūl Hījjah, 1132 H. (October 15th, 1720). The prince, then about twenty-three years of age, was the eldest son of Rafī'-'ush-shān, third son of the Emperor Bahādūr Shāh; and was therefore the brother of the Emperors Rafī'-'ud-darajāt and Rafī-'ud-daulah. He² had been designated by the Sayyids as the latter's successor, but Sayyid Khan Jahān, *ṣubuhdār* of Dihlī, with whom the final choice rested, dreading Ibrāhīm's reputation for violent temper, had substituted Roshan Akhtar, now become Muḥammad Shāh.³

Two days after the enthronement of the new sovereign, 'Abdullah Khān reached the capital, and possession was taken of the imperial treasury. The money found there, added to 'Abdullah Khān's own accumulations and Ratu Cand's hoards, which were now dug up, was devoted to enlisting an army. It is said that over one *kror* of rupees was disbursed in the next few days. Urgent orders were sent out far and near, and every Bārhaḥ Sayyid, whether in the service or not, made it a point of honour to appear. Many Jāts, Mewātis, and Rajpūts had been collected on the way back to Dihlī. As much as thirty thousand or forty thousand rupees were advanced to each leader to meet the demands of new troops. Asked why he was scattering so much money, 'Abdullah Khān replied: "If I win, the realm and its treasures are mine; if otherwise, it is better to give the money away than let it fall into the hands of my enemies." For a man with one horse the pay was eighty rupees, with two horses, one hundred and fifty rupees a month. Each foot soldier received ten rupees for the same period. On enlistment payment was made for one or two months in advance. Every animal, whatever its size or condition, was branded and taken into the service,

¹ British Museum Catalogue, p. 372, but Rodgers, p. 217, has one coin, which he reads:—

Sikkah zad dar jahān ba fazl-i karīm
Shāh-i-shahān-i-Muḥammad Ibrāhīm.

² The *Jām-i-jam*, a modern work, places his birth on the 26th Rabī, I, 1115 H. (August 9th, 1703), thus making him the youngest of the three brothers. It also gives him the same mother, Nūr-un-nisā Begam, and assigns the enthronement to the 28th Zūl Hījjah, 1132 H. (October 28th, 1720). As, however, Dānishmand Khān's *Buhādūr Shāhnāmāh*, under date of 7th Ramazān, 1119 H. (December 2nd, 1707), tells us Prince Ibrāhīm was then given the rank of 7000,2000 horse, he could hardly have been born later than 1107 H. (1695-6), twelve years being the earliest age at which *maṣūbs* were granted to princes. The *Tārīkh-i-Muḥammadi* gives his age at his death in 1159 H. (1746) as about fifty; this places his birth in 1109 H. (1697-8) and makes his age twenty-three at his accession. On the other hand, Rustam 'Alī, *Tārīkh-i-Hind*, f. 246^b, says he was then forty.

³ Khāfi Khān, II. 914; Ghulām 'Alī Khān, *Muqaddimah-i-Shāh 'Ālam-nāmāh*, *Tārīkh-i-muzaffari*, Mhd. Qāsim, Lāhori, 361; Wārid, 161^a, 16^b.

[N.S.]

donkeys only being refused. Every man who presented himself, whatever his antecedents, was accepted as a recruit.¹

In the end this liberal increase of pay to the troops produced as much harm as benefit. The increase was made recklessly, without regard to the man's length of service, the old soldier receiving no more than one newly enlisted. The veterans were disgusted at being treated the same as the recruits, and men-at-arms with good horses worth two or three hundred rupees were angry at receiving no more pay than any butcher, cook or cotton-carder who presented himself, mounted on some wretched pony that he had picked up for ten or fifteen rupees. This carelessness was especially prevalent in Najm-ud-din 'Ali Khān's division, and many of the bazar loungers, as soon as they had received their month's pay in advance, were seen no more; nay, many of the regular soldiery disappeared in the same way. In spite of the immense expenditure, it was noticed that the private servants and clerks of Prince Ibrahim had no saddles for their horses.

In a few days as many as fifty thousand men had been registered. The force was poorly provided with artillery, having only a few large guns, about two hundred small field-pieces (*rahkalah*), and five-hundred swivel-guns (*jazāir*). In their boastful way the Sayyids said that cannon were not needed; they meant at the very first onset to come to close quarters. Khāfi Khān, from the Bakhshi's records, to which he had access, and also from what 'Abdullah Khān told him, found that there were over ninety thousand horsemen recorded; out of this number perhaps fourteen or fifteen thousand new men with ponies, or other miscellaneous levies, had disappeared. This account does not include Curāman, Jāts, and Rājah Muḥkam Singh's men, nor the fugitives of Ḥusain 'Ali Khān's army and the *zamīndārī* contingents. It was the general estimate that one hundred to one hundred and thirty-five thousand men were assembled.²

Ghazi-ud-din Khān, Ghālib Jang, who since Farrukhsiyar's death had retired into private life, was won over by 'Abdullah Khān. He was flattered and styled "brother," and brought back with the rank of 7000, 7000 horse *dūaspah*,³ the title of Amīr-ul-umārā, and the office of first *bakhshī*. Great efforts were made by the other side to detach him from the Sayyid's party, as can be seen by the long letter addressed to him by Amin-ud-din Khān, Sambhalī, who had once more come to the front. 'Abdullah Khān, he wrote, could only collect the same troops that had already fled in a cowardly manner after Ḥusain 'Ali Khān's death; it was a true saying, "Beaten once will be beaten again,"⁴ and the common people looked on the easy destruction of the one brother as an omen for the speedy defeat of the other. Is not

¹ Khāfi Khān, II, 914—917; Shiū Dās, 55^b; Muḥammad Qāsim, Lāhori, 361; Khūshhāl Cand, Berlin MS., 495, f. 1011^b; *Tārīkh-i-Muzaffarī*, 204.

² Khāfi Khān, II, 918; Muḥammad Qāsim, Lāhori, 362.

³ Khāfi Khān, II, 914, says 8,000 horse.

⁴ *Zadah rā bāyad zad*.

the voice of the people a sign from God? ¹ In spite of these arguments, Ghāzi-ud-dīn Khān was steadfast in upholding the Sayyid.²

Another adherent of some note was Hāmid Khān, nicknamed "Jangali Shahzādah" or Rustic Prince, uncle of Nizām-ul-mulk and cousin of Muḥammad Amin Khān, Cin, the new *wazīr*. Although so nearly related to the leader of the opposite side Hāmid Khān and his cousin were on very bad terms, and he was thus willing enough to support his cousin's enemies.³

Najm-ud-dīn 'Ali Khān was promoted to 7000,7000 horse and made second *bakhshī*; Sayyid Salābat Khān, son of Sayādat Khān, and Bairam Khān, son of Rūhullah Khān, Ni'mat Ilāhī, were made third and fourth *bakhshīs*.⁴ Saif-ud-dīn 'Ali Khān, who arrived from Murādābād when his brother, 'Abdullah Khān, was at Palwal,⁵ was promoted to 5000,5000 horse. Other promotions were those of Shahāmat Khān (Sayyid Taj Maḥmūd), 5000,5000 horse; Sayyid Rafa'at Khān, 7000,7000 horse; I'tibār Khān, Darya Khān, Shekh Sibghatullah Khān (alias Shekhū).Lakhanawī, who joined with four sons, Sayyid Muẓaffar 'Ali Khān, Sayyid Akbar 'Ali Khān, Sa'id Muḥammad Khān, Ma'ṣūm Khān, Rustam 'Ali Khān, Sayādat Khān.⁶

Even men who had been in disgrace with the Sayyids were offered employment. Among them I'tiqād Khān (Mḥd. Murād, Kashmirī); Mḥd. Yār Khān, former governor of Dihli; Shaistah Khān and Saifullah Khān, two connections of the late Emperor Farrukhsiyar; and the two brothers Islām Khān, once Mir Atash, and Safi Khān, lately commandant of Aḡrah fort. Muḥammad Yār Khān, Islām Khān and Safi Khān declined, but I'tiqād Khān and Saifullah Khān accepted *manṣabs* and money to pay troops. As, however, I'tiqād Khān was not treated according to his pretensions, he returned to Dihli after he had marched a stage or two.⁷

¹ *Halq-i-khalq, kos-i-Khālīq*, literally: 'The throat of the created, the drum of the Creator,' i.e., *Vox populi vox Dei*.

² Shīu Das, 55b; Mḥd. Qāsim, Lāhori, 362; *Inshāe Yār Muḥammad*, p. 44.

³ Muḥammad Qāsim, Lāhori, 363. The nickname above noted explains what Tod, "Annals," II, 100, could not understand, viz., the presence of a prince with the Mahrattas in Aḥmadābād, Hāmid Khān figuring as an ally of those plunderers a few years after this time. For authorities see Khūsh-hāl Cand, Berlin MS. 495 f. 1012a, and *Sharāif-i-'uḡmānī*, Irvine MS., p. 319. The name was one given him by Farrukhsiyar's courtiers. One day in the imperial hunting preserves Hāmid Khān dismounted and, rushing forward, shouted, "Long live the emperor!" and made his obeisance. The explanation leaves us nearly as much in the dark as before; I presume there was some breach of etiquette involved, which laid him open to the depreciatory epithet, B.M. MS., 1832, f. 93a.

⁴ Yahyā Khān, 129b. says Bairam Khān was first, and his brother Ni'matullah Khān, second *bakhshī*.

⁵ According to Muḥammad 'Umar's *Sivānīh-i-Khizri* (Irvine MS.) his father, Khizir Khān, Pāoni, was an officer in Saif-ud-dīn 'Ali Khān's army, and came with him from Murādābād.

⁶ Shīu Das, 55b, 56a; Mḥd. Qāsim, Lāhori, 363; Khāfi Khān, II, 914; *Tārīkh-i-muẓaffarī*, 20.

⁷ Khāfi Khān, II, 915.

[N.S.]

By the 26th Zūl Hījjah (October 28th, 1720) 'Abdullah Khān's camp was formed just outside Dihli in the direction of the 'Idgāh.¹ He moved on the 1st Muḥarram, 1133 H. (November 1st, 1720) from Sarāe Sāhil to the Qutb, and then next day to Sarāe Bakhtāwar Khān. 'Abdullah Khān's first intention had been to wait near the capital the attack of the other side, supposed then to be marching through the Rājput States. But he soon learnt that the emperor was not advancing direct upon the capital, while the nearness of the city facilitated the secret return of the soldiers to their homes. He therefore changed his direction. Ghulām 'Ali Khān, who had escaped from Muḥammad Shāh's camp, was left behind in charge of Dihli, having with him Najābat 'Ali Khān, nephew and adopted son of 'Abdullah Khān, a boy of fourteen years of age.

On the 10th (November 10th, 1720) camp was at Faridābād; they then moved on to Palwal, where he was joined by Saif-uddin 'Ali Khān, Shahāmat Khān, his sons and relations, Sayyid Muḥammad Khān, the eldest son of Asadullah Khān, Nawāb Auliya, and Zūlfiqār 'Ali Khān. The last two had been sent up by Ḥusain 'Ali Khān to raise a corps of Bārhaḥ Sayyids for service in the Dakhin. They brought in over twelve thousand horsemen. In their train came cartload after cartload of Sayyids who although unable to raise a horse to ride on, were eager for the fray and looked forward to the day when they would be riders on elephants. Finally 'Abdullah Khān fixed on Bilochpur, a village close to the Jamnah in *pargana* Palwal, as the place at which he intended to give battle. The inhabitants were turned out of the villages, and he entrenched himself.²

At this time the strain upon 'Abdullah Khān's mind was so great that, meaning to say one thing he would utter something else. If he asked a question no one listened, and if he wanted a thing no one brought it. The men round him had quite lost their heads. This was seen by what happened at the Qutb. Following an old custom, Prince Ibrāhim was taken to that shrine to have a turban bound round his head. The same was done to 'Abdullah Khān. A sword was then attached to the emperor's waist, followed by a prostration at the Khwājah's shrine. It was usual when an emperor went forth to war to loosen the string of a bow and place it near the blessed shrine. If the string returned of itself to its place, it was a sign of coming victory. Someone reminded 'Abdullah Khān of this observance. A bow was sought for, and the demand for one became known even outside the shrine. They waited from half to three quarters of an hour, but no attention was paid to the order, and no bow was brought.³

¹ The old 'Idgāh is about three-fourths of a mile from the city wall, and to the west of it; see Constable's "Hand Atlas," plate 47. Yahyā Khān, f. 129^b, says the first march was towards the Qutb, and Khāfi Khān, II, 917, places the move to the 'Idgāh on the 17th Zūl Hījjah.

² Shūh Dās, 57, 68^a; Khāfi Khān, II, 917, 918; *Tārīkh-i-muzaffari*, 204.

³ Yahyā Khān, f. 129^b. As to the bow, see the parallel instance in

Before the armies met there were many desertions from Muḥammad Shāh's army, and the scattered soldiers of Ḥusain 'Alī Khan began to rally round his brother. Rajah Muḥkam Singh, Khatri, after collecting as many as he could of the secret adherents of the Sayyids, fled from the emperor's camp at midnight, leaving his tents standing and all his property behind. With him came Bahādur Khān, Ghaṣṣ Khān, Sayyid Kamāl Khān, Sayyid Muḥammad Khān, and others. Curāman, Jāt, in response to letters sent him by 'Abdullah Khān, had also deserted Muḥammad Shāh earlier and had begun to plunder, he and his advisers holding that in case of the Sayyids' defeat, it would be much easier to secure pardon from Muḥammad Shāh, than it would be, in the reverse case, to save themselves from the Sayyids' vengeance. The Jāt brought in with him several elephants and horses that he had taken. This booty was offered to 'Abdullah Khān but returned as a gift to the captor. To Curaman was confided the duty of harassing the imperial force and plundering wherever he could. His orders were to blow up, if possible, the imperial powder magazines or carry off the draught oxen of the gun carriages. But in this he was foiled by the watchful care of Haidar Qulī Khān.¹

SECTION 19.—THE EMPEROR MUḤAMMAD SHĀH'S ADVANCE.

We left Muḥammad Shāh encamped (October 30th, 1720) between Nandgānw and Barsānah, about twenty miles from the Jamnah. In that poorly watered country it was imperative to acquire as speedily as possible a position commanding access to that river. They marched ten miles north-east to Deothān on the 3rd Muḥarram, 1133 H. (November 3rd, 1720). Two days afterwards they moved another twelve miles to Majhwī on the Jamnah. The heavy baggage was sent back to Shergarh, a village owned by Biloch zamindars, six or seven miles to the rear, and some of the greater nobles and richer traders sent their families and dependants to the town of Mathurā, over thirty miles away to the south. On the 11th Muḥarram camp was moved northwards six miles to near Shāhpur, and again on the 12th (November 12th, 1720) five miles farther to a place near Ḥasanpur. Bilochpur, 'Abdullah Khān's position, is about six miles to the north of Ḥasanpur. Both places are on the right bank of the Jamnah in *parganah* Palwal.²

Janhar, Aftābchī, B. Museum, Oriental MS. 1690, f. 126^a, and Addl. 16, 711, f. 67^b (Stewart's "Jouhar," p. 60). An unstrung bow was placed by Ḥumāyūn's orders before the Imām's shrine at Mashhad. If the petition was to be granted, the bow would be found fully strung.

¹ Shiū Dās, f. 58^a: Khizr Khān, 67. 76; Khāfī Khān, II, 919, 921.

² Shiū Dās, f. 58^a, the *Bayān-i-wāqī*, 431, says that Rajah Muḥkam Singh, and the others already referred to, joined 'Abdullah Khān in the night between the 12th and 13th Muḥarram. According to the *Aḥwāl-ul-Khawāṣṣin*, 177^a, the armies met in the plain of Dholkot, for which see Indian Atlas Sheet 49, S.W.

SECTION 20.—PREPARATIONS FOR BATTLE.

The force told off to take the field with Muḥammad Shāh was under the command of Muḥammad Amin Khān and his son Qamar-ud-dīn Khān, Ḥaidar Qulī Khān, general of Artillery, Khān Daurān, Sher Afkan Khān, Hizbar Khān, Hizbar Afkan Khān and Amin-ud-dīn, Sambhali. Ḥaidar Qulī Khān went on in advance of the main body for several miles, and placed his artillery in a strongly entrenched position. The rear guard with camp and baggage was left in charge of Rajah Gopāl Singh, Bhadauriyah, Rajah Rāj Bahadur, Rāthor, of Kishnagarh, Jag Rām, *diwān* of Rajah Jai Singh Sawae, Mir Jumlah, Mir 'Ināyatullah Khān, Ikhlas Khān, Zafar Khān, Roshan-ud-daulah, Muḥammad Khān, Bangash, 'Aziz Khān Chaghatae and Mir Mushrif. These leaders had under them 37,000 horsemen. The total numbers are not given, but three of the other contingents amounted to 27,000 horsemen; and Khāfi Khān estimates Muḥammad Shāh's army at less than half that of 'Abdullah Khān.²

Khān Daurān, Ṣamsām-ud-daulah, commanded on the left wing, supported by Nuṣrat Yār Khān, Ṣābit Khān, Sayādat Khān and others; while the right rested on the river. The wings of the centre were under A'zam Khān, and its advance guard under Qamar-ud-dīn Khān, 'Azīmullah Khān, and Tālī Yār Khān. The centre was held by Muḥammad Amin Khān, the new *wazir*, Sher Afkan Khān, Ḥadī Khān, and Tarbiyat Khān. In reserve were Asad 'Alī Khān, Saifullah Khān, Maḥāmid Khān, Amin-ud-dīn Khān, and the contingent of Rajah Jai Singh, Sawae, ready to reinforce either the right or left wings as might be necessary, and to protect the imperial harem.³

On 'Abdullah Khān's side, after many changes of plan, positions were assigned to the several commanders for the morrow's battle. Round the *ex-wazir* gathered all the Bārhaḥ Sayyids who had flocked to the assistance of their clansman, those who had no horses marching on foot round his elephant. 'Abdullah Khān took command on his right, where he was opposed to Khān Daurān; making over the left, where less danger was anticipated, to Ghāzī-ud-dīn Khān, the new Mir Bakhshī. At the head of the artillery and the vanguard Najm-ud-dīn 'Alī Khān was placed, aided by Saif-ud-dīn 'Alī Khān, Sayyid Muḥammad Khān, Shahāmat Khān, Tahavvar 'Alī Khān, Shujā'at-ullah Khān, Zūlqār 'Alī Khān, 'Abd-un-nabī Khān, and Muzaffar Khān.⁴

There was great difficulty in forcing the Sayyids into any sort of subordination, no one of them being ready to serve under another, and thus the two wings could not be properly constituted, each man taking up his position where it seemed best to

¹ Khūshhal Cand, Berlin MS., f. 1013^b says "of Rūpsagar."

² Sūri Dās, 58^b; Khāfi Khān, II, 921; *Bayān-i-wāq'*, 432; Khūshhal Cand, Berlin MS. No. 495, f. 1013^b.

³ Khāfi Khān, II, 921, 922; *Bayān-i-wāq'*, 432.

⁴ Khāfi Khān, II, 918; *Bayān-i-wāq'*, 433.

himself. Other leaders who took the field for Sultān Ibrāhīm and 'Abdullah Khān were Hāmid Khān, Saifullah Khān, Bairam Khān, Ni'matullah Khān,¹ Amir Khān, Sayyid Ṣalābat Khān, 'Abd-ul-ghāni Khān, Ikhlas Khān, Afghān, 'Umar Khān, Rohe-lah, Dindār Khān,² 'Abd-ul-qādir Khān, Ṣibghatullah Khān, (*alias* Shekhū) of Lakhnau, Ghulām Muḥi-ud-din Khān, Diler Khān, Shujā' Khān, Palwalī, and 'Abdullah Khān, Tarin. In all there were seventy chieftains riding on elephants.³

'Abdullah Khān's own division numbered twenty-five thousand horsemen under command of his *bakhshis*, Abū, l Ḥasan Khān, Sayyid 'Alī Khān, and Hirāman. With the other details we have a total of forty thousand horse and eighteen thousand foot. The rest of the army, consisting chiefly of new levies, was left behind in charge of the baggage and of Prince Ibrāhīm. Rajah Muḥkam Singh, Khatri, who had escaped from the imperial camp the night before the battle, commanded in the rear, with orders to support the new troops, whose staunchness was doubted. With the Rajah were Khudādād Khān, Khān Mirzā, and the seven or eight hundred horsemen who had followed him in his flight.⁴

During the night 'Abdullah Khān sent out Tahavvar 'Alī Khān and Sayyid Zūlfīqār 'Alī Khān to reconnoitre.⁵ At a little distance from the imperialist camp they came across some Rohe-lah horsemen. Tahavvar 'Alī, on being challenged, went forward and declared himself to be one of Nuṣrat Yār Khān Bārbah's men, and that he had been sent by Khān Daurān to spy out the position of 'Abdullah Khān. He went on talking till Zūlfīqār 'Alī Khān and his men rode up. Three of the Rohelaha were captured, two escaped. Afraid of pursuit, the Sayyid made off with the prisoners to his own camp. About midnight the prisoners were produced before 'Abdullah Khān, and in answer to his questions they said they belonged to the force of 'Aziz Khān, Chaghatāe, that Bāyazid Khān, Mewāti, was in charge of the rear tents and the pavilion of the emperor. Owing to the Jāts having plundered during the preceding day in the rear of the camp and carried off some elephants, Muḥammad Amin Khān had ordered Afghān patrols to be sent out. That night it was the turn of 'Aziz Khān, who sent out these men with orders to announce at once the approach of any Jāts. 'Aziz Khān himself lay in ambush with one thousand men. The Bughash Afghāns and Sa'adat Khān were on the left wing. Ḥaidar Qulī Khān, with the artillery, was in advance of the main body. This was the story got from the prisoners.

'Abdullah Khān sent for one of his officers, 'Umar Khān,

¹ Bairam Khān and Ni'matullah Khān were, as already noted, the sons of Rūḥullah Khān. Ni'matullah, see Wārid, f. 164; Yashā Khān, f. 129b.

² Jalālābādī = e. son of Jalāl Khān, deceased, of Jalālābād (Muḥaffar-nagar district). *Tārīkh-i-muḥaffarī*, p. 208.

³ Khāfi Khān II, 922, 923.

⁴ Khāfi Khān, II, 923; *Siwānih-i-Khizri*, p. 78.

⁵ Khizr Khān, the hero of the *Siwānih-i-Khizri*, was one of the party.

Rohelah, to interrogate the men further. They told him of the gifts and honours conferred on 'Aziz Khān, and that he had brought with him over six thousand Mewāti Afghāns. The Jāts, they said, were for ever plundering, and the Rohelahs, being held equally proficient in the art of robbery, had been ordered out as videttes. The talk went on for several hours, mostly in the Afghān tongue. The men were then rewarded and released.¹

SECTION 21.—THE BATTLE OF HASANPUR.

Early in the morning of Wednesday, the 13th Muḥarram, 1133 H. (November 13th, 1720), before the sun rose, Muḥammad Shāh mounted his elephant Pādshāh-pasand and took his place in the centre. In the emperor's immediate retinue were Sayyid Ikrām 'Alī Khān and Shekh Ghaffarullah with the red and the yellow regiments, the Bhil and Karnātik matchlockmen, the mace-bearers and the *Aḥūdis* (gentlemen-troopers). Ḥaidar Quli Khān was sent on ahead with the strong artillery force under his command, while Khān Daurān and Ṣābit Khān were ordered to follow and support him with the left wing. Muḥammad Khān, Bangash, and Sa'ādāt Khān were sent towards the river and the rear. Round His Majesty's person were the new *wazīr* Muḥammad Amin Khān and his son Qamar-ud-dīn Khān, Dil-diler Khān, Sher Afkan Khān, Hizbar Afkan Khān, and others. Zafar Khān, Fakhr-ud-dīn Khān, his brother, Rajah Rāj Bahādur of Kishnagarh, Nuṣrat Yār Khān, Jag Rām, Jai Singh's *diwān*, 'Aziz Khān, Mir Mushrif, and Rājah Gopāl Singh, Bhadauriyah, were placed in charge of the main camp, which was at a distance of one *kos* from the position taken up by the emperor. The prisoner, Ratn Cand, was now sent for. He was brought before the emperor on an elephant; he was then made to dismount and was at once executed. The severed head was thrown before the emperor's elephant and trodden under foot.²

Curāman, Jāt, who was hovering near the army on the west, cut off many followers and penetrated into the camp. But the abovenamed Rājahs drove him out again. Next the Jāts attacked on the south, whence they carried off some private goods and part of the imperial baggage. Zafar Khān, Muzaḥfar Khān, and Muḥammad Khān Bangash, once more repelled them. They then made a farther attempt on the east side. Here Mir Mushrif and 'Alwi Khān, Tarin, of Lakhnau, met and defeated them. But the uproar was so great, that the camp followers and traders in their fright jumped into the Jamnah and tried to swim across it, many losing their lives in the attempt. By three o'clock the baggage camp was moved to a safer place, and the confusion continuing, it was again moved still farther off.³

¹ *Shiwānī-i-Khiz*, 79.

² *Shiū Dās*, 59b, 60a; *Kāmwar Khān*, 240; *Khāfi Khān*, 924, 928; *Khūshḥāl Cand*, Berlin MS. 495, f. 1013b, 1014a.

³ *Shiū Dās*, f. 60a.

When Najm-ud-din 'Alī Khān, at the head of the Sayyid vanguard,¹ appeared in the distance from the direction of the river, Haidar Quli Khān, the imperial *Mir Ātush*, moved out his cannon into the open and encountered the advancing enemy with a storm of balls from his big guns and his field-pieces.² The fire was so continuous and heavy that the artillery of the other side was silenced. After every volley Haidar Quli Khān urged on his men by lavish gifts of gold and silver. As the artillery advanced the rest of the army followed and occupied the ground. Stimulated by their commander's liberality the gunners worked zealously, and a second set of guns were loaded by the time the first were discharged. Khān Daurān's troops moved in support of the imperial artillery, Sanjar Khān and Dost 'Alī Khān, in command of that noble's guns, particularly distinguishing themselves. The latter was wounded in the foot. Sayyid Nuṣrat Yār Khān and Ṣābit Khān also took a leading part, while Sa'ādāt Khān and Muḥammad Khān, Bangash, created a diversion on the left. During the day a rocket fell on Sayyid 'Abdullah Khān's powder magazine, exploding it and causing much loss of life.³

Throughout the day of the 13th the battle was chiefly one of artillery. The brunt of the fighting on 'Abdullah Khān's side was borne by his brother Najm-ud-din 'Alī Khān, who was commanding his vanguard. Originally the Sayyids had intended to rely on a general onset. But Rajah Muḥkam Singh, who had deserted from the imperialists, dissuaded them, pointing out that to charge down on such a powerful artillery as the other side possessed would be to expose themselves to destruction. Their own small supply of guns ought, he said, to be entrenched in a good position on the edge of some ravine, and there they could await the favour of events. Although Muḥkam Singh had acquired in the Dakhin the highest reputation as a soldier, his advice was not adopted. The Sayyids' artillery was placed on a high mound under the shelter of some trees near a deserted village, and they tried to subdue the other side's fire to the extent of their ability. One of their shot passed to the left of Muḥammad Shāh's elephant, at two or three yards' distance and close to Khūshhāl Cand, the historian's horse, he being on the right side of Sher Afkan Khān. It struck the ground two arrows' flight off, ricochéd a little, and wounded a horseman.⁴

In the field the usual scattered fighting with charges and countercharges went on all day, and at one time it looked as if

¹ Khūshhāl Cand, Berlin MS. No 495, f. 1014^a, ^b, has a different distribution of commands: Shahūmat Khān he puts in the vanguard, and Saif-ud-din 'Alī Khān at the head of the artillery. Najm-ud-din Khān was, he says, on the right wing, and Ghāzī-ud-din Khān, Kosah, in charge of the left.

² His *dhamākāh* and *rakhlāh*.

³ Khūshhāl Cand, Berlin MS. No 495, f. 1015^b; Shiū Dās, 59^a, 60^b.

⁴ Muḥammad Qasim, Lāhori, 374; Khūshhāl Cand, Berlin MS. 495, f. 1015^a, 1016^a.

[N.S.]

the imperialists would give way. But Khān Daurān, Sayyid Nuṣrat Yār Khān, Ṣābit Khān, Dost 'Alī Khān, Sayyid Hāmid Khān and Asad 'Alī Khān, by redoubled exertions, prevented a catastrophe. Finding he needed reinforcements, Khān Daurān sent a eunuch to the emperor, who detached Sher Afkan Khān from the centre to his relief. Some of the Sayyids' field-pieces were taken, and the remainder were forced to move from their sheltered position under the trees. Among those who lost their lives were Shekh Sibghatullah of Lakhnau, three sons, and seventy of his men; 'Abdul-qādir Khān, Tutṭhawi, nephew of Qāzi Mir, Bahādur Shāhi, 'Abdul-ghāni Khān (son of 'Abd-ur-raḥīm Khān, 'Ālamgiri), Ghulām Muḥi-ud-dīn Khān, and the son of Shujā' Khān, Palwali. Many soldiers were also slain.¹

'Abdullah Khān had decided to single out for attack the force under Sayyid Nuṣrat Yār Khān, who had command of the advanced guard near the emperor. Against this man the Sayyids had a special grudge, because he, one of their own clan and a relation, had sided against them. Having swept him on one side, 'Abdullah Khān hoped to be able to push on to Muḥammad Shāh's centre. First of all, he tried to make his way to his objective from his own left, but found the river such an obstacle that he changed his direction and moved across his front to the right of his own army. As soon as the movement was detected reinforcements were sent for, the emperor's centre having been left very weak. The generals who were summoned objected to quit their posts. The artillery present with the emperor's division was then despatched towards the river to bar the way, and part of the vanguard was also transferred to the same point.²

Unfortunately the change in 'Abdullah Khān's line of advance resulted in his being drawn away from the river bank, and thus his main position was now some miles from the water side. The battle had continued till the afternoon, and so far 'Abdullah Khān showed no signs of discouragement; but his men, more especially the new levies, became uneasy and soon lost their heads completely. On pretence of watering their horses and camels they rode off towards the river, or as one writer puts it, "flew away like so many sparrows." At the river they found the banks in the possession of their opponents. Group after group, on the pretext of getting water, left the standard; these desertions continued until sunset, and all night long from the camp to Bārahpulāh just outside Dihli, the road was encumbered with fugitives. At nightfall there were not more than a few thousands left of the huge host which had set out from Dihli a few days before.³

At first 'Abdullah Khān had ordered a small tent to be put

¹ *Bayān-i-wāqī'*, 437; *Khāfi Khān*, II, 925, 930; *Khūshḥāl Cand*, Berlin MS. No. 495, f. 1017^a; *Shiū Dās*, f. 61^a.

² *Bayān-i-wāqī'*, 435, 440, 441.

³ Muḥammad Qāsim, *Lāhori*, 376; *Shiū Dās*, 60^b; *Khūshḥāl Cand*, Berlin MS. No. 495, f. 1016^a; *Aḥwāl-ul-khawāqin*, 177^b.

up for the night where he stood, but countermanded it when he reflected that it would be a target for the enemy's fire. The night was a moonlight one, and the imperial artillery never ceased its fire. If any man stirred in the Sayyid position or showed himself, a gun was at once pointed in that direction and discharged. From time to time the guns were dragged forward, the oxen being harnessed to the muzzle, instead of as usual to the breach end of the gun. Among the guns were those named **Ghāzi Khān** and **Shāh Pasand**. These heavy guns were fired oftener than had ever been done before in the recollection of the oldest man. **Ḥaidar Quli Khān** kept up the energy of his men by continual largesse. 'Abdullah **Khān's** troops continued to abscond in small parties. On the other side, **Muḥammad Shāh** passed the night seated on his elephant so near the vanguard as to be under fire.

When day dawned on the 14th Muḥarram (November 14th, 1720) 'Abdullah **Khān** found his army reduced to a few of his relations and his veteran troops. They were altogether not more than one thousand horsemen. These resumed the fight to the best of their power. **Najm-ud-dīn 'Alī Khān** and **Saif-ud-dīn 'Alī Khān**, the ex-*wazīr's* younger brothers, **Sayyid Afzal Khān sadar-uṣ-ṣudūr**, and **Rāe Tek Cand**, **Bāli Khātrī**, his chief officer, **Ghāzi-ud-dīn Khān** (**Aḥmad Beg**), **Nawāb Allahyār Khān**, **Shāhjahānī**, **Sayyid Ṣalābat Khān** and **Rūḥullah Khān** were found among those faithful few who had passed a sleepless night upon their elephants, having had neither food nor water for many hours. Access to the riverside was blocked by the **Jāṭs**, who plundered impartially friend and foe. As dawn was drawing near a ball struck the seat upon **Muḥkam Singh's** elephant. The **Rājah** descended, mounted his horse and galloped off, and for many a day it was not known whether he was alive or dead.¹

Early in the morning, returning to his place of the previous day, 'Abdullah **Khān**, joined by **Najm-ud-dīn 'Alī Khān** and many **Bārḥah** chiefs, again delivered an attack in the hope of reaching the emperor's centre. The imperial left opposed a stout resistance to this onset, and at length dismounted to continue the fight on foot at close quarters. **Shahāmat Khān** and his son **Pirzādah**, **Fath Muḥammad Khān**, **Tahavvar 'Alī Khān** (better known as **Babādur 'Alī Khān**), and many others on the Sayyids' side, were slain. **Darvesh 'Alī Khān**, head of **Khān Daurān's** artillery, was killed; **Dost 'Alī Khān**² and **Nuṣrat Yār Khān** were severely wounded. **Sa'adat Khān** and **Sher Afkan Khān** were also prominent in this encounter. 'Abd-unnabi **Khān** and **Mayā Rām**, two of **Ḥaidar Quli Khān's** officers, and **Muḥammad Ja'far** (grandson of **Ḥusain Khān**) were the only other men of name who lost their lives on the imperial side. **Najm-ud-dīn 'Alī Khān**

¹ **Muḥammad Qasim**, **Lāhori**, 378, *Bayān-i-wāq'*, 438, 441, 443; *Tārīkh-i-muzaffari*, 213; **Khāfi Khān**, II. 925, 926, 928; **Shiū Dās**, 61*; **Khāfi Khān**, 928, says the Sayyids had 17,000 to 18,000 men left.

² **Dost 'Alī Khān** died of his wounds on the 9th Ramaḥān, 1134 H. (June 23, 1722).

was wounded by an arrow near the eye,¹ and a ball from a swivel gun struck him on the knee.

After a time the men of Khān Daurān, Haidar Quli Khān, Sa'adat Khān, and Muḥammad Khān, Bangash, surrounded the *ex-wazir*, and an arrow struck him on the forehead, inflicting a skin wound. The soldiers then tried to make him a prisoner; but, clad in chain-mail though he was, he leapt to the ground sword in hand, intent on fighting to the death. In spite of their knowing his practice of fighting on foot at the crisis of a battle, the *wazir's* troops, when they saw his elephant without a rider, imagined that their leader must have fled, and each man began to think only of his own safety. Sayyid 'Ali Khān (brother of Abū'l Muḥsin Khān, the *bakhshī*) was wounded and taken. Then Tālī'yār Khān charged at the head of his men and cut down Shekh Nathū, commanding 'Abdullah Khān's artillery, and the Rājputs came up, took possession of the Shekh's body and carried it to the imperial camp. Najm-ud-din 'Ali Khān and Ghāzi-ud-din Khān did their utmost to rally the men, but no one paid them any heed. Shujā'atallah Khān, Zū'lfiqār 'Ali Khān and 'Abdullah Khān, Tarīn, fled. Even Saif-ud-din 'Ali Khān thought the day was lost and left the field along with two or three hundred men, taking with him Prince Ibrāhīm, who quitted his elephant and mounted a horse. Ibrāhīm's elephant and imperial umbrella were afterwards found and taken to Muḥammad Shāh. The feebleness of the defence on the Sayyids' part would be fully proved if we believe, as Wārid tells us, that after two days' fighting only forty men were left dead on the field.²

Najm-ud-din 'Ali Khān, a drawn sword in his hand, rode on to enquire for and search out his brother. He found 'Abdullah Khān standing on the ground quite alone, and although wounded in the hand still fighting like a lion, while on every side the crowd of his assailants grew greater every minute. So far not one of them had had the courage to lay hands upon him; although one of Khān Daurān's men had wounded him on a finger of the right hand. Najm-ud-din 'Ali Khān dismounted from his elephant and took his position at his brother's side. 'Abdullah Khān called out to him: "Behold the inconstancy of Fortune, and the end of all earthly greatness," adding a verse of Sa'di, Shirāzi, fitting to the occasion.³ Haidar Quli Khān, who had noticed that the

¹ He lost his eye from this wound, and the glass ball by which he replaced it was a subject of wonder to the common people for the rest of his life. *Mu'ayyir-ul-umara'*. II, 508; Khāfi Khān, II, 930.

² Muḥammad Qāsim, Lahori, 378; Khāfi Khān, 931, 932; *Tārīkh-i-muzaf-fari*, 215; Wārid, 164b; *Boydā-i-wāqī'*, 447.

³ *Cunin kunand dilerān, cū gird bāyad kār;*
Cunin na-ā'ad shamsheer-i-ghāziyān āqār.

Thus act the brave, when duty calls,
Thus do fighters' swords leave their mark.

Khizr Khān, who took part in the battle as one of the Sayyid's army, was near enough to Khān that 'Abdullah Khān called out, but from the uproar could not hear his words. Some years afterwards, in 1138 H. (1725-6),

howdah of 'Abdullah Khān's elephant was empty, made enquiries and was informed by one of his soldiers that the Nawāb was on foot, bare-headed, and wounded in the arm. Coming up at once with a led elephant, Haidar Quli Khān addressed the Sayyid, in the humblest manner, with words of praise and flattery: "Was he not a well-wisher, and was not his life one with his? Except to set forth for the presence of the Emperor what course was there left?" Najm-ud-dīn 'Alī Khān made a movement to cut down the speaker, but 'Abdullah Khān held his brother back. Then with a haughty and dignified air he took Najm-ud-dīn 'Alī Khān's hand and mounted the led elephant. Throwing the Sayyid a shawl to wind round his head, Haidar Quli Khān followed on his own elephant, and conducted his prisoner to the Emperor Muḥammad Shāh.¹

His hands bound together with Haidar Quli Khān's shawl, 'Abdullah Khān was ushered into the presence of Muḥammad Shāh. Saluting him with a "Peace be upon you," the Emperor said: "Sayyid, you have yourself brought your affairs to this extremity." Overcome with shame, 'Abdullah Khān answered only: "It is God's will." Muḥammad Amin Khān, unable to contain himself, leapt from the ground with joy and exclaimed: "Let this traitor to his salt be confided to this ancient servitor." But Khān Daurān in respectful terms intervened: "Never! Never! Make not the Sayyid over to Muḥammad Amin Khān, for he will at once slay him in an ignominious manner; such a deed is inadvisable; what did Farrukhsiyar gain by the murder of Zūlfikār Khān? Let him remain with Haidar Quli Khān or be made over to the Emperor's own servants."² The prisoner was accordingly made over to Haidar Quli Khān, along with Najm-ud-dīn 'Alī Khān, his brother, whose wounds were so severe that he was not expected to recover. Hāmid Khān was also taken a prisoner and brought, bare-headed and bare-footed, before his cousin, Muḥammad Amin Khān, and Khān Daurān. The new *vazīr* calmed his fears and assured him of being tenderly dealt with. There were many other prisoners, the chief among them being Sayyid 'Alī Khān, brother of Abū'l Muḥsin Khān, and 'Abd-un-nabi Khān.³

he met at Mathurā Najm-ud-dīn 'Alī Khān, then on his way to Ahmādābād, and obtained from him the details in the text. Khāfi Khān makes out that 'Abdullah Khān claimed *aman* (safety for life) by announcing himself as a Sayyid.

¹ *Siwānīh-i-Khizri*, 92, 93; Shiū Dās, 614; Khūshhāl Cand, Berlin MS. 495, f. 1018^b; Khāfi Khān, II, 933; *Bayān-i-wāqī'*, 446. Khūshhāl Cand attributes the capture of Najm-ud-dīn 'Alī Khān to his patron, Sher Afkār Khān, giving details and asserting that the writer's uncle, Khem Karān, was close by.

² A chronogram for 'Abdullah Khān's capture is, *Hasan mazlūm*, (1134 H.), "The afflicted Hasan," Wārid, f. 165^b. Khāfi Khān, II, 941, asserts that Muḥammad Shāh had sworn an oath before God that whatever happened he would not take 'Abdullah Khān's life.

³ Muḥammad Qāsim, Lāhorī, 379, 380; *Bayān-i-wāqī'*, 448; Khāfi Khān, II, 933.

[N.S.]

On the Sayyids' side the entrenchments were held and the fight maintained by Ghāzi-ud-din Khān and others for nearly an hour after the capture of 'Abdullah Khān. When at length they were satisfied that the day was lost, they desisted. Ghāzi-ud-din Khān moved off the field with such baggage as had been saved, and, with Allahyār Khān and many others, made straight for Dihli; while the Bārhaḥ Sayyids endeavoured to cross the Jamnah in order to make their way to their homes. Saif-ud-din 'Ali Khān had brought Prince Ibrāhīm off the field of battle, but owing to the entire absence of carriage was obliged to leave him in the orchard of Qutb-ud-din Khān, close to the village of Nekpur. Saif-ud-din 'Ali Khān went home to Jānsath, sending Bāqir 'Ali Khān and Khīzr Khān to Dihli to bring away the Sayyid women and dependants. These messengers reached the capital before the Emperor, and carried off the ladies and children to the Sayyids' country.

Late in the evening of the 14th Muḥarram, 1133 H. (November 14, 1720), news reached Dihli of the defeat and capture of 'Abdullah Khān. His wives and women, a numerous body, nearly took leave of their senses. Many of the concubines, seizing their chance, threw old veils and sheets over their rich clothes and made off with whatever they could lay their hands upon. The man in charge, one 'Abdullah Khān, Kāshī, made no attempt to do his duty, and in the confusion a ten-year old daughter of Najm-ud-din 'Ali Khān took refuge in the house of a *Mirāsīn* or singer, attached to the Sayyids, where she was discovered and seized by the Emperor's adherents. The girl was placed in charge of the Emperor's mother, Nawāb Qudsiyah, who proposed to marry her to Muḥammad Shāh. 'Abdullah Khān complained to Haidar Quli Khān that such a thing had never been done before to a Bārhaḥ Sayyid. That noble, by much persuasion, obtained possession of the child and sent her to Najm-ud-din 'Ali Khān's house.¹

To return to the field of battle. The Mughal soldiery, as their custom was, took to plundering, and appropriated to themselves whatever horses, camels, mules and cattle fell into their hands. Curāman, Jāt, followed suit, and plundering both sides with strict impartiality, made off with his booty to his own country. Among his spoils were one thousand baggage oxen and camels, which had been left negligently on a high sandy mound close to the river, several camel-loads of goods intended for charitable distribution, and the records of the Grand Almoner's Department.²

¹ Muḥammad Qāsim, Lāhorī, 381; Khāfi Khān, II, 933, 934, 936. The latter sums up with the lines:—

Ba kār ān cah dārī, cah gandum, cah jav,
Kih imroz nisht ast, fardah darau;

and adds the proverb: *kih kard kih na yāft, wa kih nisht kih nah darwid.*

² Muḥammad Qāsim, Lāhorī, 381; Shīū Dās, 61a; Khāfi Khān, II, 930.

SECTION 22.—CAPTURE OF PRINCE IBRĀHĪM.

After Sayyid Saif-ud-din 'Alī Khān had removed Prince Ibrāhīm from the battle-field, finding it impossible to escort him to a place of safety, he made him over to the Sayyids of the village Nekpur, in parganah Palwal¹ some miles from the field. Those villagers were unable to protect him and refused him shelter. With him were Amīr Khān, whose family had been for generations in the royal service, and some others. He sat down with these few companions in a mango orchard belonging to Qutb-ud-din 'Alī Khān, and not far from the houses. His men suggested that if he would move elsewhere, they would not desert him. The prince replied that he considered this battle as a final test of his fortunes; if sovereignty had been meant for him, the fact would have declared itself by a different result. He had now nowhere to go. By this time the prince's place of shelter had been traced, and Haidar Qulī Khān, Zafar Khān, and Qamar-ud-din Khān came to arrest him.²

When these men had made their obeisance he rose up and came with them. That night, when he reached the Presence, Muḥammad Shāh embraced him and made him sit down beside him, asking: "How have you come?" The prince answered: "By the way you came." His Majesty said: "Who brought you?" He replied: "The person who brought you." The allusion is, of course, to the fact that they had both been set on the throne by one and the same man, 'Abdullah Khān. An allowance of forty rupees a day was fixed for Ibrāhīm's maintenance, and he was sent back to prison in the citadel of Shāh-jahanābād. There he died on the 8th Muḥarram 1159 H. (January 30th, 1746) at the estimated age of fifty years. As a quatrain quoted by Khushḥāl Cand says, his day of power had been shortlived, "like a drop of dew upon a blade of grass."³

SECTION 23.—END OF 'ABDULLAH KHĀN.

Muḥammad Shāh announced the victory to his adherent, Nizām-ul-mulk, in the following terms: "After the death of 'Ḥusain 'Alī Khān we marched towards the capital, as soon as " we had heard that 'Abdullah Khān had raised Prince Ibrāhīm to " the throne and was planning resistance. Nor would he listen to " our remonstrances. On the 12th Muḥarram of our second year

¹ Perhaps Begpur, parganah Palwal, near the Jamnah, and about 15 miles north of Bilochpur. See Indian Atlas Sheet 49, S.E.; I can find no Nekpur.

² The *Bayān-i-wāqī'*, p. 448, omits Haidar Qulī Khān and inserts Sa'ādāt Khān. There is a story that at daybreak Ibrāhīm reached the *takiyah* of a faqir in Nekpur, and asked for a mouthful of water. The prince rewarded him with four gold coins. The recluse began to prepare breakfast for him, but before he could eat, his pursuers arrived and seized him, Khushḥāl Cand, Berlin MS., No. 495, fol. 102a.

³ Shū Dās, f. 61^b; Khāfi Khān, II. 933; Rustam 'Alī, 249^a; *Tārīkh-i-Muḥammadi* (year 1159 H.).

[N.S.]

“ we pitched our tents twenty *kos* from Dihli. Next day the
 “ battle began and lasted from morn to night. On the following
 “ day the imperial troops charged the rebels, ‘Abdullah *Khān* was
 “ captured, and Ibrāhīm, who had fled from the field, was brought
 “ back a prisoner.”¹

‘Ināyatullah *Khān* and the officers of the Escheat Department (*buyūtāt*) were now sent with all despatch to confiscate the late *Wazīr’s* property together with that of all his relatives and dependants. Sayyid Ghulām ‘Ali *Khān*, who had been left in charge of Dihli as the Sayyid’s deputy, directly he heard of the great disaster, collected all the gold and jewels he could lay hands upon, and in the confusion got clear away, thanks to the disguise he had adopted. Sayyid Najābat ‘Ali *Khān*, nephew and adopted son of the defeated *wazīr*, and then a boy of thirteen or fourteen years, was seized and sent to share his uncle’s prison.²

After this seizure, there was at this time no farther pursuit of the fugitive Sayyids; their home villages were not confiscated nor their houses plundered. This forbearance is attributed to the intercession of Sayyid Nuṣrat Yār *Khān*, a native of the Bārhaḥ village of Kaithorah,³ who had taken the side of the Turānis. Muḥammad Amin *Khān*, however, did not approve of this clemency, and gave orders to his ‘*āmil* or manager, ‘Abd-ul-laṭīf Beg, then present with five thousand horsemen in the new *wazīr’s* fiefs of Budāon and Sambhal, to cross the Ganges into the Dūābah and lay waste the Bārhaḥ country. Nothing came of this attempt. The Sayyids collected the Gūjars and other tribes dwelling on their estates, and “broke the covetous teeth of the Mughals”; and as that “old dodger,” Muḥammad Amin *Khān*, died soon after, they were left for the time in peace.⁴

Meanwhile Sayyid ‘Abdullah *Khān* remained a prisoner in the citadel of Dihli under the charge of Haidar Quli *Khān*, who, after the death of Muḥammad Amin *Khān*, was high in the imperial favour. The Sayyid was treated with respect, receiving delicate food to eat and fine clothes to wear. But so long as he survived the Mughals remained uneasy, not knowing what sudden change of fortune might happen. Thus they never ceased their efforts to alarm Muḥammad Shāh. At one time, according to them, Rajah Ajit Singh, of Jodhpur, intended to make his own submission and loyalty conditional on the release of the Sayyid. From time to time other rumours were put into circulation. At last ‘Abdullah *Khān* was removed from Haidar Quli *Khān’s* care to a place near the imperial apartments, where he continued to be well treated. Two years elapsed, but the Mughals never ceased in their plotting, until at length they obtained the emperor’s

¹ *Majma’-ul-inshā* (lithographed copy), p. 86.

² *Khāfi Khān*, II, 934.

³ Kaithorah or Kaṭhorah, one of the principal of the thirty-two villages occupied by the Chatbanūri branch of the Bārhaḥ Sayyids, see Sayyid Roshan ‘Ali’s MSS., *Sayyid-ut-tawārikh* (composed in 1864 A.D.).

⁴ Mhd. Qasim, Lāhorī, 384.

consent to the administration of poison.¹ Sayyid Qutb-ul-mulk, 'Abdullah Khān, died of poison given in his food on the 1st Muḥarram 1135 H. (October 11, 1722), being then about fifty-seven (lunar) years of age. He left no children. In accordance with his dying wishes he was buried at the side of his favourite mistress, a singing woman called Kesar Māhi, in a walled garden outside the Pumbah gate of Old Dihli. This garden was situated on the high road to the shrine of the saint Nizām-ud-din Auliya; it had been presented to Qutb-ul-mulk by Rajah Bakht Māl, *divān* of the *Khālīsah*.²

SECTION 24.—THE TWO SAYYIDS: THEIR CHARACTER AND CONDUCT.

Muḥammad Shāh ordered that the Sayyids should be referred to after their death, the one as *Namakḥarām* and the other as *Ḥarām-namak*, an order which Nizām-ul-mulk objected to and refused to comply with.³

'Ālamgir does not seem to have been fond of Bārḥah Sayyids. Once in the official news-letter from Aḥmadābād it was reported that Sayyid Ḥasan 'Alī Khān, Bahādur (afterwards 'Abdullah Khān), had shown promptitude in attacking and plundering one Hanwant, and had also captured the nephew of Jānā Ji and forced him to become a Mahomedan. Zūlfīqār Khān, Nuṣrat Jang, then on a campaign against Dhanā, Jādoṅ, heard of these feats and sent to Court a proposal for raising the rank of both brothers, the elder from 800 to 1,000, and the younger from 700 to 800. 'Ālamgir wrote across this report: "Wherefore should I not offer congratulations? But the very fact of their being Sayyids, those fountains of felicity, demands hearty exertions from them in support of the Pure Faith of their ancestor. His Majesty the Lord of Apostles. Let two robes of honour for the two brothers be issued from my private wardrobe, and let them be sent together with two swords, jewel-hilted and provided with pearl-mounted belts. Let Jamdat-ul-mulk (*i.e.*, the *wazīr*) write much praise and many congratulations when sending these presents."

Then, on the petition received from Zūlfīqār Khān, he wrote: "The proposition of that servant of my house, who knows my way of thinking, was exceedingly out of place. It is a matter of course for men of the sword (*saif*) to punish leaders of strife (*kaif*). But to agree to immediate promotion is difficult. Love

¹ Khāfi Khān, II, 941, cannot conceive it possible that Nizām-ul-mulk, although a Mughal, had any share in these plots, but *al 'ilm 'ind allah!* "God only knows!"

² *Jauhar-i-panamā* of Muḥsin Sadiqī, son of Ḥanif, B.M. Oriental MS. No. 1898. I quote from A. B. Fuller's translation, B.M. Addl. MS. Nos. 30, 784, p. 79. The name Kesar Māhi seems of doubtful accuracy, but the words are so written most plainly in the Persian text. See also *Rustam 'Alī, Tārīkh-i-Hindī*, fol. 250^a; Mhd. Qāsim, Lāhori, Kāmwar Khān, p. 255; and *Tārīkh-i-Muḥammadi* (year 1135 H.).

Khāfi Khān, II, 941.

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“ for Sayyids, those men of high lineage, is an obligation imposed by the Holy Faith, nay, is a proof of having fully accepted it ; while to harm that clan is to expose one’s self to the displeasure of the Most Merciful. But no action should be taken which produces evil in this, and disgrace in the next world. Undue favour to the Bārḥah Sayyids will be disastrous in both worlds. For when promoted or exalted they say : ‘ I am and there is none other,’ and stray from the path of duty. They lift their gaze too high and begin to cause trouble. If this attitude is overlooked, the business of this world ceases to be carried out ; if it is punished, objections will arise in the other world.”¹

In spite of the opposition he had encountered from the Sayyids, Nizām-ul-mulk is said to have done his best to protect ‘Abdullah Khān’s life after his fall from power. Khāfi Khān, who tells us this fact, thinks it only fair to record his tribute to the good qualities of the two brothers, since he has said so much about their misdeeds. He attributes the disrespect shown to Farrukhsiyar with all the bribe-taking and harshness in revenue-farming, to the bad influence of Ratn Cand, the *Wazīr’s* chief official. Up to the time of his leaving for the Dakhin, Husain ‘Ali Khān had shown extreme aversion to taking money irregularly ; afterwards, Muḥkam Singh, Khatri, and others did their best to pervert him. But both brothers were really friendly to the poor and non-oppressive in disposition. The townsmen, who were left to live in peace, made no complaints against them. They were liberal to the learned and the necessitous, and full of consideration for the deserving. In these respects Husain ‘Ali Khān was even more conspicuous than his elder brother. The younger brother began a reservoir in Aurangābād, afterwards enlarged by ‘Iwaz Khān, which formed a welcome addition to the scanty water-supply in that town. He also built in the Bārḥah country a *sarāe*, a bridge, and other works for the public benefit.²

‘Abdullah Khān was remarkable for forbearance, patience, and extreme humanity. When Haidar Quli Khān was *faujdar* of Sūrāt he confiscated the estate of ‘Abd-ul-ghaffūr, Bohrah, a wealthy merchant recently deceased, in spite of the existence of legal heirs. The line of action adopted by ‘Abdullah Khān was most commendable. Haidar Quli Khān was removed from office and the estate made over to the rightful owners. Husain ‘Ali Khān, within whose jurisdiction Sūrāt was situated, passed a sleepless night thinking over the matter. Upon the release of the property not one *dām* or *diram* was kept back. The younger Sayyid is also applauded for upholding the bazar people against a false complaint brought by his own elephant-driver.³

The conduct of the *wazīr* in the case of the East India Company’s embassy to Farrukhsiyar’s court is also very much to be commended. Misled by his Armenian colleague John Surman

¹ *Ahkām-i-‘Ālamgīrī*, Irvine MS., No. 252, fol. 264.

² Khāfi Khān, II, 941, 943.

³ Khāfi Khān, II, 943.

had negotiated through Khān Daurān, the second *bakhshi*, instead of through the *wazir*. When Khān Daurān had reaped all the benefit he could and had wasted nearly two years, he repudiated the whole affair. The envoys were at last forced to apply to 'Abdullah Khān. According to Oriental standards of conduct, this tardy application gave a splendid opening for avenging the previous neglect. Nothing of the sort happened. 'Abdullah Khān, when the Englishmen went to him, was affable and helpful, also, for a wonder, most prompt in action. The preparation of the desired *farmāns* was carried through in a few weeks; and still more wonderful, the *Wazir* accepted no present. We need not be surprised that Surman should style him "the Good Visier."

The Surman diaries also yield an indication that 'Abdullah Khān was not quite strict in the observance of Muḥammadan rules. "Hearing the Visier drinks," the envoys sent him a handsome present of Shirāz wine and brandy; and we are not told of its being returned with indignation and resented as an insult.

Another entry in the Surman diaries shows 'Abdullah Khān's kind heart. At the envoys' last audience Farrukhsiyar refused to allow the departure of William Hamilton, the surgeon who had attended him in his illness. In this emergency they invoked the aid of 'Abdullah Khān, and "the good visier readily offered to use his utmost endeavours." He wrote a very pathetic address to His Majesty, in which an imaginary wife and children in Scotland were introduced to heighten the effect. On Hamilton's promising a speedy return to India, Farrukhsiyar yielded a reluctant consent to his departure.¹

The Bārḥah Sayyids have remained almost to our own day more or less Indian in their practices. Thus it is no surprise to learn from a contemporary historian that 'Abdullah Khān observed the *Basant* or spring festival, and the Holi powder-throwing usual among Hindūs. In another direction he displayed superstition. Anand Rām, Mukhlis, noticed that every time he gave public audience, two men called *majamrah-gardān*, or censor-swingers, stood at the head of his carpet swinging silver censers full of smoking rue-seed. This was done to avert the Evil Eye. We have also seen in the course of our narrative that he was more of a soldier than an administrator; and that he was a voluptuary who in time of peace was indolent and negligent of business. He left his affairs too much in the hands of his Hindū man-of-business, Ratn Cand.²

One of the *Wazir*'s deeds of merit was the construction of a

¹ C. R. Wilson's "Early Annals," Vol. II, Part 2, "The Surman Diary," pp. 74, 131—133, 142, 143, 200, 202, 203, 205.

² Kāmwar Khān, entry of 3rd Rabī, II, 1132 H.; Anand Rām, Mukhlis, *Mīrāt-ul-istilāḥ*, fol. 248a. Herklots, "Qanoone Islam," Glossary, p. lxxxiv, says the seed used is that of *Mahndi* (*Lawsonia inermis*), mixed with benzoin or mustard-seed.

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canal in Patparganj, a suburb of Dihli. It was begun in 1127 H. (1715) after a great fire in that quarter of the town, and it was finished in the fifth year of Farrukhsiyar (1716). As to it Sayyid 'Abd-ul-jalil, Bilgrāmi, wrote :—

*Bahr-i-jūd o faiz, Quṭb-ul-mulk, 'Abdullah Khān,
Nahr-i-khairī kard jāri ān wazīr-i-muhtasham ;
Bahr-i-ān 'Abd-ul-jalil-i-Wāsiṭi tārikh kard :
"Nahr-i-Quṭb-ul-mulk madd-i-bahr-i-aḥsān o karam."
(1127 H.)*

The same learned man and poet sings the praises of 'Abdullah Khān in his *Maḡnavī*, as follows :—

*Aristū-i-fitrāte, k, Āṣaf-nishān ast,
Yamīn-ud-daulah, 'Abdullah Khān ast ;
Ba dīwān cūn nashīnad nav-bahār ast,
Ba maīdān cūn darāyad zū,lfīqār ast.¹*

Husain 'Alī Khān, Amīr-ul-umarā, differed considerably in character from his elder brother. He was prompt in action and inclined to the use of exaggerated and insolent language. Several stories showing this habit of his are on record. For instance, the hired flatterers in his train used to recite, even in the emperor's presence, Hindi verses in praise of their master. A Persian translation of two lines has been handed down ; they are to this effect :—

The whole world and all creation seeks the shelter of your umbrella,

Kings of the world earn crowns through your emprise.²

Once, on the ill-fated march to the Dakhin, being intoxicated with his own greatness, he boasted that on whosoever's head he cast the shadow of his shoe, that man would become the equal of the Emperor 'Ālamgīr. This remark gave great offence to those who heard it.³

Although he put no faith in lucky or unlucky moments and the prognostications of soothsayers, he seems to have been troubled by presages of his approaching doom. Ḥakīm Nakki Khān, Shirāzī, told Wārid that in the last weeks of his life, Husain 'Alī Khān was for ever extolling and finding new meanings in the following lines :—

*Ham cū man be-kase shahīde hech kāfir na būd,
Subh-i-maḡshar khūd damīd, wa khūn-i-man khwābidāh
ast.*

¹ *Ma, āṣir-ul-umarā*, III, 140 ; *Khushḡal Cand*, B.M. No. 3288, fol. 407^a.

² *Aḡwāl-ul-Khawāqīn*, fol. 176^a. In the original they are :—

*Panāh-i-chatr bigīrand jumlaḡ-i-'ālam o khalq,
Kalāhdār-i-jahān rā kalāh az muḡdam-i-tū.*

³ Yahyā Khān, *Tazkirat-ul-mulūk*, fol. 125^a.

L'ENVOI.

With the disappearance of the Sayyid brothers the story attains a sort of dramatic completeness, and I decide to suspend at this point my contributions on the history of the Later Mughals. There is reason to believe that a completion of my original intention is beyond my remaining strength. I planned on too large a scale, and it is hardly likely now that I shall be able to do much more. The reign of Bahādur Shāh (1707—1712) is ready to be faired out for the press; and the first draft for the years 1721 to 1738 is written. I hope soon to undertake the narrative of 1739, including the invasion of Nādir Shāh. It remains to be seen whether I shall be able to continue the story for the years which follow Nādir Shāh's departure. But I have read and translated and made notes for another twenty years ending about 1759 or 1760. The preliminary work for the period 1759—1803 has not been begun. In any case I hope that my published studies on the period, although covering only part of the ground, may prove of some use; that, at the least, they may relieve some more fortunate successor of much drudgery, of a nature commonly thought to be arid, and repellent to many minds. May my reward be, as an Oxford historian phrases it, that "some Gibbon of the future may throw me a word of thanks in a footnote."

October 20, 1907.

W. IRVINE.

53. NUMISMATIC SUPPLEMENT No. X.

Note.—The numeration of the article below is continued from p. 446 of the "Journal and Proceedings" for 1908.

The Date of the Salimī Coins—A Rejoinder.

59.—It was with no little surprise I read in the Journal and Proceedings of the Asiatic Society of Bengal for May, 1908, a brief note by Mr. Beveridge, in which the old fiction is again advanced, that the Salimī coins were issued during Akbar's lifetime, either because the Prince Salim was *de facto* governor of Gujarāt or because he was a rebel. I say "fiction," for in support of the view now advocated by Mr. Beveridge, not a shred of satisfactory evidence has been adduced. However, as the subject is thus being broached anew, it may be well to indicate once more the evidence the coins themselves supply, subversive of the deservedly discredited hypothesis. The Salimī coins, whether in silver or in copper, are all dated, and not a single one of the dates they bear admits of reference to any period in Akbar's lifetime. On the other hand, every one of the dates finds a simple and natural explanation when assigned to the term, extending over just nine months, immediately subsequent to Akbar's death. The month in which he died was the 6th (Jumādā II) of the Hijri year 1014, corresponding in the Persian calendar to the 8th month (Ābān) of his 50th regnal year. For coin purposes it suffices to know the month and year of the Emperor's decease. As to the exact *day* of Akbar's death the Histories are not concordant. See on this subject an informing note on pages 212 and 213 of Blochmann's volume of the translation of the "Ain-i-Akbari." Mr. Beveridge is, however, alone in assigning the Emperor's death to the 10th day of Jumādā II. The correct date, according to Blochmann, is the 12th of that month, which works out as the 10th of the Persian month Ābān. In my article in the Numismatic Supplement, No. 1, 1904, I accepted as the date of Jahāngīr's accession the 8th of Jumādā II. Mr. Beveridge now rightly corrects the 8th to the 20th, an emendation, however, that I myself made a year ago in the Numismatic Supplement, No. 7. But, be the day what it may, it is quite certain that Akbar died in the early half of the month Ābān of his 50th regnal year, and that in the same month his son, the Prince Salim, ascended the throne as the Emperor Jahāngīr.

Thus the question that now falls to be answered is, Were the Salimī coins issued in Akbar's lifetime, that is to say, Were they issued before Ābān 50? Now these coins, as we have already said, are themselves dated, and not one of them bears a date prior to that month of Ābān. The dates are, and quite distinctly,

Ābān (the 8th month), Ādhar (the 9th), Dai (the 10th), Bahman (the 11th), and Isfandārmuz (the 12th) of the year 50, and then Farwardīn (the 1st month), Ardibihisht (the 2nd), Khūrdād (the 3rd), and Tir (the 4th), of the year 2. Such is the evidence of the coins themselves, evidence absolutely counter to the supposition that any of them were struck during Akbar's lifetime.

Mr. Beveridge holds it unlikely that Salim would use on his coins the regnal year of his father (50). But, whatever the 50 may denote, it is certainly present; and it would be interesting to know how Mr. Beveridge explains the number, if it do not represent Akbar's regnal year. It stands in juxtaposition with one or other of five of the nine month-names, and hence we may safely infer that it indicates some year, some 50th year. It certainly was not the 50th year of Salim's "rebellion," nor was it the 50th year of his "*de facto* governorship."

But if, as we maintain, the Salimi coins were struck immediately on Akbar's death, the number 50 presents no difficulty whatever. In the month of Mihr there had issued, quite normally, from the Ahmadābād mint, rupees on which was impressed the regnal year 50. Within a fortnight after the close of that month (on the 10th of Ābān) Akbar died. Before this new month Ābān had ended, the Salimi coins were issued, and these bore the same regnal year as had been entered on the coins of the preceding month. Now this is the procedure that would in ordinary course have been adopted had the date been according to the Hijri era; and it was not unnatural to carry out the same procedure when reckoning the date from the new epoch approved by Akbar, the epoch, to wit, not of Muḥammad's Flight but of Akbar's own accession to the throne. As a matter of fact the 50 did remain on the coin-dies until the next New Year's Day came round, and only then, coincident with the change of year, was a change made in the year's number as exhibited on the coins.

Mr. Beveridge thinks it extremely improbable that after his accession Jahāngīr would use on his coins the name Salim. Well, Jahāngīr was not by any means the only Emperor to insert on the current coins of the realm the 'Ālam, or "Christian name," given soon after birth:—

1. On the well-known Lāhor rupee Shāh Jahān I. found room for the name Khurram that he had borne while a prince (Br. Mus. Catal., No. 578).
2. Of the coins issued in his first regnal year by Shāh 'Ālam I. there are two distinct types, on each of which appears that Emperor's birth-name, Mu'azzam (Lah. Mus. Catal., p. 197, Nos. 4 and 5). One type hails from the Tatta mint, and the other probably from Murshidābād.
3. Shāh 'Ālam II. before he mounted the throne was known as the Prince 'Alī Gauhar, and this latter name occurs on rupees dated—so my own cabinet shows—as late as the 13th and 14th years of Shāh 'Ālam's reign. A regnal year so late suffices to dis-

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prove the hypothesis brought forward by Mr. Longworth Dames that the 'Ali Gauhar coins were struck in the lifetime of that prince's father, 'Alamgi II.

It is thus evident that Jahāngir is but one of at least four Emperors whose coins bear the sovereign's birth-name. So far as I am aware, no one has suggested that the Khurram or Mu'azzam or 'Ali Gauhar rupees were issued by these princes while in rebellion. But if in each of these three cases the coins were those not of a rebel prince but of a reigning emperor, one need not shrink from the supposition that the Salimi coins too were issued not by the Prince Salim but by the Emperor Jahāngir.

Mr. Beveridge sets much store by the fact that the Prince Salim had large interests in the province of Gujarāt. He was, of course, a man of wealth, and quite possibly a considerable portion of it came from this "Garden of India." But how does all this bear on the Salimi coins? If the prince ever was, which I very much doubt, *de facto* governor of Gujarāt, and even if he held the province in fief, he would not thereby have been entitled to issue coins in his own name. Such action on his part would at once have constituted him a rebel, and, had he ventured on it during his father's lifetime, the autocratic Akbar would have insisted on knowing the reason why. In the whole range of Indian Mughal numismatics there is not a single instance of a coin known to have been issued by a provincial governor—all without exception were struck in the name either of the regnant Emperor or of some aspirant to the imperial throne. Thus the Salimi coins, if struck before Akbar's death, were struck by Salim not as governor nor as fief-holder but simply as rebel. Yet of any rebellion in Ahmadābād, fomented in the interests of Salim, the histories supply not a word. His revolt in the year 1600 was apparently confined to the Allahābād district. In Irvine's recent translation of Manucci's "Storia do Mogor" (Vol I., p. 131) this rebellion is described in the following terms:—"Jahāngir, then a youth (he was about thirty-two) allowed himself, in spite of his natural goodness, to be led astray by the soft words of traitors, and rose against his father, hoping that Fortune, abandoning Akbar, would transfer herself to his side. But it was not so. Akbar was able to make such efforts that in a short time Jahāngir was taken a prisoner." Clearly then the revolt was shortlived. That it extended at any time to the distant Ahmadābād we have no evidence whatsoever. It should further be remembered in this connexion that several of the Salimi coins bear the date 2. If these rupees really were issued by a rebel prince, we are sent up to the conclusion that at the time of their issue the rebellion was already in its second year. Of a revolt thus prolonged some mention would assuredly have been made in the histories of Gujarāt, yet not a hint of it is forthcoming. One may then safely relegate to the domain of fiction Salim's rebellion in Ahmadābād, and with it we may, I feel sure, also consign his *de facto*

governorship. These discredited, the hypothesis that the Salimī coins were issued "either because the Prince was *de facto* governor of Gujarāt or because he was a rebel" of itself falls to the ground. Tested alike by the evidence of the coins themselves and by the histories of the time, the hypothesis is untenable. All the evidence to hand leads definitely and consentaneously to the conclusion that these coins were first struck within a few days after Akbar's death, and that they continued to issue for nine consecutive months.

It is true that in the year 1014 H. some of Jahāngir's heavy Kalima rupees issued from the Ahmadābād mint. A specimen, dated distinctly 1-1014 and weighing 211 grains, is contained in the Bombay Asiatic Society's Cabinet. Evidently then, if our theory of the date of the Salimī coins be correct, the Ahmadābād mint must have been producing simultaneously some rupees bearing the Emperor's princely name Salim and others his regal name Jahāngir. This fact, I admit, did impress me for a time as being adverse to the theory here advocated; but my esteemed friend Mr. Framji J. Thanawala has recently supplied me what is, I believe, the true explanation of this double issue. The Ilahī rupee that Akbar favoured to the very end of his reign weighed just a few grains less than 180: but Jahāngir signalised his accession to the throne by raising this weight, and for some five years the current rupee turned the scale between the limits of 210 and 222 grains. Now it would appear that in Ahmadābād, though there alone, during the first nine months of Jahāngir's reign, coins of both types, the lighter and the heavier, were permitted to be struck. But each denomination had its own legend. Hence it came to pass, and quite in accordance with the fitness of things, that, while the heavier Kalima rupee bore invariably the imperial name Jahāngir, for the lighter Salimī coin the less exalted princely name sufficed.

GEO. P. TAYLOR,

Ahmadābād.

NOVEMBER, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 4th November, 1908, at 9-15 P.M.

MAHĀMAHOPĀDHYĀYA HARAPRASĀD SĀSTRĪ, M.A., Vice-President, in the chair.

The following members were present :—

Mr. I. H. Burkill, Mr. B. L. Chaudhuri, Mr. L. L. Fermor, Mr. H. G. Graves, Mr. D. Hooper, Rev. A. C. Ridsdale, Mr. G. H. Tipper, Dr. Satiśchandra Vidyābhuṣaṇa, Mr. W. C. Wordsworth.

Visitors :—Dr. W. Huntly, Dr. J. T. Jenkins, Mr. E. Woodhams.

The minutes of the last meeting were read and confirmed.

Three-hundred and thirteen presentations were announced.

The General Secretary reported the death of Rai Rām Brahma Sānyāl Bahadur, an Associate Member of the Society, and read the following obituary notice contributed by Mr. I. H. Burkill.

The Society has suffered the loss, by death at the age of 57, of Rai Ram Brahma Sanyal, Bahadur, since 1899 one of our Associate Members. From his home in the Murshidabad district, he came to Calcutta about 1872 as a medical student, but did not qualify, his love of natural history leading him instead to take in 1875 the post of Superintendent of the Zoological Gardens, at Alipur, Calcutta. He held that post until his death, and did most excellent work in it. The landscape gardening of the 'Zoo' was his, as well as the care of the animals. His annual reports reflected his medical training, always containing information regarding the causes of death of the animals lost from time to time. His natural bent and ability brought him friendship and encouragement from Dr. Thomas Anderson and Lieut.-Col. D. D. Cunningham: these two he looked on as his masters. He wrote a "Hand-book of the Management of Animals in Captivity in Lower Bengal" (Calcutta, 1892), "Hours with Nature" (Calcutta, 1896), a small text-book of Zoology in Bengal, and many shorter papers which appeared in various journals. His last work in connection with this Society was a plea (see the Proceedings for June) for the establishment of a marine zoological station on the coasts of Bengal, a plea which we hope is going to bear good fruit. He visited Europe once that he might gather ideas from the Zoological gardens there.

The Zoological Society of London made him a corresponding member in 1893, and the Government of India a Rai Bahadur in 1898.

The Chairman announced that the Council had appointed Mr. G. H. Tipper as a member of Council and General Secretary in the place of Mr. T. H. D. La Touche, proceeded on tour, and Mr. D. Hooper as Treasurer in the place of Mr. J. A. Chapman, resigned.

The Chairman laid on the table the following :—

1. A report by Dr. G. A. Grierson on the Linguistic Survey of India presented by him to the Fifteenth International Congress of Orientalists held at Copenhagen on 14th to 20th August 1908.

The Linguistic Survey of India has made satisfactory progress since I had the honour of submitting a report to the Fourteenth International Congress of Orientalists. I laid before that Congress four sections of the work, *viz.* :—

- | | | |
|------|------|-------------------------------------------------------------------|
| Vol. | II. | Mon-Khmer and Tai family. |
| Vol. | III. | Part III. Kuki-Chin and Burma Groups of the Tibeto-Burman family. |
| Vol. | V. | Part I. Bengali and Assamese; and Part II. Bihārī and Oriyā. |

The following is the proposed list of volumes of the Survey :—

- | | | |
|------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vol. | I. | Introductory. |
| Vol. | II. | Mōn-Khmōr and Tai families. |
| Vol. | III. | Part I. Tibeto-Burman languages of the Himālaya and North Assam.
Part II. Bodo, Nāgā, and Kachin Groups of the Tibeto-Burman languages.
Part III. Kuki-Chin and Burma Groups of the Tibeto-Burman languages. |
| Vol. | IV. | Mundā and Dravidian languages. |
| Vol. | V. | Indo-Aryan languages, Eastern Group.
Part I. Bengali and Assamese.
Part II. Bihārī and Oriyā. |
| Vol. | VI. | Indo-Aryan languages, mediate group (Eastern Hīndī). |
| Vol. | VII. | Indo-Aryan languages, Southern group (Marāthī). |
| Vol. | VIII. | Indo-Aryan languages, North-Western group (Sindhī, Lahndā, Kashmirī, and the "Piśāca" languages). |
| Vol. | IX. | Indo-Aryan languages, Central group.
Part I. Western Hindi and Panjābi.
Part II. Rājasthāni and Gujarātī.
Part III. Bhil languages, Khandōsī, &c.
Part IV. Himālayan languages. |
| Vol. | X. | Eranian family. |
| Vol. | XI. | "Gipsy" languages and supplement. |

It has been found necessary to divide Vol. IX into four instead of three parts, owing to the fact that to have included the

Bhil languages in the part devoted to Rājasthānī and Gujarātī would have made the third part too unwieldy in size.

As regards the progress made in these volumes :—

- Vol. I must necessarily wait till all the rest has been finished.
- Vol. II has been printed, and was laid before the Fourteenth Congress.
- Vol. III.—Part I. This is finished and is now being printed off.
Part II is finished and was laid before the Thirteenth Congress.
Part III is finished and was laid before the Fourteenth Congress.
- Vol. IV has been printed.
- Vol. V. Both parts have been printed and were laid before the Fourteenth Congress.
- Vol. VI. Printed. Was laid before Thirteenth Congress.
- Vol. VII. Printed.
- Vol. VIII. Partly finished and in type, only Sindhī and Kashmīrī remain to be dealt with.
- Vol. IX.—Part I. This has long been finished in MSS. but the Introduction cannot be prepared for press till the remaining parts have been printed off.
Part II. This is finished, and is now being printed off.
Part III. This has been printed.
Part IV. I am at present at work on this. About half the manuscript has been prepared, and part of this is in type.
- Vol. X. All complete and in type, except Balōchi, and a language spoken in Waziristān known as Ormuri.
- Vol. XI. Not yet touched.

Only two complete volumes therefore remain untouched. These are:—

- Vol. I. General Introduction.
Vol. XI. Gipsy languages and Supplement.

Since the last Congress the following sections have been printed and issued :—

- Vol. IV. Muṇḍā and Dravidian Languages.
Vol. VII. Marāthī.
Vol. IX. Part III. Bhil languages and Khandṣāī.

I have the honour to-day to lay these sections, and also the final proofs of Vol. III, Part I, and Vol. IX, Part II, before the present Congress.

I take the opportunity now presented to me of again expressing my gratitude to my friend and assistant, Dr. Sten Konow, for his invaluable help. Each one of the three complete sections presented to-day comes from his pen. Besides these he has written Parts I and III of Vol. III.

I think that, when it is published, Dr. Konow's section on the Tibeto-Burman languages of the Himālaya will be found of more than ordinary interest. Following the lines originally laid down by B. H. Hodgson, he has been able to separate out a remarkable group of what he calls "Pronominalized" Tibeto-Burman languages. These extend from Kunāwar in the Panjab in the West, along the southern face of the Himālayas, as far as Darjiling in the East, and are scattered over this area amid a number of non-pronominalized cognate languages. Their chief peculiarity lies in the great freedom—almost without limit—with which they employ pronominal suffixes, in the conjugation of the verb. This peculiarity, and several other remarkable facts (including the close resemblance of the forms of the earlier numerals) has enabled Dr. Konow to show that these languages, although Tibeto-Burman at the present day, are built up on a substratum of an entirely different linguistic family—the Muṇḍā. The Muṇḍā languages at present occupy the central hills of India, and traces of their influence are observable even in the Aryan languages of the Eastern Gangetic Valley. Hence there must once have been a time when they were far more widely spread than they are to-day, and have extended as far north-west as the Panjāb Himālaya. This taken in connection with Pater Schmidt's proof of the connection of the Muṇḍā languages with Khasi and with Mōn-Khmār, and, perhaps, ultimately with the languages of the Pacific even as far as Easter Island, opens out questions of wide ethnological interest.

The section on the Bhil languages has offered us no surprises. Hopes were entertained that closer enquiry into these forms of speech might reveal some secrets as to the ethnological relationship of the Bhils themselves. But this hope has, I regret to say, come to nothing. The Linguistic Survey shows that all the Bhils speak various forms of an Aryan language closely akin to Gujarāṭi. The vocabulary sometimes shows slight traces of Dravidian influence, but these few words may easily have been borrowed from neighbouring Dravidian tribes, and there is nothing to show that they belong to the original stock of the language.

The Aryan languages of the East and Central Himālaya,—Khas Kuṛā of Nēpāl, Kumauni, and Garhwāli,—the sections dealing with which are now complete in manuscript, show some interesting results from the collision between Aryan and Tibeto-Burman forms of speech. The Aryan languages we know, from history, to have been brought by immigrants from Rājputānā. The old Aryan language of the Khasās seems to have died out. The presence of the numerous Himalayan Tibeto-Burman languages in the same country has strongly influenced the Rājasthānī grammar brought by the immigrants, and, especially in Khas Kuṛā, we come across several instances of an Aryan noun declined, or an

Aryan verb constructed, according to the rules of Tibeto-Burman grammar.

2. A letter from Dr. G. A. Grierson and Mr. M. L. Dames giving an account of the Congress which they attended as delegates for the Society.

In accordance with your request we attended the Fifteenth Congress of Orientalists which assembled at Copenhagen on the 13th August, and brought its sessions to a close on the 20th of the same month.

The members of the Congress were received with the greatest cordiality and hospitality by the Government of Denmark and the Municipality of Copenhagen. Every facility was placed at our disposal, as will appear from the information given in Bulletin No. 4. The Congress was formally opened by the Crown Prince of Denmark on August the 14th, and H. M. the King of Denmark was graciously pleased to attend one of the meetings, that at which Herr von Lecoq gave an account of the explorations and excavations carried out by the German expedition to Central Asia under Prof. Grünwedel and himself at Turfan and other sites on the southern slopes of the Thian Shan mountains.

Owing to the printers' strike which prevailed at Copenhagen up to the end of the Congress it was found impracticable to issue frequent bulletins, as had been intended, in which accounts of the proceedings in the various sections would have been given. Bulletins nos. 7 & 8, herewith forwarded with the other bulletins, nos. 3 to 8, under separate cover, which appeared on the last day of the Congress, are the only ones of this sort issued, and refer only to the first day's proceedings. Bulletin no. 6 gives a full list of the members who actually attended the Congress.

Before the close of the Congress the Delegates assembled to consider the question of the next place of meeting. An invitation from Sir Andrew Fraser, Lieutenant-Governor of Bengal, to make Calcutta the next centre, was warmly received and acknowledged, but a majority decided that its acceptance was impossible as the difficulties were too considerable to be surmounted. The Indian section however passed a resolution in favour of holding a meeting of Indianists in India apart from the Main Congress.

On the invitation of the Greek Government, Athens was finally selected as the place of meeting of the Sixteenth Congress.

3. A circular on ringed birds issued by the Director of the Hungarian Central Bureau for Ornithology.

The winter-quarters and routes of our migrant birds are until now yet unknown, and there is only one method which leads to positive knowledge on this account: the marking of birds by aluminium rings, a method which has been tried with success in Germany and in Denmark, as a house-stork, marked in Pomerania, was caught in Africa 15° S. of the Equator. The Hungarian Central Bureau for Ornithology has now also begun the marking of young storks, herons, gulls and swallows. The aluminium ring is

fastened around the leg of the bird and it bears in each case the inscription "BUDAPEST," followed by a number which corresponds to the entry in the Register book of the Hungarian Central Bureau for Ornithology. Anyone catching such a marked bird, or hearing of the capture of such, is kindly requested to send the ring on to the Hungarian Central Bureau for Ornithology, József-körút 65, Budapest VIII., Hungary, accompanied by a notice stating the locality, time and particulars of capture.

The following two gentlemen were elected Ordinary Members during the recess in accordance with rule 7:—

Lala Jyotiprokāś Nande, Zemindar, Burdwan, and Sayed Muzaffarali Khan, Zemindar and Ries, Muzaffarnagar.

The following seven gentlemen were balloted for as Ordinary Members:—

Mr. S. M. Jacob, I.C.S., Sialkot, proposed by *Mr. R. B. Whitehead*, seconded by *Mr. G. H. Tipper*; *Mr. Bisvesar Bhattacharya*, Deputy Magistrate and Deputy Collector, Eastern Bengal and Assam, Nilphamari, proposed by *Dr. Satischandra Vidya-bhusana*, seconded by *Babu Nagendranath Vasu*; *Mr. J. Hector Barnes*, B.Sc., F.I.C., F.C.S. (Lond.), Agricultural Chemist, Punjab Government, and Principal, Punjab Agricultural College, Lyallpur, proposed by *Mr. G. H. Tipper*, seconded by *Dr. N. Annandale*; *Mr. Ramlal Gupta*, M.A., B.L., Pleader, Gaya, proposed by *Mr. Harinath De*, seconded by *Dr. Satischandra Vidyabhusana*; *Captain Michael Harris Thornely*, I.M.S., Civil Surgeon, Durbhanga, proposed by *Major L. Rogers*, I.M.S., seconded by *Mr. G. H. Tipper*; *Captain Charles Frederick Weinman*, M.B., I.M.S., Civil Surgeon, Midnapur, proposed by *Major L. Rogers*, I.M.S., seconded by *Mr. G. H. Tipper*; and *Captain L. Cook*, I.M.S., Central Lunatic Asylum, Berhampur, proposed by *Major L. Rogers*, I.M.S., seconded by *Mr. G. H. Tipper*.

Dr. N. Annandale exhibited a freshwater Polyzoan from Puri, *Pectinatella burmanica*. The statoblast of this Polyzoan was found in Lower Burma earlier in the year, and was described in the "Records of the Indian Museum." In describing it he regarded its relationship to the Japanese species *P. gelatinosa* as probable. The discovery of the living animal in the Sar Lake near Puri, Orissa, proves this view to be correct. The compound colonies cover a great area, as a rule, surrounding the stems of reeds, and consist of innumerable small zoaria embedded in a greenish jelly. Numerous embryos were observed in October; and large numbers of statoblasts were found at the base of some of the zoaria.

Mahāmahopādhyāya Haraprasād Sāstri exhibited some 12th century manuscripts written in Bengali.

The following papers were read:—

1. *Customs in Bashahr and its Dependency Kanawar.* By *H. A. ROSE*, I.C.S.

2. *The Bikramasilā.* By NUNDOLAL DEY.

These papers will be published in a subsequent number of the *Journal*.

3. *Rāmacarita by Sandhyākara Nandi.* Edited by MAHĀMAHO-
PĀDHYĀYA HARAPRASĀD ŚĀSTRĪ, M.A.

This paper will be published in the *Memoirs*.

4. *On Sikhim Monasteries.* By DR. SATĪSCANDRA VIDYĀBHU-
SAṆA, M.A.

This paper will be published in a subsequent number of the *Journal*.

5. *Dioscorearum Novarum descriptiones quædam auctoribus*
D. PRAIN et I. H. BURKILL.

This paper has been published in the *Journal* for September, 1908.



The Adjourned Meeting of the Medical Section of the Society was held at the Society's Rooms on Wednesday, 11th November, 1908, at 9-15 P.M.

LIEUT.-COLONEL W. J. BUCHANAN, I.M.S., in the chair.

The following members were present :—

Miss R. Cohen, Dr. H. M. Crane, Captain D. McCay, I.M.S.; Major J. Mulvany, I.M.S.; Captain J. G. P. Murray, I.M.S.; Dr. J. E. Panioty, Major J. C. Vaughan, I.M.S.; Major L. Rogers, I.M.S., Honorary Secretary.

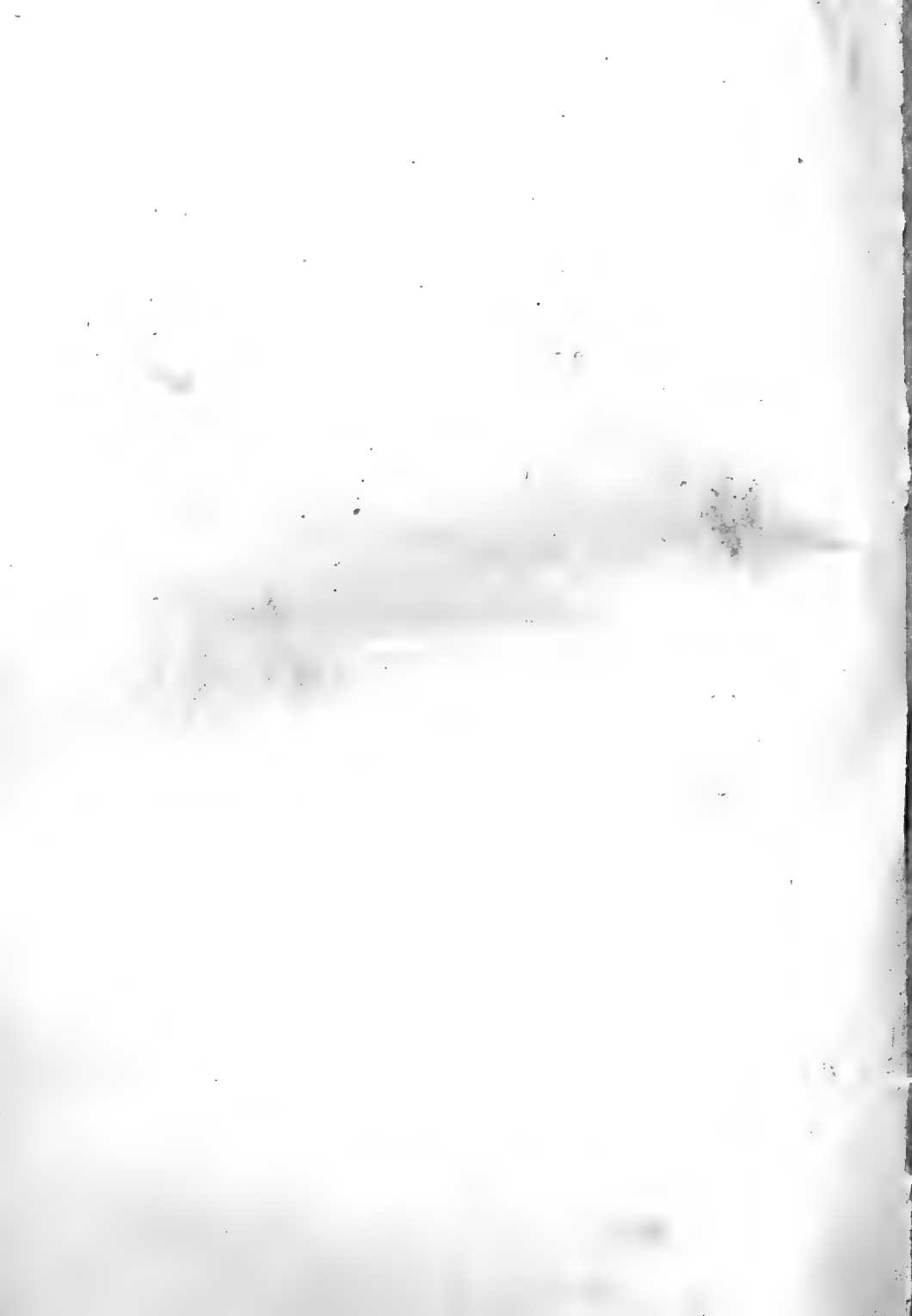
The Minutes of the last meeting were read and confirmed.

Major J. C. Vaughan, I.M.S., showed a specimen of a growth of the heart with microscopical sections.

Captain J. G. Murray, I.M.S., showed some temperature charts of cases of interest.

Major Vaughan, Captain McCay, and Major L. Rogers joined in the discussion.





PRINCIPAL PUBLICATIONS OF THE SOCIETY.

Asiatic Researches, Vols. I—XX and Index, 1788—1839.

Proceedings, 1865—1904 (now amalgamated with Journal).

Memoirs, Vol. 1, *etc.*, 1905, *etc.*

Journal, Vols. 1—73, 1832—1904.

Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*

Centenary Review, 1784—1883.

Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained by application to the Honorary Secretary, 57, Park Street, Calcutta.

PRIVILEGES OF ORDINARY MEMBERS.

- (a) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.
- (b) To propose and second candidates for Ordinary Membership.
- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
- (e) To take out books, plates and manuscripts from the Library.
- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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List of Officers and Members of Council

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54. Some Rare Sanskrit Works on Grammar, Lexicography and Prosody recovered from Tibet, No. 2.

By MAHĀMAHOPĀDHYĀYA SATIS CHANDRA VIDYABHUSANA,
M.A., PH.D.

This paper gives a short account of the Tibetan versions of some rare works on Grammar, Lexicography and Prosody, the Sanskrit originals of several of which are still extant in India. The Tibetan versions are included in the Tangyur which the writer of the paper examined while residing at the monastery of Pamiangchi, Sikkim, in October 1908. A most remarkable work in the lot is the Chandoratnākara by Ratnākara Śānti of Vikramaśīlā, the Sanskrit original of which is extinct in India but preserved in Tibet along with the Tibetan version.

1. व्यायन्तस्य क्रियापदलोचनं नाम, ¹ *དེའ་སློབས་པའི་མཐའི་བྱ་བ་*
ཚོག་གསལ་བ་ཞེས་བྱ་བ་—Elucidation of verbs ending
in *ti*, etc.

The Tibetan version of this work extends over folios 1—75 of the Tangyur, Śera, Po. The original Sanskrit text was composed by the sage Rāma-yaśas ² (called in Tibetan Dgañ-waḥi-

¹ The original reading is *व्यायन्तस्य प्रक्रियापदरोचयनाम* which has been a little modified here in conformity with the Tibetan title.

² Rāma-yaśas was the Brāhmaṇa at whose request the Kāśmīrian poet Kṣemendra wrote his *Avadāna-kalpalatā* and other works.

Cf. *सेमेश्वरानयनस्य कबीन्द्रः कौर्त्तचन्द्रिका ।*

चन्द्रस्यैवोदिता यस्य मानसोक्तिसिद्धौ सताम् ॥ ४ ॥

यस्य रामयथाः सर्वप्रबन्धप्रेरको दिवः ।

प्रयातः सच्चनानन्दः पुण्यः प्रथमदूतताम् ॥ ११ ॥

(*Avadānakalpalatā*, Introduction.)

Now, Kṣemendra was a contemporary of King Ananta of Kāśmīra, as is evident from the following:—

कौर्त्तिसाराचकुटिबदिना पापशत्रुप्रमाथे

द्विदूत्साहः किमपि सुगतो लोकनाथस्य यस्य ।

तस्मिन् श्रीश्रीपतिपरिहृष्टे शासति क्षामनके

समीपाय प्रथमसुखिनां निर्दितीऽर्थे प्रबन्धः ॥ १७ ॥

(*Avadānakalpalatā*, Introduction.)

King Ananta reigned in Kāśmīra during 1028—1063 A.D., *vide* Dr. Stein's Translation of *Rājatarāṅgiṇī*, Book VII, verse 135.

Rāma-yaśas, therefore, lived in the middle of the eleventh century A.D.

grags-pa). The text, which is extinct in India, was translated into Tibetan by Śākya Bhikṣu Dharmasri-bhadra (Dpal-chos-kyi-bzañ-po) by favour of the great sage Bu-ston¹ at a place called Ri-phug which had been sanctified by the blessings of Paṇḍita Dipaṅkara Sri-jñāna.²

2. अभिधानशास्त्रविश्वलोचनमित्यपराभिधानमुक्तावली नाम, खंडेकं
 वद्वेदं-ग्री-वस्तु-वसे-स्त्र-के-गण-गण-व-ले-स-प-सि-व-ग-ले-क
 सु-दि-ग-सि-व-ले-स-ग-व—A dictionary elucidating entire things, otherwise called a garland of pearls.

The Tibetan version of this work extends over folios 75—251 of the Tanygur, Sgra, Po. The original Sanskrit text, which is extinct, was written by Paṇḍita Sthavira noble Sri-jñāna (Dpal ye-śeḡ), at Gautamādhiṣṭhāna Vihāra in Lalitapura (Dpal-rol-paḥi-groñ).³ The text was translated into Tibetan by Sha-lu-lotsava monk Dharmapāla Bhadra in consultation with the Tibetan versions of Amarakoṣa, etc., which themselves were thoroughly revised by this translator. The translation was made during the ascendancy of the Karmapa sect⁴ (Shwa-dmar-bcoḍ pan-hdsin-paḥshi-pa) at the site afterwards occupied by the capital of the Phagmo-gru dynasty⁵ (Dpal-phag-mo-gru-paḥi-dan-sa-rin-po-che), when the fourth hierarch Spyansha-rin-po-che⁶ was still alive.

3. चन्द्रव्याकरणवर्णसूत्रवृत्ति, सुन्द-स्त्र-व-उ-व-दि-अ-व-दि-ख-दि-दि-
 र-व-दि-व—A commentary on the aphorisms of Candraya-vyākaraṇa relative to letters (of the alphabet).

The Tibetan version of this work extends over folios 275—281 of the Tanygur, Sgra, Po. The original Sanskrit text, which still exists, was composed by the great teacher Candra Gomin whose spotless white fame filled the entire Jambudvīpa. At the suggestion left by the illustrious Sha-lu-lotsava Dharmapāla Bhadra, who was a single eye to all the people of Himavat (Tibet), the text was translated into Tibetan by Me-po-byi-wahi-

¹ Bu-ston was born in 1288 A.D., *vide* Csoma's Tibetan Grammar, p. 187.

² Dipaṅkara Sri-jñāna was born in 980 A.D., and visited Tibet in 1038 A.D.

³ Lalitapura is in Nepal.

⁴ The Karmapa sect was founded in the middle of the twelfth century A.D. Their first monastery was built in 1154 A.D., at Tshur-phu, about one day's journey to the north of Lhasa beyond Sera.

⁵ The Phagmo-gru dynasty rose to its highest power in Tibet about 1302—1432 A.D., *vide* a short history of the House of Phagda by Rai Sarat Chandra Das in the J.A.S.B., Vol. I., No. 8, 1905.

⁶ Spyansha-rin-po-che lived in 1192 A.D., when the governor Dorje-pal established his seat of Government in Ne-don-tse.

[N.S.]

rgyal-can under auspices of the Phag-mo-gru governor **Ñag-dwañ-rin-chen-bkra-sis**.¹

4. **इन्दोरत्नाकर, झेवसांशुंर'रिं'केव'द्वुद'गकसांउसा'गु'व—**

An ocean of metres.

The Tibetan version of this work extends over folios 281—286 of the Tanygur, Sgra, Po. The original Sanskrit text, which is extinct in India, was composed by Ratnākara Śānti² (Rin-chen-hbyun-gnaś-shi-wa). The text was translated into Tibetan by Chos-ldan-raś-wa, Grags-pa-rgyal-mtshan and Lo-chen-byaū-rtse-wa. Afterwards the translation was corrected by Lotsava Nam-mkhah-bzaū-po. Finally the text with examples was systematically translated into Tibetan by Ses-rab-rin-chen of Stag-cheḍ. The Sanskrit text of **इन्दोरत्नाकर** along with the Tibetan version is preserved in Tibet.

5. **नवश्लोक, Nava śloka, कौमसांशु'वउद'प'द्वु'व —** Nine stanzas.

The Tibetan version of this work extends over folios 332—333 of the Tanygur, Sgra, Po. The original Sanskrit text, which is extinct in India, was composed by Venerable Sri La-wa-pa.³ The text was translated into Tibetan by the great Kāśmīrian Paṇḍita Sumanaśrī and the Tibetan interpreter-monk Rin-chen-grub.

6. **कलाप-अवतार, गालू'प'द'द्वु'व —** An introduction to Kalāpa (grammar).

The Tibetan version of this work extends over folios 334—348 of the Tanygur, Sgra, Po. The Sanskrit text of it was translated into Tibetan from a Nepalese copy by Tarānātha of Rgyal-khams, the difficult passages having been explained by a Brāhmaṇa Paṇḍita named Kṛṣṇa.

7. **मञ्जुश्रीशब्दलक्षणम्, दैसा'द'प'प'शु'र'रि'स'क'व'र'र' —** A Sanskrit grammar called Mañjuśrī-śabdalaḥṣaṇa.

The Tibetan version of this work extends over folios 1—190

¹ Ñag-dwañ-rin-chen-bkra-sis was a governor of Tibet who patronised the Grand Lama Esod-nams-rgya-tsho (1543—1589 A.D.).

² Ratnākara Śānti was a great scholar of the university of Vikramaśīla about 983 A.D.

³ La-wa-pa is spelt variously as **ལ'ལ'པ', ལ'པ'པ'** and **ལ'པ'པ'!**

He was also called Kambhala. He was a great teacher and born of a Kṣatriya family in Kañkara. Vide Pag-sam-jon-zah, pp. 108, 125.

of the Tangyur Sgra, Pho. The Sanskrit text, whic his extinct in India, was composed by Sādhukīrti, and a commentary on the first two chapters was written by Rāja-rāja Deva, teacher of the Buddhist lord of Kalinga. The text was translated into Tibetan under orders of Sṗyan-ṣāa-rin-po-che, the 4th hierarch of the Karmapa sect, by Shālu-lotsava Dharmapāla Bhadra in the monastery of Grwa-thaū.

8. **सरस्वतीयाकरणसूत्र, वदंश्लोदं'प'दगुदस'उक'श्री'सदं**—Aphorisms of Sārasvata grammar.

The Tibetan version of this work extends over folios 190—198 of the Tangyur, Sgra, Pho. The original Sanskrit aphorisms with explanation were composed by Ācārya Anubhūti under inspiration from Sarasvatī.

9. **सरस्वतीयाकरणसूत्र, वदंश्लोदं'प'दगुदस'उक'श्री'सदं**—Aphorisms of Sārasvata grammar.

The Tibetan version of this work extends over folios 198—335 of the Tangyur, Sgra, Pho. The original Sanskrit aphorisms were composed by Ācārya Anubhūti under inspiration from Sarasvatī. A Sanskrit commentary on the aphorisms was composed by Paṇḍita Bhīma Sena (Hjigs-sdes). The Sanskrit text of the aphorisms and commentary was obtained from a pure Brāhmaṇa of Kurukṣetra and was translated into Tibetan by Dkon-mchog-chos-grags of Tha-sal at Potala under the auspices of the Dalai Lama (Tsaṅs-dwyaṅs-rgya-mtsho) in the wood-ox year (1684 A.D.).

The work begins thus :—

प्रणम्य परमात्मानं बालधीवृद्धिसिद्धये ।
 सारस्वतीमञ्जुं कुर्वे प्रक्रियां नातिविस्तराम् ॥
 सकेवापी'वदवा'श्रिद'ल'के'दव'दु'वदुद'दे ॥
 वृसा'पदि'ह्लो'मृसा'द'येल'वद'व'क्षुव'पदि'पुिद ॥
 सके'द्वक'सस'सके'द'व'दु'पु'व'क'सस ॥
 पीक'दु'कुस'सिक'पो'पदस'व'क'स'पद'पु ॥

इन्द्रादयोऽपि यस्यान्तं न ययुः शब्दवारिष्ठेः ।
 प्रक्रियां तस्य क्वत्सस्य क्षमो वक्तुं नरः कथम् ॥

གང་ཞེས་སྐྱ་ཡི་རྒྱ་གཏེར་དག་གི་མཐའ་॥
 དབང་པོ་ལ་སོགས་ཀྱིས་ཀྱང་མ་སྟོབས་པའོ།།
 དེ་ཡི་རབ་དུ་བྱ་བ་རྫོགས་པར་ནི།།
 སི་ཡིས་བརྗོད་པར་བྱ་བ་ཇི་ལྟར་བཟོར།།

10. प्रक्रियाकौमुदी, रवः प्रो. श्वेदः तु वासलं च श्लोकाणां वसः शक्तिः
 २—Elucidation of etymological structure, Volume II).

The Tibetan version of this work extends over folios 1—255 of the Tangyur, Sgra, Mo. The Sanskrit text, which still exists in India, was composed by the great teacher Rāmacandra. It was obtained by the Tibetans from Paṇḍita Balabhadra and his brother Gokula Nātha Mīśra who were two pure Brahmanas of Kuruk-ṣetra. The work is said to be based on Pāṇini's grammar.¹ It ends thus :—

प्रक्रियाकौमुदी सेयं रामचन्द्रप्रकाशिता ।
 असद्वचस्तमी वध्यात् सच्चकोरप्रिया चिरम् ॥

¹ The second volume of the Tibetan version of Prakriyā-kaumudī begins thus :—

བད་སྟོན་པའི་བསྟན་བཅོས་ཆེན་པོ་པ་འི་ཁྱི་བྱ་ཀ་ར་ཆའི་གཞུང་
 འགྲེལ་གྱི་བོ་དོན་ཆོག་དབང་བརྗོད་ལེགས་བཤེན་ལོར་བྱ་འདེན་པའི་ཤིང་
 དེ་ཞེས་བྱ་བ་ལས་སྐྱེགས་པས་གཉིས་པ་བཞུགས།།

There are manuscripts of the प्रक्रियाकौमुदी in the library of the Asiatic Society of Bengal and of the Sanskrit College, Calcutta. The Sanskrit original begins thus :—

श्रीमद्भद्रकलमानस्य पाणिन्यादिमुनीन् गुरुन् ।
 प्रक्रियाकौमुदीं कुम्भः पाणिनीयानुसारिणीम् ॥

Rāmacandra, author of the work, was born in the Andhra country, as is evident from the following :—

किं शेषः पाणिनिर्वा वरश्चिरथवा सर्वविद्याप्रणेता
 शम्भुभावभूदु भूदुरकुलतिलकोऽन्यदेवोऽयवमे ।
 अगवेदौ सर्वशास्त्रप्रकटनपटधोः कृष्णजो रामचन्द्रोऽ
 नन्माचार्यप्रयोचो दिशतु कृतिमतिं मे सकौण्डिन्यगोचः ॥

(Prakriyākaumudī, beginning.)

བ་བྱེ་ཤིང་ཏུ་གསལ་བ་དེ་འདི་ཡང་།
 དགའ་བྱེད་རྒྱ་བས་རབ་ཏུ་གསལ་བར་བྱས།
 བདེན་མེད་བརྗོད་བ་མཐའ་མ་འཛིང་བྱེད་དེ།
 དབྱོད་ལྷན་དམ་པ་དག་ཏུ་དགའ་བར་བྱེད།
 आचार्यः पातु भगवान् शिष्यो भातु विनायकः ।
 निर्विघ्नं स्याच्च सर्वत्र पाणिनीयप्रसादनः ॥
 སློབ་དཔོན་སྤུང་བར་མཛོད་ཅིག་བཅོས་ལྷན་འདས།
 སློབ་མ་སྤུང་བར་མཛོད་ཅིག་རྣམ་པར་འདེན།
 ཐམས་ཅད་དུ་འང་གོགས་ཡོད་མ་ཡིན་པ།
 དང་སློང་བ་ཁྱིའི་ཡི་བྟའ་དེན་ལས།
 मङ्गलं लेखकानां च पाठकानां च मङ्गलम् ।
 मङ्गलं सर्वभूतानां भूमिभूपतिमङ्गलम् ॥
 འདི་བ་རྣམས་ཀྱང་བཀྱ་ཤིས་ཤིང་།
 རྟོག་པ་རྣམས་ཀྱང་བཀྱ་ཤིས་པ།
 སློག་ཆགས་ཐམས་ཅད་བཀྱ་ཤིས་ཤིང་།
 ས་དང་ས་བདག་བཀྱ་ཤིས་ཤོག།

Nṛsīṃha, son of Rāmacandra, copied the book in Śaka 1345 or 1423 A.D., as is evident from the following:—

མ་ཀེ་ཤམ་མུ་དྭ་བ་རྫོག་མེད་ཅེ་སྐབ་སྐྱེ་གོ་མཚན་
 བསྟེ་ཤ་སྐྱུ་འཛིན་ཅེ་མ་སྐྱུ་འཛིན་ཅེ་ཤེ་དགམ་ལྟོ་ལི་ཤི།
 མུ་རྫོག་མུ་འཛིན་ར་མ་མུ་འཛིན་ཅེ་སྐྱེ་གོ་མུ་འཛིན་
 མུ་འཛིན་ཅེ་སྐྱེ་གོ་མུ་འཛིན་ཅེ་སྐྱེ་གོ་མུ་འཛིན་

(Prakriyākaumudī, Colophon.)

It seems therefore that the original Sanskrit text of the Prakriyā-kaumudī was composed about 1400 A.D.

55. The Etymology of "Ranchi."

By MAULAVI 'ABDU'L WALI.

A few years ago, the Deputy Commissioner of Ranchi found it impossible to trace the origin of the word Rāñchī, the administrative headquarters of the District of the same name, and of the Chota Nagpur Division. The following story, in reference to the origin of the word, was told me by certain Kōls of Rāñchī :—

Many years ago, when the Oraoñs were driven out from Rohtās Garh and migrated to Chota Nagpur, certain members of the tribe settled in a place now called Rāñchī. This place is close to the beautiful hillock called *Pahārī*, which overlooks the town of Rāñchī. One day in summer, an Oraoñ farmer of the village went to till his land, which was on the foot of the hillock. As the Oraoñ was about to commence tilling the land, a *deo* (demon) in the form of a human being appeared, and addressed the farmer thus :—" This is my land which you can not till." The farmer at first got frightened, but soon took courage, and began to plough the land, saying, " This is my land. I can not stop ploughing." The demon tried to obstruct the farmer, but the latter became enraged and beat the demon with his *archi* or stick. In the Kol language the stick with which a cultivator drives his plough-oxen is called an *archi* (sometimes pronounced *alchī*). The demon being severely hit, began to cry loudly *archi, archi, archi* and disappeared. The farmer told the incident to his co-villagers. From this fact the village was named Archi or Rchi. The transition from Archi to Rachi, and latterly to Rāñchī, was gradual but inevitable. The first vowel *a* in *archi* being short was dropped, and a fresh vowel was substituted after *r* by the aliens to assist them in pronouncing the word.

The above fable, in my opinion, if cleared from the mist of superstition, shows distinctly the fact that might was then, as it is now, the arbiter of the right. Was the *deo*, or the man in the shape of a demon, one of the Mundās who, as it is said, preceded the Oraoñs in their migration to Chota Nagpur plateau, and whose land the latter was going forcibly to cultivate ? If fancy can picture the correct situation, the fable clearly demonstrates the fact that, however peaceful might be the settlement of the Oraoñs, they dispossessed by force the Mundās of their land. This fable also suggests that agrarian disputes, now so rampant, was not unknown in the hazy past, when one aboriginal people came in contact with the other. It is incon-

sistent with the commonly accepted theory that the Oraoñs settled in Chota Nagpur peacefully, and that the Mundās were eventually crowded out from their habitations. However peaceful might be at first the influx of the Oraoñs, it is inconceivable that it continued to be so for long. The emigration of the Oraoñs in large numbers was the cause of the rupture, which at last compelled the Mundās to leave the place and move to the south.

The interval between the dim past and the historic present is long. In 1833 Captain (afterwards Sir Thomas) Wilkinson, as Agent to the Governor-General of South-Western Frontier Agency, established the headquarters of the Agency at Rāñchī. He built a residence, now occupied by the Commissioner, and on its north-western side he built a Kachhari and record-room, and close to them quarters for Mukhtārs and 'Amlas. His residence touched the outskirts of the Oraoñ hamlet, Ranchi. The new town was called Wilkinsonpur, after its founder, but corrupted in the vernacular to Kisunpur. In 1840 the headquarters of the District, too, were transferred from Lohardaga to Rāñchī. Colonel Ouseley was the Agent, and his brother, Captain Richard Ouseley, was his Senior Assistant. Colonel Ouseley, though it may seem incredible, built a Hindu temple on the hillock, which forms to this day a peculiar sight of Rāñchī. In 1899 the name of the District of Lohardaga was changed to that of Ranchi—the archi of the Oraoñs of the fabulous time. The modern town consists of three villages—Chadri, Kōnkā, and only a part of Ranchi. The old village is now called *Puranki* Ranchi (or old Ranchi) to distinguish it from its modern namesake.

The Hindi version of the fable was written for me by a young Oraoñ, and is transcribed below *verbatim et literatim* in his own *patois*, which is spoken by the aborigines of Rāñchī in conversation with other people. It shows at once the language and the mode of expression of the tribe. The story is now almost forgotten, and is remembered only by a few.

APPENDIX.

[Of the two plateaux in the Chota Nagpur Division, the Aryan language of the northern or Hazaribāgh plateau is *Magāñhi*, and that of the southern or Rāñchī plateau a form of *Bhojpūrī*—Dr. Grierson's *Linguistic Survey of India*, vol. v, part ii.]

The following story is told in what is called Gañwāri or Nagpuria Hindī, admixed with such expressions as the literate aborigines pick up in schools.]

Ranchi sahar ke nam ke bare men ek kahani hai. Bahut baras bit gaye, or that jab Uraon log Rohittas Garh se khadere gaye our Chotanagpur ke basinde hue. Us wakt Ranchi sahar

[N.S.]

ek chhota sa basti tha usi pahari ke najdik, wahi basti men kitne Uraon log rahte the. Ye Uraon najdik ke jaminon ko jotte our chain se rahte the.

Dhupkal men ek roj ek kisan apne khet ko jotne ko gaya khet usi pahari ke najdik men tha, jab wah jotne par tha, tab ek Deo (ed saks ke rup men) hajir hua our usko jamin jotne se roka, yah kah karke, "Yah mera jamin hai, tum jot nahin sakte ho." Wah kisan jaubhi bahut hi usko achanak se dekhne se dar gaya, nahin thahar gaya, lekin jotne hi laga, yah kah karke, "Yah mera hai, main nahin thahar sakta hun." Wah Deo usko rokne ko bahut hi kosis kiya lekin wah kisan, krodhit hoke, us Deo ko apne lathi se aisa mara jis lathi se wah apne bailon ko hank raha tha (yahi lathi Uraon men *Archi* kahlata hai). Deo mar pake bahut jor se Archi, Archi, Archi kahkar chilane laga aur chilate chilate wah phir nahin dekh para. Wah kisan is ghatna ko ganwwalon ko bataya, tab ganwwale us wakt se apna ganw ko *archi* kahne lage. Archi Rachi hua, aur Rachi Ranchi hua. Abhi samucha sahar Ranchi kahlane laga.

TRANSLATION.

(*Literal*).

Regarding the Ranchi town there is a story. Many years have gone by, that is, when the Uraon people from Rohitas Garh were driven away, and of Chotanagpur became inhabitants at that time Ranchi town a small village was near that hillock. In that hamlet some Uraon log used to live. These Uraons the adjacent lands used to cultivate, and peacefully they used to live.

In summer season, one day, a cultivator (Uraon) his own farm to till went. The farm near that hillock was. When he was about to plough, then a *dēo* (in the form of a man) appeared, and him from tilling the land (he) forbade, this by saying, "This my land is, you cannot till it." The cultivator, nevertheless, very much, him on a sudden by seeing, got frightened; nay (the cultivator) staid on, but continued to till, this by saying: "This is mine, I cannot stop." The demon (*dēo*) him to stop very much tried, but the cultivator, becoming angry, him, with his stick so struck, with which stick he was driving his cattle. (This stick in Uraon is called *archi*). The *dēo* having got beating, very loudly shouted *archi, archi, archi*, and shouting and shouting he (*dēo*) could not be seen any more. The cultivator this incident to the villagers told. Then the villagers, from that time, their own hamlet, have been calling *Archi*. *Archi* became *Rachi*, and *Rachi* became *Ranchi*. Now the entire town is called *Ranchi*.



56. Recent Plant Immigrants.

By Prof. PAUL BRÜHL, *Engineering College, Sibpur.*

PART I.—CROTON SPARSIFLORUS, Morung.

About four or five years ago, the author noticed a species of *Croton* establishing itself along the foreshore road in front of the Engineering College, Sibpur. He found himself unable to identify the plant by the aid of any book or paper available in Sibpur, but was informed by one of the assistants in the Herbarium of the Sibpur Botanical Gardens that Colonel Prain had discovered the plant a few years previously growing near Diamond Harbour and other places in the Sunderbans; and from some sheets preserved in the Herbarium it appeared that Colonel Prain had identified it with *Croton sparsiflorus*, Morung. On those sheets it is stated that *Croton sparsiflorus* had been first described in the Journal of the New York Academy of Sciences, 1893, vol. VII, page 227. Colonel Prain had meanwhile left the country, and the writer's search for the journal in the libraries of the Botanic Gardens and the Asiatic Society proved unsuccessful; he finally bethought himself of that refuge of the despairing searcher after scientific literature, the library of the Geological Survey of India, and he found the required information. Some herbarium specimens collected in Eastern Bengal he owes to the courtesy of Mr. I. H. Burkill, Reporter on Economic Products to the Government of India.

The following is a detailed description of the plant as it grows in the vicinity of Sibpur:—

CROTON SPARSIFLORUS, *Morung.*

An undershrub; when in flower from about 8 cm. (or even less) to 80 cm. high (about 3 in. to 3 ft.); full-grown on suitable soil and isolated, forming bushes of approximately spherical outline; but when growing in a crowded condition, assuming a more or less straggling habit. Faintly fragrant.

Root a tap-root, rather woody, slender conical, little branched, of larger specimens up to 50 cm. long. Stem much branched from near its base; stouter branches woody; bark greyish-brown. Twigs green, with mostly elongated lenticels, tubercled and pale-striated; upwards longitudinally ridged and grooved, and rather densely beset with small white stellate hairs distributed chiefly along the ridges.

Leaves scattered, more densely crowded near the tips of the branches below the inflorescences, alternate, near the tips nearly opposite or whorled, petioled; petiole $\frac{1}{2}$ to $\frac{1}{3}$ the length of the blade, semiterete to nearly terete, grooved above, stellately hairy,

commonly more or less orange-tinted; blade membranous, lanceolate, 25 to 60 mm. (1—2½ in.) long, commonly 3 to 4 times as long as its greatest breadth; larger leaves 15 to 20, rarely 25 mm. broad, the greatest width at $\frac{1}{6}$ to $\frac{1}{7}$ the length from the base; base of blade rounded or obscurely cordate; margin undulate, simply and rather obtusely serrate; tip acute or subacuminate; upper surface dark-green and glabrous, lower surface paler and sparsely stellately hairy.

Inflorescence terminal on the branches, monœcious, protogynous, female below, male upwards; axis sparsely stellately hairy. Female flowers two to six in each inflorescence, alternate, sometimes accompanied by a male cyme reduced to a single flower, monochlamydeous; sepals 5, inserted on a very short swollen pedicel, rather distant from each other, lanceolate, about 2 mm. long, green, persistent; disc consisting of 5 small orange-red glands opposite the sepals; pistil 3-carpellary, sessile; ovary 3-locular, ellipsoidal, in flower about 2 mm. long, densely stellately hairy; styles 3, bifid to about the middle, spreading, about 1 mm. long; ovules single in each cell, pendulous. Male flowers in clusters of three to four; clusters 12 to 18 in number, subsessile, arranged in a racemose manner at a distance of 3 to 9 mm. from each other, supported by small ovate pale-margined bracts; male flowers stalked; pedicels 1—2 mm. long, of a pale-orange hue; sepals 5, valvate in aestivation, herbaceous, ovate, subacute, green below, more or less orange upwards, glabrous or nearly so, about 2 mm. long; petals 5, alternate with the sepals, oblong, attenuated at base and apex, blunt, white, subpellucid, recurved, about 2 mm. long, rather less than 1 mm. broad, villous at the base with white hairs; disc of 5 small spherical orange-coloured glands alternating with the petals; stamens about 15; filaments inflexed in bud, terete, about 2 mm. long, slightly attenuated upwards; anther orbicular in outline, subintrorsely dehiscing, about 1 mm. in diameter, white, connective ovate; pollen-grain spherical, smooth.

Fruit tricoccos, subellipsoidal in outline, triquetrous, shallowly 3-grooved, brownish-green to greenish-brown, more or less stellately hairy; pericarp dehiscing into three cocci, cocci finally splitting up ventrally and often also dorsally; epicarp herbaceous; endocarp crustaceous, white, thinner ventrally.

Seeds pendulous; caruncle forming a shallow, oblique, rather thin, fleshy, white, somewhat dentate cap; testa crustaceous, covered with a whitish external layer, otherwise minutely reticulately wrinkled, brownish-black outside, lighter brown on the inner surface.

As no authentic specimens of Morung's plant are available in India, it appears to me advisable to reproduce here Morung and Britton's original description of Morung's plant from the *Journal of the New York Academy of Sciences*, *loc. cit.*

"A low shrub, $\frac{1}{3}$ to 1 m. in height. Stem fuscous, branching irregularly, angular, lepidote, the scales deeply cut by 15 to 20 appressed radiating hairs. Leaves dark-green, alternate, ovate-

[N.S.]

lanceolate, acute at the apex, cuneate at the base, serrate, penninerved, smooth above, sparsely lepidote beneath, with two patelliform glands, $\frac{3}{4}$ mm. broad at the base; blades 3—6 cm. long and 1—3 cm. wide; petioles 1—2 cm. long. Stipules mere subulate points, caducous. Flowers in slender terminal racemes, 6—12 cm. long, the flowers continuous, pistillate below, staminate above, pistillate much fewer. Staminate flowers scattered along the rhachis, about 2 mm. high, the perianth segments white and smaller, woolly at the base inside; stamens about 13. Perianth segments of the pistillate flowers lanceolate, ciliate; inner segments none; ovary tomentose; styles 3, each 2-divided. Capsule angular globose, 5 or 6 mm. long, and 4 mm. broad, sparsely lepidote; seeds flattened cylindrical, obtusely 2-angled, with a furrow on one side, truncate at either end, glabrous, slightly mamillate-asperous, shining, 5 mm. long, the caruncle conspicuous. The young branches and petioles are densely white lepidote.

It will be seen that the two descriptions agree closely with each other, so that there can be hardly any doubt about the plant which is making its way into Eastern and Western Bengal being the same as that collected by Morung in South America. I prefer to describe the hairs as stellate instead of calling the indumentum lepidote. Of course, the two forms of indumentum pass into each other; but the trichomes of our plant are very much like that of Fig. 23 C—*Croton floribundus*, Spring—in Engler, Pflanzenfamilien, vol. III, pt. 5, page 37; and the author of the Euphorbiaceae in the Flora of British India would probably have placed our plant in the same subsection as *Croton Wallichii*, Muell. Arg.

In Britton's description no mention is made of the rather conspicuous orange-red disc-glands; this is probably due to Britton having drawn up his description from dried material, or because the disc-glands are a generic character, and therefore, perhaps, were not referred to by him.

THE PRESENT DISTRIBUTION OF *CROTON SPARSIFLORUS* IN BENGAL.

In Western Bengal the plant has been spreading from the Sunderbans upwards and is now found on both sides of the Hugli River. It has already been mentioned that *Croton sparsiflorus* had been observed by Colonel Prain at Diamond Harbour and other places in the Western Gangetic Delta.

Just below the Botanical Gardens, Sibpur, it has been found growing for at least seven years; immediately above the Gardens it made its appearance four or five years ago. The plant appears to prefer road and railway embankments in the vicinity of rivers and extensive pools of water. It grows abundantly near the Lime Works below the Sibpur Gardens, and on that side of the river I have followed it right down through Andul. After having once taken a foothold on the foreshore road south of the Engineering

College it soon became a prominent feature of the riverside flora, specially adorning occasional rubbish heaps with its deep green spherical masses of foliage. When the Port Commissioners proceeded with the rectification of the foreshore, throwing up spurs, *Croton sparsiflorus* experienced a temporary eclipse, one single specimen having escaped destruction. All the seeds, however, had, of course, not been destroyed, and a new generation is rapidly taking the place of the old, having found in the new spurs just the locality which suits its predilections. *Croton sparsiflorus* occurs sporadically within the precincts of the Shalimar Railway Yard, but for several years it has flourished along the new road leading from the Bataitola Police Station to Sibpur Ghat. There it forms a dense strip of vegetation along the short branch-railway embankment between the railway yard and the Bengal Flour Mill. I have not discovered it along the banks of the Hughli above the Shalimar railway yard, nor have I been able to trace it between Howrah and Utterpara. On the right bank of the Hughli, therefore, Howrah appears to act as an effective check on the upwards spread of the immigrant. It is evidently not able to get across rice-fields, as I have not met with it along the Howrah-Andul road and in other places west of the river. I have undertaken some bicycle excursions east of the Hughli, below Calcutta, with the special purpose of establishing the northern limit of the present distribution of *Croton sparsiflorus* in that direction. Proceeding along the Diamond Harbour road on the 5th of April 1908 I came across a flourishing colony of the immigrant just below Barisa where the country opens out into ricefields and hogla (*Typha*) swamps; here we find the *Croton* on either side of the road for quite a short distance; but I could find no further trace of it down to the 20th mile-stone, nor could I discover it along the roads running east and west of the Diamond Harbour road. This isolated appearance of the plant is rather puzzling.

On the 26th of April, 1908, I searched for the plant along the Budge-Budge Road down to the 18th mile-stone without seeing a single specimen. But on the river banks in Budge-Budge it had established itself firmly, and it was there, on an open plot of land, which evidently had been cleared for the purpose of laying out a garden, that I met with some of the finest specimens of *Croton sparsiflorus* that I ever have come across. I have followed it up to Garden Reach, but Calcutta seems to form another full stop on that side of the river.

It is highly probable that *Croton sparsiflorus* was first imported into Chittagong and from there made its way up the Megna and across to the mouths of the Hughli. Mr. Hooper collected it in Chittagong in October, 1898, and again on the 3rd of October, 1905. Mr. Burkill gathered it in Tippera, along the railway embankment near Hajiganj and Chandpur, during an excursion undertaken in 1906. One of my former students in the Agricultural Department of the Sibpur College, Babu Hemendra Kishor Datta, informed me, in a letter dated the 13th July, 1907, that he

had observed the plant, to which I drew his attention whilst in Sibpur, for at least ten years along the railway embankment between Chandpur and Akhārera, and on the banks of the river Titus near Brahmanbaria.

The one feature which strikes the observer more than any other is the freshness of the leaves even during the driest parts of the year. The leaves, however, are very thin and a water tissue is absent, so that the plant does not utilise the dew directly. But its root deeply penetrates into the ground, and it depends probably nearly entirely on the water which it receives by percolation.

Like *Jatropha gossypifolia*, it has no special facilities for spreading. The secret of its conquering course lies in a property which it has in common with field mice—its consistent multiplication leading to the production, ever repeated, of a numerous progeny. I have seen specimens which began to flower when they were only three inches high, and the plant blooms and fruits all the year round. Further, cattle do not seem to touch it, nor have I ever discovered an insect attacking its leaves.

Having in *Croton sparsiflorus* a species, the arrival of which in India can be dated to a close degree of approximation, and whose exact present distribution is tolerably well known and could, without great difficulty, be ascertained still more exactly, we shall be able to follow its spread in future and thus get possession of an excellent example illustrating the dispersal of a species.

PART II.—THE 'FLORA ADVENA' OF BENGAL AND BIHAR.

My investigations on the subject of Recent Plant Immigrants prompted me to draw up a list of the Phanerogams of which we know, either with absolute certainty or at least with a high degree of probability, that they are natives of other countries. I have confined the list to species which grow in Bihar and in Bengal Proper, excluding the country east of the Megna, as well as Orissa and the inner parts of Chhota Nagpur. These provinces really belong to different botanico-geographical subdivisions, and the vast bulk of the exotics which have settled down for good in the Lower Provinces are inhabitants of Bengal Proper and of Bihar. I have also excluded from my list all the plants which are indigenous in the Indian Peninsula west and south of the Gangetic Plains.

The literature referred to in the list consists of Prain, *Bengal Plants* (B. P.); Hooker's *Flora of British India* (F. B. I.); Firminger, *Indian Gardening*, 3rd and 5th editions; Voigt, *Hortus Suburbanus Calcuttensis* (H. S. C.); Roxburgh, *Flora Indica* (F. I.); Roxburgh, *Hortus Bengalensis* (Hort. Beng.); Rumphius, *Herbarium Amboinense* (Herb. Amb.); Rheede, *Hortus Malabaricus* (Hort. Mal.); and Watt, *Economical Dictionary* (Ec. Dict.). I have usually preferred to quote from these works literally.

In a country which is as essentially agricultural as are Bihar and Bengal, crops and plants growing in gardens and village jungles play a considerable part in the Flora of the country, and purposely or accidentally introduced species which find the climatic and other conditions suitable have a much greater chance of spreading in Bengal and Bihar than they have in the more hilly and more jungly parts of India. Even trees which occur only planted and show no tendency to spring up spontaneously may become prominent features in the landscape.

RANUNCULACEÆ.

1. *NIGELLA SATIVA*, *Linn.* B. P., vol. i, p. 194: "In cultivated ground, spontaneous, especially in the western parts. A crop, also occurring as a weed." Watt, *Ec. Dict.*, vol. v, p. 428: "A native of Southern Europe. Its Sanscrit name indicates its introduction at a very early period." Voigt, H. S. C., p. 4: "Acclimatized in the gardens of India. Domesticated about Serampore." Roxb., F. I., p. 450: "*Nigella indica*, R. A native of Hindoostan." Probably originally a native of Northern Syria and the adjacent parts of Asia Minor. Now found wild in the whole of the Eastern Mediterranean Region. The writer has also found it growing on the banks of the Ganges in N. Bengal.

ANONACEÆ.

2. *ANONA RETICULATA*, *Linn.* B. P., vol. i, p. 206: "Near villages, planted and oftener self-sown, very common. Bullock's Heart." Watt, *Ec. Dict.*, vol. i, p. 258: "Naturalised in some parts of India." F. B. I., i, 78: "Naturalised in Bengal and elsewhere. Tropical America." Voigt, H. S. C., p. 14: "Domesticated in India." Roxb., F. I., p. 453: "It is said to be indigenous amongst the mountains immediately east of Bengal, and universally cultivated in India." Rheede, *Hort. Mal.*, 3, t. 30-31.

3. *ANONA SQUAMOSA*, *Linn.* B. P., i, p. 206: "Near villages, planted and sometimes self-sown, common. Custard Apple." Watt, *Ec. Dict.*, vol. i, p. 259: "Naturalised in Bengal. There seems to be hardly any doubt as to *Anona squamosa* being an introduced plant." Brandis says that it is almost wild in the Central Provinces and the Bandelkhand. Murray believes it to grow wild in the Deccan. General Cunningham is very emphatic on *Anona squamosa* being indigenous. Neither *Anona squamosa* nor *Anona reticulata* appear to possess an ancient Sanscrit name, the names Rāmphal and Sitāphal being probably of vernacular origin. Considering that out of sixty species of *Anona*, all of which are natives of Tropical America, only two or three are doubtfully African and Asian, we may take it as highly probable that both *A. squamosa* and *A. reticulata* are indigenous in America, probably in the Antilles Islands. So much appears to be certain, that if either of the two is Indian, it is rather *A. reticulata* than *A. squamosa*.

PAPAVERACEÆ.

4. PAPAVER SOMNIFERUM, *Linn.* B. P., vol. i, p. 215: "Cultivated only." Watt, *Ec. Dict.*, vol. vi, 1, p. 17: "DeCandolle says that botanists are agreed in regarding the opium-yielding poppy to be a cultivated state of *P. setigerum*, a species which is wild on the shores of the Mediterranean." F. B. I., i, 117. Roxb., F. I., p. 426: "Extensively cultivated in many parts of India." *Papaver setigerum* is indigenous in the Peloponnese and in Cyprus.

5. ARGEMONE MEXICANA, *Linn.* B. P., vol. i, p. 216. Watt, *Ec. Dict.*, vol. i, p. 306: "Introduced into India within historic times." F. B. I., i, 117. Voigt, H. S. C., p. 6: "Domesticated all over India." Roxb., F. I., p. 426, makes no remark about its being of foreign origin. As all the other species of Argemone are natives of Tropical and Subtropical America, we may safely assume that *Argemone mexicana* hails, as its name indicates, from Mexico, or neighbouring countries.

CRUCIFERÆ.

6. ALYSSUM MARITIMUM, *Linn.* B. P., vol. i, p. 222: "In gardens, cultivated in the cold season, but occasionally coming up spontaneously on rubbish heaps." Voigt, H. S. C., p. 68: "Kœniga maritima." Southern Europe.

7. CAPSELLA BURSA-PASTORIS, *Moench.* B. P., vol. i, p. 222. "A weed of cultivation in the cold season, Tirhut, Behar. Very rare in C. Bengal." F. B. I., i, 159. Spread into India probably from the Iranian countries or from Central Asia. Now a denizen of all temperate countries.

8. LEPIDIUM SATIVUM, *Linn.* B. P., vol. i, p. 223: "Cultivated in Tirhut, Behar, and N. Bengal." F. B. I., i, 159: "Cultivated throughout India." Voigt, H. S. C., p. 70. Roxb., F. I., p. 497: "Universally cultivated in the warmer parts of Asia." It is probably a native of the eastern parts of the Mediterranean Region.

9. THLASPI ARVENSE, *Linn.* B. P., vol. i, p. 223: "Behar, very rare. A weed of cultivation in the cold season." F. B. I., i, 162. An inhabitant of the Northern Temperate Zone. Frequently met with in the Himalayas.

10. SENEBIERA PINNATIFIDA, *Del.* B. P., vol. i, p. 223: "A weed in garden grounds and by roadsides, but apparently only in C. Bengal. Especially common at Matlah. Of recent introduction to India." Not mentioned in F. B. I. Voigt, H. S. C., p. 69: "Europe. Domesticated in our gardens." Roxburgh does not enumerate it.

IXACEÆ.

11. BIXA ORELLANA, *Lin.* B. P., vol. i, p. 230: "An American tree or large bush. Cultivated everywhere, but in Bengal proper very generally wild in village jungles." Watt, *Ec. Dict.*, vol. i, p. 454. F. B. I., i, 190. Voigt, H. S. C., p. 85. Roxb., F. I., p. 429. "Appears to be a native of India. The flowers are however white. In plants reared from West India seed the flowers are rose coloured." Rumphius, *Herb. Amb.*, ii, t. 19. A native

of Panama, Columbia, and Peru. Cultivated throughout the Tropics. An interesting account of the present distribution of *Bixa orellana* in India is given by I. H. Burkill in the "Agricultural Ledger," 1904, No. 12, p. 183 and ff.

PORTULACACEÆ.

12. *TALINUM PATENS*, Willd. B. P., vol. i, p. 240: "C. Bengal, becoming somewhat common in the neighbourhood of Calcutta. An American introduced weed." A native of Brazil, where it is used as a vegetable. Roxb., F. I., p. 391: "*Talinum cuneifolium*. Native place uncertain. In the Botanic garden at Calcutta it flowers chiefly during the rains, and ripens abundance of seed in the cold season." Not referred to in F. B. I., nor by Voigt.

13. *MALVASTRUM COROMANDELIANUM*, Willd. *Malvastrum tricuspdatum*, Ait. B. P., vol. i, p. 257: "Common in W. and C. Bengal." F. B. I., i, 321: "Various parts of Bengal and Madras, introduced." Neither in Voigt, H. S. C., nor in Roxb., F. I. Native of the warmer parts of America, now spread to Australia and Tropical Africa and Asia.

14. *MALVASTRUM SPICATUM*, Linn. B. P., vol. i, p. 357: "In waste places in C. Bengal, rare." F. B. I., i, 321: "Various parts of India, introduced." Hails from Tropical America, now spread through the tropics of both hemispheres. Enumerated neither by Voigt, nor by Roxburgh.

15. *ANODA HASTATA*, Cav. Not mentioned in B. P. As it occurs, however, in various parts of India, it may yet be traced in the Bengal Provinces. F. B. I., i, 321: "Various parts of N. W. India and the Western Peninsula." A weed indigenous in Tropical America. Voigt, H. S. C., p. 115: "Mexico." Not enumerated by Roxburgh.

16. *WISSADULA ROSTRATA*, Planch. B. P., vol. i, p. 260: "C. Bengal, an occasional escape." Watt, Ec. Diet., vol. vi, 4, p. 308: "Native of the Malay Peninsula, Java, Tropical Africa and America." F. B. I., i, 325. Voigt, H. S. C., p. 114: "Abutilon periplocifolium: Sumatra, Malay Islands." Roxb., F. I., p. 516: "Sida periplocifolia."

17. *MALACHRA CAPITATA*, Linn. B. P., vol. i, p. 262: "Common. A weed of waste places." F. B. I., i, 329: "Throughout the hotter parts of India. Probably introduced." Voigt, H. S. C., p. 112: "W. Indies. Domesticated about Serampore." Not referred to by Roxburgh. It is almost certain to be native of Tropical America, but it has taken a firm foothold in West Africa and India.

18. *HIBISCUS MANIHOT*, Linn. B. P., vol. i, p. 266: "C. Bengal, naturalised. Native of China." F. B. I., i, 341. Voigt, H. S. C., p. 120. Roxb. F. I., p. 529: "Reared in the Botanic Garden from seeds received from Mr. Kerr at Canton in China."

19. *HIBISCUS HIRTUS*, Linn. B. P., vol. i, p. 266: "Behar frequent; probably, however, only an escape from gardens." F. B. I., i, 335. Voigt, H. S. C., p. 118. Roxb., F. I., p. 523: "Hibis-

cus phœniceus." Rheedee, Hort. Mal., x, p. 1. This species is probably indigenous in the Indian Archipelago, but has been growing in India for centuries. It may be a native of the Indian Peninsula.

20. *HIBISCUS RADIATUS*, Willd. B. P., vol. i, p. 267: "Bengal, cultivated." F. B. I., i, 335. Voigt, H. S. C., p. 116: "Common in gardens. Native place?" Roxb., F. I., p. 528: "Native place uncertain, but it is common in gardens about Calcutta." Perhaps a native of the Indian Archipelago or the Malay Peninsula.

21. *HIBISCUS SYRIACUS*, Linn. B. P., vol. i, p. 268: "In gardens everywhere." F. B. I., i, 344: "Cultivated throughout India and China." Voigt, H. S. C., p. 117. Roxb., F. I., p. 523: "I have not yet found it in the wild state." Its real home is Turkish Armenia and the Lenkoran; does not appear to be a native of Syria.

22. *HIBISCUS ROSA-SINENSIS*, Linn. B. P., vol. i, p. 268: "In most gardens." Watt, Ec. Dict., vol. iv, p. 242: "A native of China." Voigt, H. S. C., p. 116: "China, Moluccas, interior of Hindustan." F. B. I., i, 344. Roxb., F. I., p. 523: "I have only found it in cultivated state; however the single sort is found wild in the interior of Hindustan." Its real home is probably the Indian Archipelago.

23. *HIBISCUS MUTABILIS*, Linn. B. P., vol. i, p. 268: "In most gardens." Watt, Ec. Dict., iv, p. 242: "It is a native of China." Voigt, H. S. C., p. 118: "Moluccas." F. B. I., i, 344. Roxb., F. I., p. 525: "A native of China; now common in gardens all over India. Rheedee, Hort. Mal., vi, t. 38-42. Rumphius, iv, t. 9.

24. *ADANSONIA DIGITATA*, Linn. B. P., vol. i, p. 270: "Planted here and there, especially in the western drier parts, and especially near the tombs of Mahomedan saints." Watt, Ec. Dict., vol. i, p. 105: "Originally introduced by Arab traders. Experimentally cultivated in the Sunderbuns." A native of Tropical Africa. F. B. I., i, 348. Voigt, H. S. C., p. 106. Roxb., F. I., p. 513: "The tree is scarce in India. In the Botanic Garden at Calcutta are many trees, the largest about twenty-five years old." *Adansonia digitata* hardly deserves to be considered a member of the Bengal Flora.

STERCULIACEÆ.

25. *GUAZUMA TOMENTOSA*, Kunth. B. P., vol. i, p. 278: "Often planted by roadsides and near tanks, but also very readily self-sown." Watt, Ec. Dict., vol. iv: "Perhaps only introduced. Probably a native of the West Indies." F. B. I., i, 875. Voigt, H. S. C., p. 108: "S. America. Cultivated in India. Young bark used in Martinique to clarify sugar." Roxburgh, Hort. Beng., p. 50: "Bubroma Guazuma."

GERANIACEÆ.

26. *AVERRHOA CARAMBOLA*, Linn. B. P., vol. i, p. 296: "Planted rather frequently everywhere; occasionally also self-sown." Watt, Ec. Dict., vol. i, p. 359. F. B. I., i, 439: "Native country unknown." Voigt, H. S. C., p. 191: "Moluccas. Cultivated." Roxb., F. I., p. 387: "Native place uncertain." Rheedee, Hort. Mal.,

iii, t. 43, 44. Rumphius, *Herb. Amb.*, i, t. 35. It has been suggested that the species of *Averrhoa* now cultivated in the Eastern Hemisphere have been brought by the Portuguese from America. Of the two most closely related genera, *Connaropsis* with three species is indigenous in the Malay Archipelago, whilst *Dapaña* is a native of Sumatra. Voigt's suggestion may therefore prove to be correct.

27. *AVERRHOA BILIMBI*, *Linn.* B. P., vol. i, p. 296: "Planted everywhere; and often occurring self-sown." Watt, *Ec. Diet.*, vol. i, p. 359: "It has almost become naturalised in India." F. B. I., i, 439: "Native country unknown." Voigt, H. S. C., p. 191: "Moluccas. Cultivated." Roxb., F. I., p. 387: "This pretty little tree I have only found in a cultivated state. Where it is indigenous, I cannot say. In Bengal it is uncommon." Rheede, *Hort. Mal.*, iii, t. 45, 46. Rumph., *Herb. Amb.*, i, t. 36. Undoubtedly a native of the Malay Archipelago.

ZYGOPHYLLACEÆ.

28. *TRIBULUS CISTOIDES*, *Linn.* B. P., vol. i, p. 292: "C. Bengal only near Calcutta; introduced and rare." F. B. I., i, 423: "Western Peninsula, Tenasserim. Throughout the Tropics." Voigt, H. S. C., p. 184: "S. America." Voigt quotes Roxb., *Hort. Beng.*, p. 33. Not enumerated in Roxb., F. I. Probably a native of the Antilles.

RUTACEÆ.

29. *CLAUSENA WAMPI*, *Blanco.* B. P., vol. i, p. 301: "Chota Nagpur, planted." *Vern.* Wangpi (from the Chinese name). F. B. I., i, 505: "Cultivated in India and the Eastern Islands." Voigt, H. S. C., p. 140: "Cookia punctata. China." Roxb., F. I., p. 364: "A Chinese fruit tree, now common in Bengal." Rumphius, *Herb. Amb.*, i, t. 55.

30. *TRIPHASIA AURANTIOLA*, *Lour.* B. P., vol. i, p. 303: "In gardens in all the provinces. Apparently introduced into India from China." Watt, *Ec. Diet.*, vi, 4, p. 88: "Common as an escape in the Western Peninsula and in gardens throughout India. It is a native of China, and has been introduced into India for many years." F. B. I., i, 507: "I am not aware that it has anywhere been found in an indigenous state." Voigt, H. S. C., p. 138. Roxb., *Hort. Beng.*, p. 25.

31. *CITRUS DECUMANA*, *Linn.* B. P., vol. i, p. 307: "Cultivated very largely. The Pumelo. *Beng.* Batavi nimbu. The Bengali name indicates pretty clearly that the first knowledge of the fruit in our area was derived from the Malay Islands." Watt, *Ec. Diet.*, vol. ii, p. 348: "A native of the islands of the Malay Archipelago, more particularly abundant in the Friendly Isles and Fiji. Introduced into India from Java and into the West Indies by Captain Shaddock." Voigt, H. S. C., p. 141: "Moluccas. Sunda Islands. Cultivated in India." Roxb., F. I., p. 590: "The Bengali name denotes its being an exotic here." Rumph., *Herb. Amb.*, ii, 96, t. 24.

MELIACEÆ.

32. *SWIETENIA MAHAGONI*, *Linn.* B. P., vol. i, p. 319: "Native of W. Indies and Honduras." F. B. I., i, 540. Brandis, For. Fl., 70. Voigt, H. S. C., p. 137. Roxb., H. B., p. 33. Introduced into the Royal Botanic Garden, Sibpur, in 1795.

33. *SWIETENIA MACROPHYLLA*, *King.* B. P., vol. i, p. 319: "Planted very generally." Hooker, *Icones Plantarum*, 1886, vol. vi, 2, plate 1150. Here Sir George King says: "The seeds of this tree were received from the India Office in the year 1872, and were said to have been collected in Honduras. It seeds freely, whereas the true Mahogany rarely seeds at all." The earliest fruiting specimens preserved in the Sibpur Herbarium date from February 1886.

SAPINDACEÆ.

34. *LITCHI CHINENSIS*, *Sonnerat.* B. P., vol. i, p. 346: "Nephelium Litchi, Camb." Watt, Ec. Dict., vol. v, p. 346: "Introduced from South China. F. B. I., i, 687. Voigt, H. S. C., p. 95. Roxb., F. I., p. 328: "Scytalia Litchi. This famous tree is now common in Bengal. It was originally brought from China. Specimens of this tree have been sent to me from old trees growing on the Garrow mountains."

35. *EUPHORIA LONGANA*, *Lamk.* B. P., vol. i, p. 346: "Nephelium Longana, Camb.: Planted occasionally." Watt, Ec. Dict., vol. v, p. 348: "It is called *Longan* in China, from which country, according to DeCondolle, it was introduced into the Malay Peninsula some centuries ago." F. B. I., i, 688. Voigt, H. S. C., p. 95. Roxb., F. I., p. 329: "Scytalia Longan. It is a native of China, as well as of the mountainous countries which form the Eastern frontier of Bengal." Chinese: *Long-yen* or *Lin-Reng* = Dragon's Eye.

ANACARDIACEÆ.

36. *ANACARDIUM OCCIDENTALE*, *Linn.* B. P., vol. i, p. 354: "Cultivated and sometimes appearing as wild, especially in Orissa and Chittagong. Native of America." Watt, Ec. Dict., vol. i, p. 232: "Introduced from South America, now established in the coast forests of India, Chittagong, Tenasserim, and the Andaman Islands, and over South India." F. B. I., ii, 20. Voigt, H. S. C., p. 270: "W. Indies, Mexico, S. America, Chittagong." Roxb., F. I., p. 342: "A tree common in the East and West Indies." Rheede, Hort Mal., iii, t. 54. Rumphius, Herb. Amb., i, t. 69. An undoubted native of the Antilles. Appears also to grow wild on sandy places in Brazil.

37. *SPONDIAS DULCIS*, *Willd.* B. P., vol. i, p. 356: Otaheite apple. Native of Polynesia." Watt, Ec. Dict., vol. vi, 3: "Indigenous in the Society, Friendly, and Fiji Islands. In India it does not appear to germinate freely." Voigt, H. S. C., p. 144: "Cultivated in India." Roxb., F. I., p. 387: "A native of the Society Islands and now common in the Botanic Garden at Calcutta, where it grows to be a large tree."

LEGUMINOSÆ.

Belonging to this natural order there are a number of species cultivated in the Indo-Gangetic plains from ancient times, probably not originally indigenous in this area, but introduced by the Aryan settlers from the countries lying north-west of India. I mention them here, and shall not refer to them in detail further on. They are the following. The localities placed in brackets after each name are the areas in which the respective species are most probably really indigenous.

Cicer arietinum, Linn. (Mediterranean Region).

Vicia sativa, Linn. (Most parts of Europe, the Mediterranean Region, and Western Asia as far as Persia).

Lens esculenta, Moench. (Central Europe, the Mediterranean Region and Western Asia including Afghanistan. Probably introduced by the early Aryan settlers.)

Lathyrus Aphaca, Linn. (Most parts of Europe, the Mediterranean Region, Western Asia into the Himalayas).

Lathyrus sativus, Linn. (Western Asia to Afghanistan and the N. W. Himalaya).

Pisum arvense, Linn. (Italy).

Pisum sativum, Linn. (Western Asia).

Cajanus indicus, Spreng. (Tropical Africa).

The following species, on the other hand, have been introduced into Bengal, or into India in general, in later times, and their native country is, in most cases, either known with certainty or at least traceable with a considerable amount of probability.

38. CROTALARIA SALTIANA, *Andr.* B. P., vol. i, p. 373: "Throughout Bengal, including the Sundribuns, and in Chittagong. Probably introduced during the last century." F. B. I., ii, 84: *C. striata* in part. See also under the following.

39. CROTALARIA BROWNEI, *Bert.* B. P., vol. i, p. 373: "Cultivated and also in some places naturalised." F. B. I., ii, 84: *C. striata*, in part. Voigt enumerates, on page 207, a "*C. striata*, D.C., Bengal, (Serampore)" and a "*C. Brownei*, *Bert.* W. Indies."

40. CROTALARIA INCANA, *Linn.* B. P., vol. i, p. 373: "Cultivated, also at times an escape" F. B. I., ii, 83: "Perhaps naturalised only. Malay islands. Trop. Africa and America." Voigt, H. S. C., p. 207. "W. Indies."

41. PTEROCARPUS INDICA, *Willd.* B. P., vol. i, p. 412: "Native of the Moluccas. Planted occasionally in C. Bengal." Watt, *Ec. Diet.*, vol. vi, 1, p. 355. Padouk. F. B. I., ii, 338 partly Roxb., F. I., p. 538: "A native of China, the Moluccas, and Eastern parts of Asia. From the former it has been brought to Calcutta, and now, April 1808, a young tree is in flower in Sir John Royd's garden."

42. PTEROCARPUS DALBERGIOIDES, *Roxb.* B. P., vol. i, p. 412: "Planted not infrequently in C. Bengal, Andaman Red Wood." F. B. I., ii, 238: *Pterocarpus indica* in part. Roxb., F. I., p. 537: "A native of the Andaman Islands, from thence, in 1794, young trees were sent to the Botanical Garden by Colonel Alexander Kyd.

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These are now, 1809, from forty to eighty feet high, blossoming during the rains in June and July chiefly; and ripening their seeds eight months after."

43. *ARACHIS HYPOGÆA*, *Linn.* B. P., vol. i, p. 415: "Occasionally cultivated. Watt, Ec. Dict., vol. i, p. 262: "An annual of South America. Cultivated in certain parts of Bengal." F. B. I., ii, 161. Voigt, H. S. C., p. 243: "Hot parts of America." Roxb., F. I., p. 552: "Found in all the warmer parts of Asia. Though in Bengal it appears to be rather scarce." Rumphius, Herb. Amb., v. t. 156, fig. ii.

44. *PHASEOLUS LUNATUS*, *Linn.* B. P., vol. i, p. 386: "C. Bengal; cultivated." Watt, Ec. Dict., vol. vi, 1, p. 186: "According to DeCandolle it is a native of Brazil, and is believed to have come to India originally from the Mauritius." F. B. I., ii, 200. Roxb., F. I., p. 554: "I doubt its being a native of India."

45. *PHASEOLUS VULGARIS*, *Linn.* B. P., vol. i, p. 386: "Cultivated." Watt, Ec. Dict., vol. vi, 1, p. 195. According to De Candolle's researches this species is probably of South American origin. F. B. I., ii, 200. Roxb., F. I., p. 554: "Where indigenous uncertain."

46. *PHASEOLUS MULTIFLORUS*, *Willd.* B. P., vol. i, p. 387: "Cultivated. The Scarlet Runner." Watt, Ec. Dict., vol. vi, 1, p. 187: "It is a native of Mexico." F. B. I., ii, 200.

47. *INDIGOFERA SUMATRANA*, *Gaertn.* B. P., vol. i, p. 432: "Cultivated, chiefly in Tirhut, and occasionally spontaneous in Tamarrisk jungles and on river banks. Bengal Indigo." F. B. I., ii, 99. *I. tinctoria*, partly. Roxb., F. I., p. 585: "Native place uncertain, for though now common in a wild state over most parts of India, yet is in general not remote from places where it is or has been cultivated." *Indigofera sumatrana* is most probably a species developed under cultivation from the wild form of *I. tinctoria* which is indigenous in Tropical Africa (Nubia). See Prain and Baker in Journal of Botany, 1902, vol. 40.

48. *INDIGOFERA ARTICULATA*, *Gouan.* B. P., vol. i, p. 432: "Behar; not now cultivated in our area. Surat Indigo." *I. argentea* var. *cœrulea* in F. B. I., ii, 99. *I. cœrulea*, Roxb. in F. I., p. 584: "A species growing on dry, barren, uncultivated ground. After an inquiry of nearly two years I have not been able to discover that the natives of any part of India make use of it." *Indigofera articulata* is a native of Nubia (and Arabia).

49. *BAUHINIA MONANDRA*, *Kurz.* B. P., vol. i, p. 442: "Occasionally planted. Native of Madagascar." F. B. I., ii, 285. Kurz in Journ. As. Soc. Bengal, xlii, 2, 73. Not mentioned by Voigt and Roxburgh.

50. *PARKINSONIA ACULEATA*, *Linn.* B. P., vol. i, p. 446: "Planted, but also as if wild in all the provinces." F. B. I., ii, 260: "Universally cultivated and often naturalised. A native of Tropical America." Voigt, H. S. C., p. 246: "S. America. Domesticated in India." Roxb., Hort. Beng., p. 31.

51. *POINCIANA REGIA*, *Bojer.* B. P., i, p. 446: "This was introduced to India from Mauritius; the general supposition that

it is a native of Madagascar does not appear to be correct; whence it came to Mauritius is not exactly known." F. B. I., ii, 260. Voigt, H. S. C., p. 245. Not mentioned in Roxb., F. I.

52. *COLVILLEA RACEMOSA*, Bojer. B. P., i, p. 447: "Planted occasionally; introduced from Mauritius." Voigt, H. S. C., p. 245.

53. *NEPTUNIA PLENA*, Benth. B. P., i, p. 454: "Introduced. Native of America." Roxb., F. I., p. 420: "Mimosa Adenanthera. Native place uncertain." Voigt, H. S. C., p. 254: "Desmanthus punctatus, Willd. Jamaica. St. Domingo. Guadeloupe." Benth, in F. B. I., ii, 286: "Neptunia plena, a native of Tropical America."

54. *DESMANTHUS VIRGATUS*, Willd. B. P., i, p. 455: "C. Bengal, naturalised, but rare." F. B. I., ii, 290: "Only introduced. Wild throughout Tropical America." Voigt, H. S. C., p. 259: "W. Indies." Roxb., Hort. Beng., p. 41.

55. *LEUCAENA GLAUCA*, Benth. B. P., i, p. 455: Chota Nagpur; C. Bengal; naturalised. Native of America." F. B. I., ii, 290: "Spread throughout India, but probably indigenous only in Tropical America." Voigt, H. S. C., p. 261: "Acacia frondosa, Willd., Patna (Buch)."

56. *ALBIZZIA RICHARDIANA*, King et Prain. B. P., vol. i, p. 460: "Planted in C. Bengal. Native of Madagascar."

57. *PITHECOLOBIUM DULCE*, Benth. B. P., vol. i, p. 462: "Planted everywhere, but often also self-sown. Native of Tropical America." F. B. I., ii, 302: "Cultivated throughout India, but not indigenous." Voigt, H. S. C., p. 257: "Inga dulcis, Willd." Roxb., Coromandel Plants N. 99 and Hort. Beng., 40: "Mimosa dulcis." F. I., p. 421: "A native of the Philippine Islands." Watt, Ec. Dict., vi, 1, p. 281: "A large tree, introduced from Mexico."

58. *ENTEROLOBIUM SAMAN*, Prain. B. P., i, p. 463: "Planted. Tropical America." Sometimes called the Rain Tree. Watt, Ec. Dict., vi, 1, p. 283: "Native of America, introduced into the neighbourhood of Calcutta, the plantations of Kadalah and Kadur, etc., as an ornamental tree of rapid growth."

ROSACEÆ.

59. *ROSA GALLICA*, Linn. B. P., vol. i, p. 467: "In gardens, occasionally." Watt, Ec. Dict., vol. vi, 1, p. 566. Not enumerated by Voigt and Roxburgh. A native of Western. Central and South Europe and Asia Minor.

60. *ROSA DAMASCENA*, Mill. B. P., vol. i, p. 466: "In gardens, frequent; cultivated for Attar." Watt, Ec. Dict., vol. vi, 1, p. 561: "Its native country is absolutely unknown. It is not till the close of the thirteenth century that we find any mention of rose-water. In India, attar of roses is said to have been first discovered by Nur-i-Jehan Begum, A.D. 1612." The most probable hypothesis is that *Rosa damascena* is a secondary species derived from *Rosa gallica* as a consequence of cultivation.

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61. *ROSA CENTIFOLIA*, *Linn.* B. P., vol. i, p. 467: "In gardens. The Cabbage Rose." Watt, Ec. Dict., vol. vi, i, p. 560: "A native of the Caucasus and Assyria." F. B. I., ii, 364.

62. *ROSA INDICA*, *Linn.* B. P., vol. i, p. 467: "In gardens frequent." Watt, Ec. Dict., vol. vi, i, p. 567: "A native of China, but early introduced into India, where it has found a congenial home." *Rosa semperflorens* Willd. is a marked variety of *Rosa indica*. Roxb., F. I., p. 407: "Rosa chinensis. A native of China." *Rosa indica* has played a part as a centre of development of secondary species in Eastern Asia similar to the part played by *Rosa gallica* in Europe and Western Asia.

63. *ROSA ALBA*, *Linn.* B. P., vol. i, p. 467: "In gardens." Watt, Ec. Dict., vol. vi, i, p. 559. Boissier states it to be a native of Iberia in the Caucasus and of Pontus. Roxb., F. I., p. 407: "Rosa glandulifera. Where this plant is indigenous, I don't know; probably in China, as I know it has been brought from thence to the Botanic Garden at Calcutta." It has reached Upper India probably over Persia and Afghanistan.

64. *ROSA RUBIGINOSA*, *Linn.* Firminger, Gardening, 3rd ed., p. 470: "Sweetbriar. Common in all parts of India." Voigt, H. S. C., p. 194: "England." Its native country extends from the Canary Islands and England to the Caucasus, Persia and Arabia petraea.

65. *ROSA SINICA*, *Ait.* F. B. I., ii, 364. Firminger, Gardening, p. 471: "Rosa ternata. A common plant about Calcutta. Voigt, H. S. C., p. 195: "Rosa ternata Pais." Roxb., F. I., p. 408: "Rosa triphylla, R. From China this very extensive rambler was brought to the Botanic garden at Calcutta, previous to 1794, and is known to the Chinese gardeners in the garden by the name *Tsha-te-bay-ju*."

66. *ROSA MULTIFLORA*, *Thunb.* Firminger, Gardening, p. 471. F. B. I., ii, 364: "Japan, China." Voigt, H. S. C., p. 194. Not mentioned by Roxburgh.

67. *ERIOBOTRYA JAPONICA*, *Lindley.* B. P., vol. i, p. 468: "Cultivated. The Loquat." Watt, Ec. Dict., vol. iii, p. 257: "Introduced from Japan. Extensively cultivated for its fruit." F. B., ii, 372. Voigt, H. S. C., p. 198. Roxb., F. I., p. 106: "Mespilus japonica. From China it was introduced into Bengal, where it is much cultivated."

68. *FRAGARIA VESCA*, *Linn.* B. P., vol. i, p. 465: "Cultivated in the cold season in the western provinces." Indigenous in Europe and temperate Asia including the Himalaya. Voigt, H. S. C., p. 196. Roxb., Hort. Beng., p. 39.

COMBRETACEÆ.

69. *QUISQUALIS INDICA*, *Linn.* B. P., vol. i, p. 484: "In gardens everywhere." Watt, Ec. Dict., vol. vi, i, p. 388: "Indigenous to the Malay Peninsula." F. B. I., ii: "Wild probably in the Transgangetic Peninsula. Wild in Malaya." Voigt, H. S. C., p. 39: "Moluccas, Moulmein, Singapur.

Malacca, Pegu." Roxb., F. I., p. 379: "A native of Amboyna." Rumph., Herb. Amb., v, t. 38. Brandis considers it to be indigenous in the Eastern Peninsula, the Philippines, and in Western Tropical Africa.

MYRTACEÆ.

70. MELALEUCA LEUCODENDRON, *Linn.* B. P., vol. i, p. 486: "C. Bengal, in parks and gardens." Watt, Ec. Dict., vol. v, p. 204. F. B. I., ii, 465. Voigt, H. S. C., p. 45. Roxb., F. I., pp. 590-592: "Melaleuca Cajuputi and Melaleuca Leucodendron. This species (*M. Leucodendron*) was introduced into the Botanic Garden in 1811, whereas *M. Cajuputi* has been there since 1797-8." The genus *Melaleuca* is eminently Australian, but *M. Leucodendron* extends from New South Wales and West Australia over New Caledonia and the Malayan Archipelago to the Philippines and Further India. Firminger, Gardening, 5th ed., p. 568: "Numerous plants spring up self-sown."

71. PSIDIUM GUYAVA, *Linn.* B. P., vol. i, p. 487: "Naturalised and planted in all provinces. The Guava." F. B. I., ii, 468: "Indigenous in Mexico and possibly in other parts of Tropical America. In India it often grows wild, but there are no grounds for supposing that the Guava is indigenous in India (*Brandis*)." Royle surmises that the Guava was introduced into India by the Portuguese. Roxb., F. I., p. 396: "Psidium pyriterum, *Linn.*, and Psidium pomiferum, *Linn.*" In discussing the original home of the Guava tree it must be remembered that everyone of the more than hundred species of Psidium is indigenous within the area extending from Paraguay to Mexico and the Antilles.

72. PIMENTA OFFICINALIS, *Berg.* B. P., vol. i, p. 487: "Occasionally planted in native gardens, especially in the Eastern Provinces." F. B. I., ii, 462: "Allspice, a West Indian tree, is much cultivated for the sake of its aromatic leaves and berries." Voigt, H. S. C., p. 47: "Jamaica." Roxb., Hort. Beng., p. 37.

73. MYRTUS COMMUNIS, *Linn.* B. P., vol. i, p. 488: "In hedges: Behar, Tirhut. Myrtle." Watt, Ec. Dict., vol. v, p. 316: "Indigenous in the area extending from the Mediterranean region to Afghanistan and Beluchistan." Voigt, H. S. C., p. 46. Roxb., F. I., p. 402: "Common in gardens."

74. EUGENIA MALACCENSIS, *Linn.* B. P., vol. i, p. 490: "Planted in E. and C. Bengal." Watt, Ec. Dict., vol. iii, p. 288: "It is a native of the Malay Islands, and is now cultivated in Bengal and Burma, chiefly in gardens." F. B. I., ii, 471. Voigt, H. S. C., p. "Moluccas. Cultivated." Roxb., F. I., p. 397: "In Bengal it blossoms and bears fruit at different periods of the year." Rumphius, Herb. Amb., i, t. 37. Rheede, Hort. Mal., i, t. 18.

TURNERACEÆ.

75. TURNERA ULMIFOLIA, *Linn.* B. P., vol. i, p. 511: "In most of the provinces; an escape from the Gardens." Firminger,

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Gardening, p. 407: "Met with growing out of old walls about Calcutta." Voigt, H. S. C., p. 85: "Jamaica. Domesticated about Serampore." *Turnera ulmifolia* is indigenous in the area extending from Argentina to Mexico and the Antilles. Naturalised in the Seychelles and in Indo-Malaya.

76. *TURNERA TRIONIFLORA*, Sims. Firminger, Gardening, p. 406: "Native of Brazil." Voigt, H. S. C., p. 85: "Brazil, Trinidad, Mexico. Domesticated about Serampore." Not known whether it occurs as an escape at the present day.

77. *PUNICA GRANATUM*, Linn. Watt, Ec. Dict., vi, I, p. 369: "Cultivated, or spontaneous throughout India." Voigt, H. S. C., p. 50. Roxb., F. I., p. 402. Wild in Persia, Afghanistan, and Kurdistan. Has been cultivated in India from very old times.

PASSIFLORACEÆ.

78. *PASSIFLORA SUBEROSA*, Linn. B. P., vol. i, p. 512: "C. and E. Bengal; Sundribuns; Chittagong. A native of America, but quite naturalised." F. B. I., ii, 599. Voigt, H. S. C., p. 80. Roxb., Hort. Beng., p. 49.

79. *PASSIFLORA FETIDA*, Linn. B. P., vol. i, p. 512: "A native of America, but fairly naturalised." F. B. I., ii, 599. Voigt, H. S. C., p. 80: "W. Indies."

80. *PASSIFLORA ADENOPHYLLA*, Mast. B. P., i, p. 513: "N. Bengal, naturalised. A garden escape." Not referred to by Voigt.

81. *PASSIFLORA QUADRANGULARIS*, Linn. B. P., i, p. 513: "N. Bengal, naturalised. A garden escape." Voigt, H. S. C., p. 81: "Jamaica."

82. *CARICA PAPAYA*, Linn. B. P., i, p. 514: "Generally cultivated and often subsponaneous. Native of America." F. B. I., ii, 599. Roxb., F. I., p. 736. Watt, Ec. Dict., vol. ii, p. 159, states that in 1626 seeds were sent from India to Naples.

CACTACEÆ.

83. *OPUNTIA DILLENI*, Haw. B. P., vol. i, p. 531. Watt, Ec. Dict., vol. v, p. 490: "Indigenous in America, but naturalised all over India, from Bengal and Madras to the Panjab. It is most probable that it was introduced by the Portuguese. When the cochineal insect was brought to India in 1795, this species of *Opuntia* was then so prevalent in India as to lead the writers of that date to speak of it as an indigenous species." F. B. I., ii, 657: "An American plant." Voigt, H. S. C., p. 62: "South America. Domesticated all over India." Roxb., F. I., p. 395: "Cactus indicus."

ARALIACEÆ.

84. *POLYSCIAS FRUTICOSA*, (Linn.). B. P., vol. i, p. 543: "*Panax fruticosum*, Linn. Cultivated." F. B. I., ii, 725: "Throughout the warmer parts of India, cultivated. Distr. Malaya

and Polynesia, cultivated; wild state unknown." Voigt, H. S. C., p. 24: "Moluccas, Java." Roxb., F. I., p. 266: "This elegant shrub was introduced into the Botanic Garden near Calcutta from the Moluccas in 1798." Rumphius, Herb. Amb, iv, t. 33. Evidently indigenous in Ternate, Amboina, Java, New Guinea.

RUBIACEÆ.

85. *HAMELIA PATENS*, Jacq. B. P., vol. i, p. 563: "A favourite shrub in gardens; often also spontaneous near villages in C. Bengal." Firminger, Gardening, p. 586: "No plant is more easily propagated either by cuttings or by seed." Voigt, H. S. C., p. 385: "S. America. Flowered 1840." *Hamelia patens*, a species rich in varieties, is indigenous in the area extending from Paraguay to the Antilles and Mexico. Now establishing itself in village shrubberies about Calcutta.

86. *GARDENIA FLORIDA*, Linn. B. P., vol. i, p. 565: "In gardens." Watt, Ec. Dict., vol. iii, p. 480: "A handsome shrub, which, though native of China, is now extensively cultivated in India." Voigt, H. S. C., p. 377: "China. Cultivated in Japan, the Moluccas, India." F. B. I., iii, 115. Roxb., F. I., p. 236: "A shrub found in gardens about Calcutta and originally from China." Rumphius, Herb. Amb., vii, 26, t. 14, f. 2. *Gardenia florida* has become naturalised in Tropical America.

87. *IXORA STRICTA*, Roxb. B. P., vol. i, p. 571: "Planted in most provinces." F. B. I., iii, 145: "Cultivated in various parts of India, but a native of the Moluccas and China according to Roxburgh. Kurz regards it as indigenous in Rangoon and Upper Tenasserim." Voigt, H. S. C., p. 389: "China, Manilla, Moluccas, Cochin China." Roxb., F. I., p. 127: "This beautiful plant was brought to the Botanic Garden from the Moluccas in 1798. In the Botanic Garden there is a more ramous variety of this charming plant introduced from China." Rumphius, Herb. Amb., iv, 107, t. 47: "*Flamma sylvarum peregrina*."

88. *VANGUERIA EDULIS*, Vahl. B. P., vol. i, p. 575: "Cultivated occasionally. Native of Madagascar." F. B. I., iii, 136. Voigt, H. S. C., p. 386: "Madagascar, from whence it has been introduced into the Mauritius, China, etc. Has been introduced into Honorable Company's Garden." Not enumerated by Roxburgh.

COMPOSITE.

89. *EUPATORIUM AYAPANA*, Vent. B. P., vol. i, p. 592: "Cultivated in C. and E. Bengal." Watt, Ec. Dict., vol. iii, p. 293: "A small aromatic shrub naturalised in many parts of India." F. B. I., iii, 244. Voigt, H. S. C., p. 407: "Eupatorium triplinerve, Vahl (E. Ayapana, Vent). Banks of the Amazon river. In India and America formerly employed against snake-bite." Not enumerated in Roxb., F. I., but in Roxb., Hort. Beng., p. 61. A native of Equatorial America, but cultivated in the West Indies, Mauritius, Bourbon and India.

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90. *EUPATORIUM ODORATUM*, *Linn.* B. P., vol. i, p. 592: "Cultivated sparingly in C. and E. Bengal." F. B. I., iii, 244. Voigt, H. S. C., p. 407: "Jamaica." It was not grown then in Serampore. Roxburgh does not enumerate it.

91. *MIKANIA SCANDENS*, *Willd.* B. P., vol. i, p. 592: "C. Bengal, locally quite naturalised." F. B. I., iii, 244: "Native from Eastern Assam to the Malay Archipelago and the Philippines." Not known to Voigt as occurring in Bengal and not grown in the Serampore garden in his time.

92. *FLAVERIA REPANDA*, *Lagasc.* B. P., vol. i, p. 606: "W. Behar, rare. An introduced weed; slowly spreading eastwards from the Deccan, where it is now common." Not mentioned in the F. B. I., nor by previous writers. A native of Tropical America.

93. *TAGETES PATULUS*, *Linn.* B. P., vol. i, p. 607: "Cultivated, but often also an escape." Watt, Ec. Dict., vol. vi, 3: "African and French Marigolds are quite naturalised in India." Firminger, Gardening, p. 319: "The plants where once grown, continually reproduce themselves by self-sown seeds." Voigt, H. S. C., p. 416: "French Marigold. Mexico." Roxb., F. I., p. 604.

94. *TAGETES ERECTUS*, *Linn.* Perhaps a variety of the former. Hoffmann, in Engler's Pflanzenfamilien, keeps them separate. Voigt, H. S. C., p. 417: "African Marigold. Mexico. Domesticated in India." Roxb., F. I., p. 604: "If originally from Mexico, like Tobacco, they (*T. patulus* and *T. erectus*) have now become denizens of the East and considered as indigenous, particularly in Persia and China." Watt, Ec. Dict., vol. vi, 3, p. 403: "*Rojia*, the name current in Western India, perhaps denotes the introduction of the plant by the Portuguese with whom it appears to represent the *Rosa de ouro* or golden rose, which the Pope usually blesses at mass on a Sunday in Lent (*Dymock*)." Is it mentioned in Sanskrit literature? It is quite possible that it has reached different parts of India by different channels.

95. *XANTHIUM SPINOSUM*, *Linn.* B. P., vol. i, p. 608: "C. Bengal; occasional in waste places. A native of Southern Europe, recently introduced." Not mentioned in F. B. I., nor by Voigt.

96. *LAGASCEA MOLLIS*, *Cav.* B. P., vol. i, p. 608: "C. Bengal. An introduced weed of cultivated places." F. B. I., iii, 302: "A weed in cultivated places in various parts of India. Indigenous in Central America, introduced in various warm countries." Voigt, H. S. C., p. 406: "Hills of Cuba, and at St. Fe, in Mexico." Not mentioned by previous writers.

97. *ZINNIA ELEGANS*, *Jacq.* Firminger, Gardening, p. 317: "In a spot where once grown, Zinnia plants are sure to come up self-sown the following season." Indigenous in America. Voigt, H. S. C., p. 413: "Mexico."

98. *ZINNIA PAUCIFLORA*, *Linn.* B. P., vol. i, p. 609: "In gardens in every province, but occasionally springing up spontaneously." Voigt, H. S. C., p. 413: "Peru." This species has a wide distribution in the warmer parts of Western America and has established itself in the Cape Verde Islands.

99. *COSMOS SULFUREUS*, Cav. B. P., vol. i, p. 616: "Chota Nagpur; C. Bengal. A weed in waste places; native of America." Voigt, H. S. C., p. 416: "Mexico." *Cosmos caudatus*, H. B. K., which has spread throughout the warmer parts of America and has become practically endemic in some parts of the Old World, should be looked for in India.

100. *TITHONIA TAGETIFLORA*, Desf. B. P., vol. i, p. 612: "In most of the provinces, cultivated." Not enumerated by Voigt, nor mentioned in Firminger, Gardening, 3rd edition. The plant is sometimes cultivated in Europe. It is a native of Mexico.

101. *HELIANTHUS ANNUUS*, Linn. B. P., vol. i, p. 613: "In gardens in all the provinces; cultivated only." Watt, Ec. Dict., vol. iv, p. 210: "Said to be a native of Mexico and Peru, and to have been introduced into Europe about the end of the sixteenth century. The *Āftābī*, or sunflower, is mentioned in the *Ain-i-Akbārī* as a flower cultivated for ornamental purposes during the reign of Akbar. In many hill-stations it is rapidly becoming naturalised." Voigt, H. S. C., p. 415. Roxb., F. I., p. 607: "Although originally from Peru, it may now be inserted here as an Indian plant."

102. *HELIANTHUS ARGYROPHYLLUS*, Torr. et Gray. B. P., vol. i, p. 613: "In gardens in all the provinces; cultivated and also freely springing up spontaneously in cultivated ground and waste places." Not enumerated by Voigt.

103. *HELIANTHUS TUBEROSUS*, Linn. B. P., vol. i, p. 613: "In gardens generally. The *Girasole* or Jerusalem Artichoke." Watt, Ec. Dict., vol. iv, p. 211: "The Jerusalem Artichoke was first introduced into Rome about 300 years ago and rapidly spread over Europe." Champlain, in 1603, found the root employed by the natives of North America as a vegetable. Voigt, H. S. C., p. 415: "Commonly cultivated in gardens."

104. *GUIZOTIA ABYSSINICA*, Cass. B. P., vol. i, p. 614: "Cultivated." Watt, Ec. Dict.: "Native of Tropical Africa, but extensively cultivated as an oil-seed in various parts of India." F. B. I., iii, 308. Voigt, H. S. C., p. 414: "Lower Bengal." Roxb., F. I., p. 606: "*Verbesina sativa*. In 1800, the seeds were received into the Botanic Garden from H. Colebrooke, Esq., the Resident at the court of the Berar Raja, and from Mr. Heyne at Bangalore."

105. *SYNEDELLA NODIFLORA*, Gaertner. B. P., vol. i, p. 615: "C. Bengal; in cultivated ground." F. B. I., iii, 308: "Tropical America." Not mentioned by Voigt and Roxburgh. Found in the whole of Tropical America.

106. *GALINSOGA PARVIFLORA*, Cav. B. P., vol. i, p. 618: "Appearing occasionally as a cold weather weed, but not persisting." Very common in the tea gardens of the Darjiling District. F. B. I., iii, 311: "Introduced from America." Not mentioned by Voigt. A native of Mexico, now in most of the temperate and warmer parts of the world.

107. *TRIDAX PROCUMBENS*, Linn. B. P., vol. i, p. 618: F. B. I., iii, 311: "Introduced from S. America." Wall, Cat., 3197.

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Voigt, H. S. C., p. 417: "Mexico, Vera Cruz. St. Martha. Cuba. Entirely naturalised in the Mauritius, in Tropical India, etc. In Serampore and its neighbourhood it is one of the worst weeds." Not mentioned by Roxburgh, which, considering that it is now exceedingly common in Sibpur, is very remarkable. Mr. Burkill has kindly given me the following additional information. He states that he believes that this plant has but recently arrived in Northern Bengal; thus in 1906 *Tridax procumbens* was only sparingly found along the railway lines near Jalpaiguri; in 1908 there was abundance of it by the bridge over the Murti River on the newer branch of the Bengal Duars Railway, but it appears to be still generally absent from the Duars and evidently a relatively new arrival even at Jalpaiguri. Mr. Burkill did not observe it at Siliguri in 1906.

108. *CHRYSANTHEMUM CORONARIUM*, *Linn.* B. P., vol. i, p. 619: "N. Bengal. An annual herb; a cold weather field crop." Watt, *Ec. Dict.*, vol. ii, p. 272: "A native of the Mediterranean region." *F. B. I.*, iii, 314. Voigt, H. S. C., p. 419. Roxb., *F. I.*, p. 604: "*Pyrethrum indicum*. A native of Bengal." The plant, although indigenous in the region extending from the Azorian Islands to Syria and Egypt, has become naturalised in various parts of the Old and New World.

109. *CHRYSANTHEMUM INDICUM*, *Linn.* Watt, *Ec. Dict.*, vol. ii, p. 272: "Commonly cultivated in Indian gardens, and is in fact only known in the garden state. It would appear that this and the preceding plant are not distinguished from each other by the natives of India." Voigt, H. S. C., p. 418. "China. Japar. Common in gardens." Roxb., *F. I.*, p. 604: "Common in gardens all over India." Rheede, *Hort. Mal.*, x, t. 44. Rumphius, *Herb. Amb.*, v, t. 91.

CAMPANULACEÆ.

110. *LOBELIA RADICANS*, *Thunb.* B. P., vol. i, p. 634: "Chota Nagpur; naturalised near Ranchi." Voigt, H. S. C., p. 367: "*Pratia radicans*, Don." Roxb., *F. I.*, p. 170: "Accidentally introduced from China into the Botanic Garden at Calcutta."

SAPOTACEÆ.

111. *ACHRAS SAPOTA*, *Linn.* B. P., vol. i, p. 648: "Cultivated. Native of America. The Sapota." Watt, *Ec. Dict.*, i, p. 80: "Introduced from America, and now cultivated throughout India." *F. B. I.*, iii, 534. Voigt, H. S. C., p. 339: "W. Indies. Cultivated throughout the hot parts of South America." Roxb., *F. I.*, p. 300: "A native of China, from thence introduced into the Botanic Garden at Calcutta, where growing in the same place with the West Indian tree they are not to be distinguished from it." *Achras Sapota* grows wild in the forests of the Antilles and is now cultivated in all tropical countries for the sake of its fruit.

EBENACEÆ.

112. *DIOSPYROS KAKI*, *Linn. f.* B. P., vol. i, p. 653: "Planted only in our area. Cultivated for its edible fruit." Watt, *Ec. Dict.*, vol. iii, p. 145: "Native of the Khasia Hills, Upper Assam, and Burma." Firminger, *Gardening*, p. 256: "Date-plum. Thrives well, and bears abundantly in the neighbourhood of Calcutta." Voigt, *H. S. C.*, p. 345. Roxb., *F. I.*, p. 412: "This tree is now pretty common about Calcutta." Roxburgh considered *Diospyros Kaki* to be a native of China, Japan, and "the mountains of Nepal to the northwards of Bengal." Hooker *f.* found it wild in various localities in the Khasia Hills: *F. B. I.*, iii, 556. It is very probable that *Diospyros Kaki* reached Bengal proper from China; the tree seems to have been cultivated for a long time in Japan, China and Tonkin.

113. *DIOSPYROS PHILIPPENSIS*, *Desr.* B. P., vol. i, p. 654: "D. discolor. Cultivated in C. Bengal." Watt, *Ec. Dict.*, vol. iii, p. 138: "Native of the Philippine Islands." Not mentioned in Firminger, *Gardening*, 3rd ed. *Diospyros philippensis* is cultivated in various parts of S. E. Asia, in Mauritius, the Seychelles, and in Brazil.

APOCYNACEÆ.

114. *ALLAMANDA CATHARTICA*, *Linn.* B. P., vol. ii, p. 667: "Planted in gardens; occasionally naturalised in C. and E. Bengal." Watt, *Ec. Dict.*, vol. i, p. 168: "Run wild in the tidal backwaters of the western coast (*Beddome*)." Voigt, *H. S. C.*, p. 528: "This shrub was introduced from Guiana into India in 1803, and is now very common in gardens." Roxb., *Hort. Beng.*, p. 19. The original home of this species extends from Brazil to Central America and the West Indies.

115. *THEVETIA NERIFOLIA*, *Juss.* B. P., vol. ii, p. 669: "In gardens in all the provinces." Voigt., *H. S. C.*, p. 531: "New Granada, etc. Domesticated about Serampore." It is indigenous in North, Central, and South America from Mexico and the Antilles to Brazil. Roxburgh does not mention the plant.

116. *PLUMIERIA ACUTIFOLIA*, *Poiret.* B. P., vol. ii, p. 670: "Planted everywhere in gardens and near temples." Watt, *Ec. Dict.*, vol. vi, 1, p. 297: "Dr. Hove in 1787 found the tree growing abundantly on Malabar Hill." Voigt., *H. S. C.*, p. 528: "Cultivated in China, India, the Moluccas, etc., where it is thoroughly domesticated. It is, however, no doubt, with the other Plumieras a native of S. America or the W. Indies." *F. B. I.*, iii, p. 641. Roxb., *F. I.*, p. 248: "This very elegant, small tree does not appear to be a native of this part of India. I have only found it in gardens; but there it is very common, which shows it to be of considerable antiquity." This species is almost certainly a native of Mexico.

117. *RAUWOLFIA CANESCENS*, *Linn.* B. P., vol. ii, p. 671: "C. Bengal, cultivated and at times naturalised. Native of West Indies." Voigt, *H. S. C.*, p. 532: "Jamaica," Indigenous in the Antilles and on the neighbouring South American Main.

118. *LOCHNERA ROSEA* (*Linn.*). *B. P.*, vol. ii, p. 672: "Vinca rosea. Planted everywhere in gardens and near temples, also often subspontaneous. Native of West Indies." Its present distribution comprises the whole of the Tropics where it is frequently naturalised, but it seems to be really indigenous in the Antilles only. *Watt, Ec. Dict.*, vol. vi, 4, p. 244: "Occasionally domesticated in waste places near villages." *Voigt* supposes it to be a native of Cochin China. *Roxb., F. I.*, p. 242: "Both the red and white varieties are common in gardens over India. I have never found it in its native state."

119. *VALLARIS PERGULANA*, *Burm.* *B. P.*, vol. ii, p. 675: "Occasionally cultivated." *F. B. I.*, iii, 651: "I doubt the species being British Indian." It is a native of the Malay Archipelago. *Voigt, H. S. C.*, p. 524. *Roxb., F. I.*, p. 247: "A native of Bengal, but scarce." *Rumph., Herb. Amb.*, 5, t. 29.

120. *ROUPELLIA GRATA*, *Wall.* *B. P.*, vol. ii, p. 677: "Frequently planted." *Strophanthus gratus*, *Baillon*. A native of West Africa from the Gaboon to Senegambia. *Firminger, Gardening*, 3rd ed., p. 498: "In the cold season large plants will occasionally bear a seed-pod or two." Not mentioned in *Voigt, H. S. C.* nor in *F. B. I.*, nor in *F. I.*

ASCLEPIADACEÆ.

121. *CRYPTOSTEGIA GRANDIFLORA*, *R. Br.* *B. P.*, vol. ii, p. 684: "In gardens in most of the provinces. Native of Africa or of Madagascar." *F. B. I.*, iv, 6: "Supposed to be a native of Africa or Madagascar, from which latter country another species is described, but this is only known from Mauritius garden specimens." *Voigt, H. S. C.*, p. 544. *Roxb., F. I.*, p. 245. *Roxburgh* thought this species to be a native of the Peninsula of India. The other species referred to is *C. madagascariensis*, *Boj.*, which has lately been found to grow wild in Madagascar.

122. *ASCLEPIAS CURASSAVICA*, *Linn.* *B. P.*, vol. ii, p. 689: "Native of America." *F. B. I.*, iv, p. 18: "A weed introduced from the West Indies throughout the Tropics. *Voigt, H. S. C.*, p. 539: "Curaçao, Essequibo, Cumana, Trinidad." *Roxb., Hort. Beng.*, 20.

123. *STEPHANOTIS FLORIBUNDA*, *Thouars.* *B. P.*, vol. ii, p. 695: "Native of Madagascar." Not mentioned in *F. B. I.*, nor in *Voigt's H. S. C.*, nor by *Roxburgh*. *Firminger, Gardening*, 3rd ed., p. 504.

POLEMONIACEÆ.

124. *PHLOX DRUMMONDI*, *Hook.* *B. P.*, vol. ii, p. 710: "Occasionally subspontaneous on rubbish heaps in C. Bengal, but only the white-flowered form. Native of N. America." Not mentioned by *Voigt*.

BORAGINACEÆ.

125. *HELIOTROPIMUM CURASSAVICUM*, *Linn.* *Voigt, H. S. C.*, p. 444: "S. America, etc. Domesticated about Serampore." *Col.*

Prain does not include the plant in his treatise ; it has probably disappeared, but it should be searched for.

126. *EVOLVULUS NUMMULARIUS*, *Linn.* B. P., vol. ii, p. 726 : " A native of the West Indies, now completely naturalised and rapidly spreading." Mentioned neither in F. B. I., nor in Voigt, nor in Roxburgh, F. I. It must therefore be of comparatively recent introduction. I have observed it within the precincts of the Engineering College, Sibpur, and in the Botanic Gardens for about twenty years. It is common on grass plots about Calcutta and prefers tennis grounds. It is found hanging down the side of tiled drains from the edges, and the frequent mowing or cutting of the grass of grassy plots seems to favour its growth and spread, as the cutting tool does not touch it. Although its delicate roots penetrate but slightly into the soil, it succeeds in weathering even such seasons of intense heat and dryness as India experienced in the earlier parts of the present year, always looking cheerfully fresh and green except during the hottest part of the day, when its leaves become flaccid, to refresh themselves again by and in the dew of the following night. It will be exceedingly interesting to watch its gradual spread in this country. Mr. Burkill has kindly supplied me with the following additional information. *Evolvulus nummularius* is advancing in two directions—in the direction of the North-West Provinces, and in the direction of Assam. In the first direction we find it to be common near Bardwán along the Grand Trunk Road under planted trees. Similarly it is found in Arisah in a planted avenue under Pipal trees ; at Tarkaulia Factory in the District of Champáran and at Keota Factory, Dalsing Serai, in the District of Darbhanga, it has settled down under planted Mango trees. East of the Hughli we notice it growing in great abundance in the Park at Barrackpur ; at Cháudanga in the Nadia District it has taken root under young Mango trees, whilst half-way between Pachuria and Goálando in the District of Faridpur Mr. Burkill found a single patch of the *Evolvulus*, about a yard across, growing on the railway embankment far away from trees. Col. Prain once received it from a correspondent at Gauháti, Assam, but it was not stated whether the specimen had been gathered at Gauháti or elsewhere.

127. *JACQUEMONTIA CERULEA*, *Choisy.* B. P., vol. ii, p. 728 : " In gardens, general." F. B. I., iv, 220 : " Cultivated often in India." Voigt, H. S. C., p. 364, enumerates it as desirable : " Guinea." Not in Firminger's Gardening, 5th ed.

128. *IPOMŒA TRICOLOR*, *Oav.* B. P., vol. ii, p. 736 : " In gardens. Native of America. This species, though of recent introduction, is now one of the most favourite of annual trellis climbers." Not mentioned by Voigt. A native of Mexico.

129. *IPOMŒA LEARII*, *Paxt.* B. P., vol. ii, p. 734 : " A favourite garden plant ; semi-naturalised in Chittagong." Not in Voigt's H. S. C. A native of Argentina.

130. *IPOMŒA NIL* (*Linn.*). B. P., vol. ii, p. 734 : " In gardens in all the provinces ; as if wild at times in the western parts." F. B. I., iv, 199 : " I. hederacea. Probably an American plant,

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naturalised in the Old World." Roxb., F. I., p. 168: "I. cœrulea, König." A native of Tropical America.

131. *IPOMŒA PURPUREA*, Lamk. B. P., vol. ii, p. 735: "This, though often found growing as if wild in the Himalayas, is only to be met with in gardens in the plains." F. B. I., iv, 200: "Tropical America; extensively cultivated in all warm countries." Voigt, H. S. C., p. 354: "Pharbitis purpurea. S. America." Roxb., Hort. Beng., p. 14. A native of Brazil and other parts of Tropical South America.

132. *IPOMŒA BATATAS*, Lamk. B. P., vol. ii, p. 735: "Cultivated occasionally, especially in the western provinces." Watt, Ec. Dict., vol. iv, p. 478: "Originally a native of Tropical South America." F. B. I., iv, 202. Roxb., F. I., p. 162. Rheede, Hort. Mal., vii, 35. Rumphius, Herb. Amb., v, t. 130. Possibly native of Central America (Honduras).

133. *QUAMOCLIT COCCINEA*, Manch. B. P., vol. ii, p. 737: "Quamoclit phœnicea, Choisy. In all provinces, cultivated and naturalised." F. B. I., iv, 199: "Ipomœa coccinea. Cultivated and quasi-wild throughout India, erroneously supposed by Roxburgh to be a native of Coromandel. Introduced from Tropical America." Roxb., F. I., p. 169: "Ipomœa phœnicea, R. This plant has also been reared from seeds received from the Island of Trinidad." Roxb., Hort. Beng., 14. Not referred to by Rheede. Whilst there can be hardly any doubt about *Quamoclit coccinea* being a native of Tropical America, it is very different with *QUAMOCLIT PENNATA* (Lamk.), *Q. pinnata*, Bojer, *Q. vulgaris*, Choisy. B. P., vol. ii, p. 738: "In most of the provinces, cultivated and naturalised." It is certain not to be a native of Bengal, but Roxburgh may be quite correct when he, in F. I., p. 169, declares it to be a native of India. It was known to Rheede (Hort. Mal., xi, 123, t. 60) and Rumphius (Herb. Amb., v, 155, t. 2).

SOLANACEÆ.

134. *SOLANUM LYCOPERSICUM*, Linn. B. P., vol. ii, p. 743: "Cultivated and sometimes an escape." Watt, Ec. Dict., vol. v, p. 100: "Introduced from South America." F. B. I., iv, 237: "Cultivated and an escape." Voigt, H. S. C., i, p. 513: "Domesticated in India." Roxb., F. I., p. 190: "Although this is now very common in India, I suspect it is as little a native as the common potato, which is now very generally cultivated over India, even by natives, for their own use." Rumph., Herb. Amb., v., t. 154. Probably indigenous in the western parts of South America.

135. *SOLANUM TUBEROSEUM*, Linn. B. P., vol. ii, p. 745: "Cultivated sparingly." A native of Chili, Peru, and New Granada. According to Watt the cultivation of the potato was probably introduced into India some time between the end of the sixteenth and the beginning of the eighteenth century. The potato was probably introduced into India by the Portuguese, as it was cultivated on the Iberian Peninsula a considerable time before Walter Raleigh introduced it into Ireland. See Roxburgh's remark under *Lycopersicum esculentum*.

136. *SOLANUM SISYMBRIFOLIUM*, *Lamk.* B. P., vol. ii, p. 746 : "An escape: native of America." Not mentioned in F. B. I., nor by Voigt, nor Roxburgh.

137. *CAPSICUM ANNUM*, *Linn.* B. P., vol. ii, p. 748 : "Cultivated sparingly in gardens of Europeans." Watt, *Ec. Dict.*, vol. ii, p. 135 : "A native of equinoctial America, most probably of Brazil." Hove states that capsicums were grown in Bombay in 1787.

CAPSICUM ANNUM, *var. ACUMINATUM*, *Fingerhut.* B. P., vol. ii, p. 748 : "Cultivated generally. There is little doubt that the forms (*Gachh mirich*, *Lal gachh mirich*, *Lanka mirich*, and *Lal Lanka mirich*) have been evolved since *C. annum* was first introduced into India, for in America they are only known as having been raised from Indian seeds." This is the *Capsicum frutescens* of F. B. I., iv, 239 and F. I., p. 193.

CAPSICUM ANNUM, *var. ABBREVIATUM.* B. P., vol. ii, p. 748 : "Cultivated sparingly in the gardens of Europeans. This includes the majority of the pungent forms of chillie usually raised from European seed." Roxb., F. I., p. 193 : "This does not appear to be a native of India as the Hindoos have no name for it, nor is it even found in their gardens. In India the *capsicums* are all shrubby and they are seldom suffered to remain longer than one season."

CAPSICUM ANNUM, *var. GROSSUM*, *Sendt.* B. P., vol. ii, p. 748 : "Cultivated in gardens, both European and native." *Capsicum grossum.* F. B. I., iv, 239. Roxb., F. I., p. 193 : "The plant does not appear to me a native of India."

CAPSICUM ANNUM, *var. CERASIFORME.* B. P., vol. ii, p. 749 : "Cultivated occasionally in European gardens. Cherry pepper." F. B. I., iv, 239. Roxb., F. I., p. 193 : "Capsicum cerasiforme. I doubt much whether this be a native of India, for I have only found it in the gardens of the curious."

CAPSICUM ANNUM, *var. NIGRUM.* B. P., vol. ii, p. 749 : "Cultivated occasionally in native gardens. Purple chillie." Roxb., F. I., p. 192 : "Capsicum purpureum. In 1796, I found a single plant of this species in the garden."

138. *CAPSICUM FRUTESCENS*, *Linn.* B. P., vol. ii, p. 749 : "Cultivated, but not very extensively; quite naturalised in waste places in all provinces. Birds'-eye chillie." *C. minimum*, F. B. I., iv, 239. Roxb., F. I., p. 193. East Indian Bird Chilly.

CAPSICUM FRUTESCENS, *var. BACCATUM*, *Irish.* B. P., vol. ii, p. 749 : "Cultivated occasionally. Brazil pepper or pimentas." F. B. I., iv, 239 : *Capsicum minimum*, in part.

139. *PHYSALIS PERUVIANA*, *Linn.* B. P., vol. ii, p. 750 : "In all provinces, cultivated in gardens." The Tipari or Cape gooseberry. Watt, *Ec. Dict.*, vol. vi, 1, p. 225 : "Occasionally spontaneous from cultivation." F. B. I., iv, 238. Voigt, H. S. C., p. 314. Roxb., F. I., p. 189 : "I have found this only in the cultivated state." A native of America.

140. *NICOTIANA RUSTICA*, *Linn.* B. P., vol. ii, p. 752 : "In all the provinces sparingly cultivated, except in N. Bengal, where its

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cultivation is general." Watt, Ec. Dict., vol. v, p. 352: "Believed to be a native of Mexico, and according to De Candolle, it is probably indigenous in California." F. B. I., iv, 245. Voigt, H. S. C., p. 516. Roxb., Hort. Beng., p. 16.

141. *NICOTIANA TABACUM*, *Linn.* B. P., vol. ii, p. 752: "In all provinces, generally cultivated, but most extensively in N. Bengal." Watt, Ec. Dict., vol. v, p. 353: "De Candolle gives Ecuador and the neighbouring countries as the region where it probably had its origin." F. B. I., iv, 245. Voigt, H. S. C., p. 516. Roxb., Hort. Beng., p. 16.

142. *NICOTIANA PLUMBAGINIFOLIA*, *Viv.* B. P., p. 752: "Though now so general a weed, this plant is not alluded to by Roxburgh; it is not, however, certain that it is an introduction subsequent to Roxburgh's time, because the genus *Nicotiana* is omitted from the Flora Indica; though it is probable, because Roxburgh enumerates the two preceding species (*N. rustica* and *N. Tabacum*) in the Hortus Bengalensis, but omits this one." F. B. I., iv, 246: "Bengal, a common introduced weed. Native of Mexico and the W. Indies. The only species of *Nicotiana* that has established itself in India." Voigt, H. S. C., p. 516: "Rio Grande. Domesticated about Serampore."

143. *BROWALLIA ELATA*, *Linn.* B. P., vol. ii, p. 753: "In gardens in the cold season; often occurring spontaneously in garden beds and on rubbish heaps. Native of Peru." Voigt, H. S. C., p. 500. Roxb., Hort. Beng., p. 45.

SCROPHULARIACEÆ.

144. *ANTIRRHINUM MAJUS*, *Linn.* B. P., vol. ii, p. 758: "In gardens during the cold season; subsontaneous in some parts of India, but not so in Lower Bengal." F. B. I., iv, 253. Voigt, H. S. C., p. 499. A native of the Mediterranean Region. It would be interesting to know whether *Antirrhinum majus* (the snap-dragon) ever occurs as an escape in Bihar or Chota Nagpur as it does in the Nilgiris.

145. *RUSSELIA JUNCEA*, *Jacq.* B. P., vol. ii, p. 758: "In gardens, very common." Firminger, Gardening, 5th ed., p. 470: "Every portion of it that touches the ground in the rains takes root. Voigt, H. S. C., p. 501: "Mexico."

146. *HERPESTIS CHAMÉDROIDES*, *Linn.* B. P., ii, p. 765: "C. Bengal. A small weed of garden paths, of recent introduction, but now thoroughly naturalised. Native of America." Not referred to in Voigt, H. S. C.

147. *TORRENIA FOURNIERI*, *Linn.* B. P., ii, p. 767: "An annual which springs up spontaneously in garden beds and waste places. Native of Cochin China." Not mentioned by Voigt.

148. *SCOPARIA DULCIS*, *Linn.* B. P., ii, p. 772, without any remark. F. B. I., iv, 289: "Plains of Bengal, abundant, Clarke, Distr. Tropics of America and sporadically in Africa, Asia, and Australia. Though now a superabundant Bengal plant, it was unknown in Roxburgh's time, and occurs in no Indian Herbarium

except Clarke's." Voigt, H. S. C., p. 507: "Native of every part of the world within the Tropics, common particularly near the sea. About Serampur. An infusion of the plant is used by the Indians of S. America to cure agues (*Thunb.*)." Sir Joseph Hooker in F. B. I. suggests that the plant has spread from Serampore. It is certainly remarkable that Roxburgh does not mention the plant as it is now very common about Sibpur, as in other parts of Bengal.

BIGNONIACEÆ.

149. *MILLINGTONIA HORTENSIS*, *Linn. f.* B. P., vol. ii, p. 788: "Planted along roadsides and in gardens, also often occurring spontaneously." Watt, *Ec. Dict.*, vol. v, p. 247. F. B. I., iv, 377: "Burma. Planted extensively in India, and in other tropical countries. Perhaps wild also in Central India and on the Upper Godavery." Voigt, H. S. C., p. 476. under *Bignonia suberosa*. Roxb., F. I., p. 495: "The native country of this beautiful tree I have not been able to discover; all I can learn is that some plants or seeds were brought from the Raja of Tanjore's garden to Madras, from thence one plant was procured for the Company's Botanic Garden in Calcutta, about fifteen years ago." Roxb., *Coromandel plants*, 3, t. 214.

150. *TECOMA STANS*, *Linn.* B. P., vol. ii, p. 788: "In gardens, general." Voigt, H. S. C., p. 479: "W. Indies, Mexico. Introduced at Bombay."

151. *CAMPSIS GRANDIFLORA* (*Thunb.*). Firminger, *Gardening*, p. 540: "*Tecoma grandiflora*. It bears seed abundantly in November." Voigt, H. S. C., p. 478. Roxb., F. I., p. 493: "A native of China; runs over bushes, etc." *Campsis grandiflora* is indigenous in Japan.

152. *CAMPSIS RADICANS* (*Linn.*). Firminger, *Gardening*, p. 540: "*Tecoma radicans*. Emitting roots from its branches wherever they touch the ground." Voigt, H. S. C., p. 478. Roxb., *Hort. Beng.*, p. 47. This species is a native of the United States, from Illinois to Florida.

MARTYNIACEÆ.

153. *MARTYNIA ANNUA*, *Linn.* (*Martynia diandra*, *Glox.*) B. P., vol. ii, p. 791: "Chota Nagpur, very common on roadsides and near villages." Also found by the writer in N. Bengal. Watt, *Ec. Dict.*, vol. v, p. 192: "An American weed (called Tiger Claw or Devil's Claw) is now common in the Gangetic plain and elsewhere in India." Voigt, H. S. C., p. 475: "Mexico. Domesticated about Serampore." Roxb., *Hort. Beng.*, p. 45. This species, although having its probable home in Mexico, is now a tropical cosmopolitan.

ACANTHACEÆ.

154. *RUELLIA TUBEROSA*, *Linn.* B. P., ii, p. 803: "Occasionally naturalised. Native of America." Found along the Howrah Botanical Garden road not far from the northern gate of the Civil Engineering College. Not mentioned by Voigt.

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155. *LANTANA TRIFOLIA*, *Linn.* B. P., ii, p. 824: "Naturalised, native of America." F. B. I., iii, 563. Voigt, H. S. C., p. 472: "West Indian mountains." Roxb., Hort. Beng., p. 46.

156. *LANTANA CAMARA*, *Linn.* B. P., ii, p. 825: "In the central and eastern provinces frequently, in the western parts only occasionally naturalised." F. B. I., iv, p. 562: "An American plant, has run wild in India, especially in the W. Deccan and Ceylon." Voigt, H. S. C., p. 472: "L. aculeata, L. Jamaica and most W. Indian Islands, where it is called *Wild Sage*, on account of its strongly aromatic smell." Roxb., Hort. Beng., p. 46. Of some interest is also *LANTANA INDICA*, *Roxb.* This grows in most parts of Bengal. In the Flora of British India it is stated that it is common in the warmer parts of India and Ceylon, and one of the commonest weeds on the river banks of Bengal. It appears, however, that the shrub has spread in Bengal only in recent times; for Roxburgh says that it is a native of Mysore, whence Dr. Heyne sent seeds to the Botanic Garden at Calcutta, "where the plants thrive luxuriantly." It does not appear to have been a common plant in Bengal in 1840, for the only remark that stands against *Lantana indica* in Voigt's H. S. C. is: "Mysore. Common about Dharwar. Fl. small, light purple, inodorous. R. S.; fr. 0."

157. *STACHYTARPHETA INDICA*, *Vahl.* B. P., ii, p. 826: "Naturalised; often also cultivated in native gardens. Native of America." F. B. I., iv, 564, 565: "Probably naturalised in Asia; the examples from extra-tropical India are almost surely escapes." Voigt, H. S. C., p. 471, under *St. jamaicensis* and *St. urticæfolia*, stated to be from the W. Indies and S. America. *St. jamaicensis* is also mentioned in Roxb., Hort. Beng., p. 4.

158. *LIPPIA GEMINATA*, *H. B. K.* B. P., ii, p. 825. Col. Prain treats it as indigenous. C. B. Clarke in F. B. I., iv, p. 564, also appears to consider it so, for he writes: "Bengal, frequent; below Dacca, *J. D. H.*, etc. Distrib. Trop. America, a widely dispersed weed." Voigt enumerates *Lantana canescens*, Kunth, which may, or more likely, may not be *Lippia geminata*. Possibly *Lippia geminata* may have been overlooked by the earlier authors in consequence of its great resemblance to *Lantana indica*.

159. *DURANTA PLUMIERI*, *Jacq.* B. P., ii, p. 827: "In gardens and shrubberies in all provinces, planted; occasionally also spontaneous in village thickets in C. Bengal." F. B. I., iv, p. 560: "Duranta, a large American bush, is much cultivated in India." Voigt, H. S. C., p. 471: "W. Indies." Not mentioned by Roxburgh. The freedom with which it produces fruits and seeds would lead one to expect this shrub to spread much more copiously into the jungles of Bengal than it does. Indeed it is rarely met with in localities where it may not have been planted.

160. *CLERODENDRON FRAGRANS*, *Vent.* B. P., ii, p. 835: "C. Bengal; Chittagong: escaped from cultivation. Native of China." F. B. I., iv, p. 589: "Extensively cultivated." Voigt, H. S. C., p. 466.

161. *CALLICARPA CANA*, *Linn.* B. P., ii, p. 828: "Often cultivated; occasionally naturalised in C. Bengal. Native of the Malay Peninsula." F. B. I., iv, 568. Voigt, H. S. C., p. 467. Roxburgh, F. I., p. 131: "This shrub was introduced into the Botanic Garden from the Moluccas in 1798."

162. *HYPTIS CAPITATA*, *Jacq.* B. P., ii, p. 848: "C. Bengal, naturalised, rare. Introduced from America." Not referred to by previous authors. An erect annual. Its native distribution is from Mexico to Brazil and Paraguay.

163. *HYPTIS SUAVEOLENS*, *Poit.* B. P., ii, p. 848: "In all the western provinces, very common. Native of America." F. B. I.: "Deccan Peninsula, Cachar and Nicobar Islands; introduced. Distr. Tropical America, introduced into Tropical Asia." Does not appear to be referred to by Voigt, unless his *Hyptis pectinata*, *Poit.*, is the present species. Roxburgh does not mention it. Its original home extends from S. Brazil and Peru to Mexico.

164. *MERIANDRA BENGALENSIS*, *Benth.* B. P., ii, p. 858: "In native gardens in C. Bengal. Native of Abyssinia. *Vern.* Kafur ka pat." F. B. I., iv, 653. Wall, Pl. As. Rar., i, 29. *Salvia bengalensis*, König. Roxburgh, F. I., p. 49. "Is only found in gardens."

165. *SALVIA COCCINEA*, *Linn.* B. P. ii, p. 859: "In gardens generally, and occasionally subsponaneous. Native of S. America." Voigt, H. S. C., p. 455: "Domesticated in many parts of India."

NYCTAGINACEÆ.

166. *MIRABILIS JALAPA*, *Linn.* B. P., ii, p. 862: "Cultivated, and as an escape. Native of America." Voigt, H. S. C., p. 328: "Domesticated in our gardens."

167. *BOUGAINVILLEA SPECTABILIS*, *Willd.* B. P., ii, p. 864: "In gardens of European residents common. Native of Brazil." Voigt, H. S. C., p. 329: "Rio Janeiro, August 1839."

168. *BOUGAINVILLEA GLABRA*, *Choisy.* B. P., ii, p. 863: "In gardens, both native and European. Native of Brazil."

PHYTOLACCACEÆ.

169. *RIVINA HUMILIS*, *Linn.* B. P., ii, p. 883: "In all the provinces, cultivated, and in most of them thoroughly naturalised and as if wild. Native of America." F. B. I., v, 21: "Rivina Lathenia, Ham. in Wall. Cat. 6952, from Patna, is the common South American Rivina lævis, Linn, or an allied plant." Voigt, H. S. C., p. 323: "Rivina lævis, W. Indies. Domesticated about Serampore." Roxb., H. B., p. 11.

PIPERACEÆ.

170. *PEPEROMIA PELLUCIDA*, *Kunth.* B. P., ii, p. 894: "C. Bengal, naturalised. A succulent herb, recently introduced, but now extremely abundant." Not mentioned in F. B. I., nor in

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Voigt, H. S. C. Its native country extends from Northern Brazil and Peru to the Antilles. Doubtfully indigenous, but completely domesticated in Western and Eastern Tropical Africa. In America it is eaten as a salad.

POLYGONACEÆ.

171. *ANTIGONON LEPTOPUS*, *Endl.* B. P., vol. ii, p. 889: "In gardens generally." Firminger, *Gardening*, 3rd ed., p. 437: "Of late introduction. Propagated by seeds or cuttings." Not mentioned by Voigt. A native of the western parts of Mexico.

LAURACEÆ.

172. *CINNAMOMUM ZEYLANICUM*, *Breyn.* B. P., vol. ii, p. 899: "Planted, but rarely. Native of Ceylon." Watt, *Ec. Dict.*, vol. ii, p. 324: "A native of the Ceylon forests; also said to be met with in the forests of Tenasserim. F. B. I., v, 131. Voigt, H. S. C., p. 307. Roxb., F. I., p. 336: "General Macdowal, in command on the Island of Ceylon, sent to the Botanic Garden at Calcutta, in 1801, several plants of the best sort. The sort introduced forty years ago is of the narrow-leaved, inferior kind."

173. *CINNAMOMUM CAMPHORA*, *F. Nees.* B. P., vol. ii, p. 899: "Planted rather commonly. Native of China." The Camphor tree. Watt, *Ec. Dict.*, vol. ii, p. 317: "A native of China, Japan, and Malay Islands." F. B. I., v, 134. Voigt, H. S. C., p. 308: "*Camphora officinarum*." Roxb., F. I., p. 339: "*Laurus camphorifera*. This tree is a native of the Malaya Islands and was introduced into the Botanic Garden in 1802." This tree is a native of China, Formosa (and Japan).

EUPHORBIACEÆ.

174. *EUPHORBIA TIRUCALLI*, *Linn.* B. P., ii, p. 924: "A hedge plant in most of the provinces, now quite naturalised in the western parts. Native of Africa." F. B. I., v, 254: "Naturalised in Bengal, the Deccan Peninsula and Ceylon." Voigt, H. S. C., p. 162. Roxburgh, F. I., p. 393. Rheede, *Hort. Mal.*, 2, t. 44. Rumph, *Herb. Amb.*, t. 29. The Bengali name, *Lanka Sij*, seems to indicate that the plant has been introduced from Ceylon directly. This probably justifies Buchanan-Hamilton's view (*Trans. Linn. Soc.*, xiv, 286) that the plant is of comparatively recent introduction. It is very probable that the plant had been introduced into Ceylon and the Indian Archipelago from Africa, before reaching the Indian continent.

175. *EUPHORBIA PULCHERRIMA*, *Willd.* B. P., ii, p. 924: "Cultivated in European gardens. Native of America." Generally known under the name of *Poinsettia pulcherrima*. F. B. I., v., 239. Voigt, H. S. C., p. 164: "*Poinsettia pulcherrima*, Grah., Mexico. In Honourable Company's Garden fl. C. S." (cold season). The plant seems not to have been common in Calcutta gardens in 1840.

176. *EUPHORBIA GENICULATA*, *Ortega*. B. P., ii, p. 924: "In gardens, occasionally. An annual herb." F. B. I., v, 239: "Is both cultivated in gardens, and has been found apparently wild, but no doubt as an escape, in the Sutlej Valley." *Euphorbia prunifolia*, *Jacq.*, *Wall. Cat.*, 7690. *Voigt*, H. S. C., p. 163: "Peru." *Roxb.*, H. B., p. 36. It would be interesting to know whether this species shows any tendency to run wild in Bengal.

177. *EUPHORBIA SPLENDENS*, *Bojer*. Often cultivated. A native of Madagascar. *Firminger*, *Gardening*, 3rd ed., p. 393. *Voigt*, H. S. C., p. 162.

178. *EUPHORBIA BOJERI*, *Hook*. Often cultivated. A native of Madagascar. *Firminger*, *Gardening*, p. 362. *Voigt*, H. S. C., p. 162.

179. *EUPHORBIA HETEROPHYLLA*, *Linn*. B. P., vol. ii, p. 924: "In gardens generally, and often also subsontaneous in waste places in C. Bengal." Not mentioned in *Firminger*, *Gardening*, 3rd edition. It is indigenous in the area extending from Peru and Brazil to Illinois in the United States. *Euphorbia heterophylla* is mentioned under the name of *Euphorbia cyathophora* as a desirable by *Voigt* in H. S. C., p. 164.

180. *EUPHORBIA GRAMINEA*, *Jacq*. B. P., ii, p. 924: "C. Bengal, naturalised. An annual herb. A recently introduced American weed, not yet very common." Not mentioned by *Voigt*. Its original home extends from Mexico to Peru.

181. *PEDILANTHUS TITHYMALOIDES*, *Poit*. B. P., ii, p. 925: "A hedge plant, especially in the central and eastern provinces; introduced." F. B. I., v, 239: "A West Indian succulent shrub, which is much cultivated in native gardens and planted in hedges." *Voigt*, H. S. C., p. 164: "Was introduced into the country before 1794, and is now domesticated everywhere. Chiefly used for hedges, as neither goats nor cows will touch the leaves. Used in the W. Indies medicinally under the name of *Ipecacuanha* in all cases where that drug is required." *Roxburgh*, H. B., p. 36.

182. *JATROPHA MULTIFIDA*, *Linn*. B. P., ii, p. 941: "In gardens and near temples, general. Native of S. America." F. B. I., v, 383: "Cultivated and naturalised in various parts of India." *Wall. Cat.*, 7801. *Voigt*, H. S. C., p. 159: "Coral plant. America." *Roxb.*, *Hort. Beng.*, p. 69.

183. *JATROPHA GOSSYPIFOLIA*, *Linn*. B. P., ii, p. 941: "In all the provinces, in waste places. A common weed of roadsides. Native of Brazil." F. B. I., v, 383: "Bengal, *Clarke*." Not mentioned in *Voigt*, H. S. C., nor by *Roxburgh*. As the plant was not collected by *Sir Joseph Hooker*, it has probably been introduced after 1850. I found it to be very common in C. and N. Bengal in 1881. It would be very interesting to trace the history of its spread in Bengal.

184. *JATROPHA CURCAS*, *Linn*. B. P., ii, p. 941: "In all provinces and in village thickets." F. B. I., v, 388: "Throughout India and Ceylon, common near villages, cultivated and naturalised." *Voigt*, H. S. C., p. 158: "Cuba, South America. Domesticated in India." *Roxburgh*, F. I., p. 689, takes the plant to

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be a native of the coast of Coromandel. It would be interesting to know how far back this species can be traced in Indian medical literature.

185. *ALEURITES MOLUCCANA*, Willd. B. P., i, p. 942: "In gardens, especially in C. Bengal." F. B. I., v, 384: "Native of the Malay ? and Pacific Islands." As if wild in the Wainad. Roxburgh, F. I., p. 670: "*Aleurites triloba*. A large tree, now pretty common in gardens about Calcutta, originally from the Malay countries." Voigt, H. S. C., p. 159.

186. *CROTON SPARSIFLORUS*, Morung, described in the present paper. Not mentioned in B. P., nor anywhere else.

187. *CROTON* sp. A new species from Chittagong, evidently an immigrant, under investigation.

188. *CODIÆUM VARIEGATUM*, Bl. B. P., ii, p. 944: "In gardens everywhere." *Croton* of the Anglo-Indians. F. B. I., v, 399: "Native of the Molucca Islands." Voigt, H. S. C., p. 157: "*Codiaeum chrysosticton*, Rumph." Roxburgh, F. I., p. 687: "*Croton bractiferum*, R. A native of the Moluccas."

189. *RICINUS COMMUNIS*, Linn. B. P., ii, p. 952: "Apparently introduced from Africa." Roxburgh, F. I., p. 690.

190. *MANIHOT UTILISSIMA*, Pohl. B. P., vol. ii, p. 940: "N. Bengal Duars, cultivated in clearings." Watt, Ec. Dict., vol. v, p. 157. Voigt, H. S. C., p. 158: "*Jatropha manihot*, Kunth. Has never flowered here, nor had it done so in H. C. G. in 1814, though introduced in 1794." Roxb., Hort. Beng., p. 69. Cultivated in Brazil, Peru, and Mexico before the advent of the Europeans. Probably a native of Brazil where it is reported to grow wild.

191. *SAPIUM SEBIFERUM*, Roxb. B. P., vol. ii, p. 954: "Cultivated, occasionally, especially in the northern parts." Watt, Ec. Dict., vol. vi, 2, p. 472: "Indigenous to China, and introduced as a cultivated plant into various parts of India." F. B. I., v, 470. Voigt, H. S. C., p. 161: "*Stillingia sebifera*. Domesticated about Serampore." Roxb., F. I., p. 691: "Is now very common about Calcutta, where in the course of a few years it has become one of the most common trees. In Bengal it is only considered as an ornamental tree." A native of China and Japan.

URTICACEÆ.

192. *CANNABIS SATIVA*, Linn. B. P., ii, p. 960. F. B. I., v, 487. "Wild in the N. W. Himalaya. Central Asia, wild; cultivated elsewhere." Roxb., F. I., p. 718. *Cannabis sativa* occurs as an inhabitant of waste places and on roadsides in many places in Bengal. It may now fairly be considered to be indigenous.

193. *BROUSSONETIA PAPIRIFERA*, Vent. B. P., ii, p. 967: "Planted, occasionally, and wherever planted springing up spontaneously. The Paper Mulberry. Native of Burma, Malaya, and Polynesia." F. B. I., v, 490. Voigt, H. S. C., p. 284: "Has been in the garden here more than twelve years without flowering."

194. *FIGUS PUMILA*, Linn. B. P., ii, p. 982: "In many of the provinces, planted to take the place of ivy as a creeper on walls.

Native of Japan and China. The Ivy-Fig." Not mentioned by Voigt.

CYCADACEÆ.

195. *CYCAS RUMPHII*, *Miq.* B. P., ii, p. 993: "In gardens, occasionally. Native of the Andamans and Malaya." F. B. I., v, 657. Voigt, H. S. C., p. 554: "*Cycas circinalis*." Roxb., F. I., p. 709: "*Cycas circinalis*, Willd. This beautiful small palm has of late years been introduced from Amboyna into the Company's Botanic Garden, where it thrives freely."

196. *CYCAS REVOLUTA*, *Thunb.* B. P., ii, p. 993: "In gardens, frequently. Native of Japan." F. B. I., v, 656: Voigt, H. S. C., p. 555: "Common in gardens about Calcutta." Roxb., F. I., p. 709: "Very common in gardens about Calcutta." Voigt says the plant was introduced into H. C. G. in 1794.

CASUARINACEÆ.

197. *CASUARINA EQUISETIFOLIA*, *Forst.* B. P., vol. ii, p. 985: "Chittagong coast. Elsewhere often planted." I include this species in the present enumeration, because, as far as Bengal proper is concerned, it is eminently an introduced plant, which, however, forms a familiar feature in many a Bengali landscape. Watt, *Ec. Dict.*, vol. ii, p. 230: "Introduced into the plains of India as a roadside tree about the beginning of the nineteenth century." F. B. I., v, 598. Roxb., F. I., p. 632: "It was sent by Dr. Buchanan (from Chittagong) to the Botanic Garden, where in the course of ten years from the seed, they have grown to be trees of from sixty to eighty feet in height."

CONIFERÆ.

198. *THUJA ORIENTALIS*, *Linn.* B. P., vol. ii, p. 992: "Often planted." Voigt, H. S. C., p. 557. Roxb., F. I., p. 678: "From China it has been introduced into our garden in India." A native of China and Japan.

BROMELIACEÆ.

199. *ANANAS SATIVUS*, *Linn.* B. P., vol. ii, p. 1052: "*Ananassa sativa*. Sparingly planted." Watt, *Ec. Dict.*, vol. i, p. 236: "Introduced from America. It is apparently a native of Brazil. It was introduced by the Portuguese into Bengal in 1594. Its introduction is expressly mentioned by Indian authors." Roxb., F. I., p. 279: "*Bromelia ananas*. Its not being a native of India is supported by the various vernacular names, evidently derived from *ananas*, as well as there being no Sanscrit name for so remarkable a plant, a thing which could scarcely have happened if it had been a native of the East Indies." Rheede, *Hort. Mal.*, 11. t. 1 and 2.

HÆMODOURACEÆ.

200. SANSEVIERIA TRIFASCIATA, *Hort.* B. P., vol. ii, p. 1054 : "Often cultivated; sometimes as an escape." Evidently closely related to *S. guineensis*, and perhaps a variety of the latter. It may be considered to be a native of Africa.

201. SANSEVIERIA CYLINDRICA, *Bojer.* B. P., vol. ii, p. 1054 : "Occasionally cultivated." A native of Zanzibar; cultivated along the coast of Africa from Zanzibar to Angola.

SCITAMINACEÆ.

202. MARANTA ARUNDINACEA, *Linn.* B. P., vol. ii, p. 1048 : "Occasionally planted. Arrow-root." Watt, *Ec. Dict.*, vol. v, p. 180 : "In Bengal it did not attract attention much before 1830. Voigt, H. S. C., p. 575. A native of Tropical America.

203. RAVENALA MADAGASCARIENSIS, *Sonnerat.* B. P., vol. ii, p. 1050 : "Occasionally planted." F. B. I., vi, 198. Voigt, H. S. C., p. 579. Roxb., F. I., p. 279 : "*Urania speciosa*, Willd. In 1802 three plants of this elegant tree were brought from the Island of Mauritius by Captain Tennant to the Botanic Garden at Calcutta. The seeds of the first crop of flowers ripened in November 1807."

IRIDACEÆ.

204. IRIS CHINENSIS, *Curtis.* Firminger, *Gardening*, 5th ed., p. 372 : "A common plant in gardens in all parts of India, but seems to blossom more freely in the United Provinces than in Bengal." Voigt, H. S. C., p. 604. Roxb., F. I., p. 57 : "This species has been introduced from China into the Botanic Garden."

205. MOREA IRIDIOIDES, *Linn.* Firminger, *Gardening*, 5th ed., p. 373 : "*Iris moræoides*." Voigt, H. S. C., p. 603 : "Thrives and blossoms well in Calcutta."

206. TIGRIDIA PAVONIA, *Linn.* Voigt, H. S. C., p. 605 : It thrives well in Upper India (Firminger). A native of Mexico and Peru.

207. CIPURA PALUDOSA, *Aubl.* B. P., vol. ii, p. 1055 : "C. Bengal; quite naturalised in thickets near Calcutta." Voigt, H. S. C., p. 601. Roxb., *Hort. Beng.*, p. 5. Tropical America, widely distributed.

208. BELAMCANDA CHINENSIS, *Leman.* A native of Tropical East Asia and Japan. B. P., vol. ii, p. 1056 : "In gardens in all the provinces." Firminger, *Gardening*, 5th ed., p. 373 : "*Pardanthus chinensis*. A common plant in all gardens in India." F. B. I., vi, 277. Voigt, H. S. C., p. 605. Roxb., F. I., p. 57 : "*Morea chinensis*. Common in gardens over India." Rheede, *Hort. Mal.*, xi, t. 37.

AMARYLLIDACEÆ.

209. ZEPHYRANTHES TUBISPATHA, *Herb.* B. P., vol. ii, p. 1060 : "In gardens and sometimes naturalised. Native of Peru."

F. B. I., vi, 277: "Cultivated in gardens and found as an escape far from habitations." Voigt, H. S. C., p. 582: "Blue Mountains, Jamaica."

210. *AMARYLLIS BELLADONNA*, *Linn.* Firminger, Gardening, 5th ed.: "Common in Indian gardens." Voigt, H. S. C., p. 586. A native of the Cape and the Canary Islands.

211. *EURYCLES AMBOYNSIS*, *Willd.* (= *E. sylvestris* Salisb.). Voigt, H. S. C., p. 594. Roxb., F. I., p. 285: "Criminum nervosum. Introduced into the Company's Botanic Garden at Calcutta, where it blossoms, but rarely ripens its seeds." A native of the Malaya Archipelago. Pretty common in Calcutta gardens.

212. *EUCHARIS GRANDIFLORA*, *Planch.* (= *Eucharis amazonica*, Lindley). Firminger, Gardening, 5th ed., p. 369: "Native of Brazil, and quite naturalised in this country."

213. *HIPPEASTRUM RUTILUM*, *Herb.* var. *FULGIDUM* (= *Hippeastrum fulgidum*, Herb.). Voigt, H. S. C., p. 585. A native of Brazil, now frequently seen in gardens about Calcutta.

214. *HIPPEASTRUM RETICULATUM* (*L'Hérit.*). Voigt, H. S. C., p. 585. Indigenous in Brazil, now common in Calcutta gardens.

215. *HIPPEASTRUM EQUESTRE* (*Herb.*). Voigt, H. S. C., p. 585. Roxb., Hort. Beng., p. 24. Bahama, Antilles, Guyana. Frequently met with in Calcutta gardens.

216. *HIPPEASTRUM STYLOSUM*, *Herb.* (= *Hippeastrum maranense* (Ker)). Voigt, H. S. C., p. 584. A native of N. Brazil often seen in gardens about Calcutta.

217. *AGAVE VERÆ-CRUCIS* (*Miller*). In Drummond and Prain, The Agricultural Ledger, 1906, No. 7, p. 86: "Agave Vera Cruz, Miller. Native country doubtful, probably Mexico; naturalised throughout Southern Europe, also in North-Western Africa and the Atlantic Islands; S. Africa; Mauritius; Ceylon," besides Indian localities. Mr. Burkill has observed *Agave Veræ-Crucis* at the following places in Bengal and Bihar—Siliguri in the Darjeeling Terai, Patgram in the Jalpaiguri District; Rangpur and Kākinā in the Rangpur District; in the Districts of Dacca, Mymensingh, Dinajpur and Bogra; Rampur Boalia; Nalhati and Naihati; Cuttack (very plentiful) and Jajpur in Orissa; Boinchi in Bardwān District; Bankipur; near Mokameh and Katihar; Bairagnia, Mozafferpur District; Papri, Hatwāri, and Chitani in the District of Darbhanga. Voigt, H. S. C., p. 597: "Agave Veræ Crucis, S. America. Introduced in 1840."

218. *AGAVE WIGHTII*, *Drummond and Prain*. These authors, *loc. cit.*, p. 91: "Native country unknown." We may take it to be a native of some part of Tropical America, perhaps Mexico. It existed in India in Wight's time. Mr. Burkill notices the following localities—Rangpur; Bogra; Gauripur in Mymensingh; neighbourhood of Bardwān; Naihati.

219. *AGAVE CANTALA*, *Roxb.* Drummond and Prain, *loc. cit.*, p. 87: "Native country unknown." Voigt, H. S. C., p. 597: "Fourcroya cantala." Roxb., F. I., p. 296: "Agave cantala. It is now common everywhere. In Bengal the plants blossom in May and June." Roxb., Hort. Beng., 25. Rumph., Herb. Amb.,

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v, t. 94. This species is found growing at some localities in Bihar: Chilwara and Tarkaulia in Tirhut. It is probably a native of Central America.

220. *FURCRAEA*? *SELLOA*, *C. Koch.* Mr. Burkill informs me that a rough-leaved *Fourcroya* is planted at Kütūpur in the Mozafferpur District.

221. *POLIANTHES TUBEROSA*, *Linn.* Firminger, Gardening, 5th ed., p. 352: "The commonest, perhaps, of any plant in the gardens of India." Voigt, H. S. C., p. 656: "No doubt a native of Mexico or S. America." Roxb., F. I., p. 295: "In gardens only." Rumph., Herb. Amb., v, p. 285. *Polianthes tuberosa* is most probably a native of Central America, as the remaining two species of *Polianthes* hail from that part of the world.

LILIACEÆ.

222. *ALLIUM ASCALONICUM*, *Linn.* B. P., vol. ii, p. 1075: "Cultivated. *The Shallot.*" Watt, Ec. Dict., vol. i, p. 168: "Has been cultivated from the remotest times by all nations of the East." F. B. I., vi, 337. Roxb., F. I., p. 288. A native of Asia Minor.

223. *ALLIUM AMPELOPRASUM*, *Linn.* B. P., vol. ii, p. 1076: "Cultivated. *The Leek.*" F. B. I., vi, 337. Watt, Ec. Dict., vol. i, p. 171: "*Allium porrum.* This esculent plant has been known from time immemorial." Roxb., F. I., p. 287. A native of the Mediterranean Region.

224. *ALLIUM CEPA*, *Linn.* B. P., vol. ii, p. 1075: "Cultivated. *The Onion.*" F. B. I., vi, 337. Watt, Ec. Dict., vol. i, p. 169: "Cultivated all over India." Roxb., F. I., p. 287. Native country unknown; but probably a native of the Mediterranean Region.

225. *ALLIUM SATIVUM*, *Linn.* B. P., vol. ii, p. 1076: "Cultivated. *Garlic.*" F. B. I., vi, 337. Watt, Ec. Dict., vol. i, p. 172: "Cultivated all over India." Roxb., F. I., p. 287. A native of Songaria.

226. *HEMEROCALLIS FULVA*, *Linn.* B. P., vol. ii, p. 1078: "In gardens, generally." F. B. I., vi, 326: "The Himalaya and Khasia Hills; possibly indigenous; cultivated throughout India. Distr. S. Europe, the Caucasus, N. Asia to Japan." Voigt, H. S. C., p. 670. Roxb., F. I., p. 296: "It was introduced by Dr. W. Carey into the Botanic Garden at Calcutta from Dinajpur, where, if not indigenous, it may have been carried thither from China, its native country, through Bhutan."

PALMACEÆ.

227. *CARYOTA MITIS*, *Lour.* B. P., vol. ii, p. 1093: Occasionally planted or self-sown, but chiefly in and near European centres: perhaps wild in Southern Chittagong. Native of Burma, Andamans, Malaya." F. B. I., vi, 423. Mentioned neither by Firminger nor Voigt.

228. *LIVISTONA CHINENSIS*, *R. Br.* B. P., vol. ii, p. 1092 : "Cultivated frequently. Native of China." F. B. I., vi, 434 : "A Chinese and Japanese species." Griffith, *Palms of British India*, 131. Not referred to by Voigt.

ARACEÆ.

229. *TYPHONIUM INOPINATUM*, *Prairn.* B. P., ii, p. 1108 : "C. Bengal, introduced; a native, as now appears, of Upper Burma. Plentiful and rapidly spreading in thickets in and about the Royal Botanic Garden. This was never in cultivation; how it may have been introduced is unknown, but the introduction would seem to have been recent."

230. *TYPHONIUM ROXBURGHII*, *Schott.* B. P., ii, p. 1108 : "C. Bengal, introduced. Native of Malaya. Accidentally introduced into the Royal Botanic Garden a century ago, where it occurs with the three preceding (*T. inopinatum*, *T. Schottii*, *T. trilobatum*) species, but more locally and rarely than they. Unlike the others, this seems not yet to have spread beyond the limits of these gardens." F. B. I., vi, 510 : "T. Mottleyanum; Malacca, Penang, Borneo." Voigt, *H. S. C.*, p. 686 : "*Typhonium trilobatum*." Roxb., *F. I.*, p. 628 : "The roots came accidentally from the Moluccas, amongst the earth that some other plants were brought in."

GRAMINACEÆ.

231. *PENNISETUM TYPHOIDEUM*, *Rich.* B. P., vol. ii, p. 1169 : "Cultivated in the western provinces." F. B. I., vii, 82 : "Throughout the hotter parts of India, cultivated as an escape." Watt, *Ec. Dict.*, vol. vi, i, p. 128 : "Most probably of African origin." Roxb., *F. I.*, p. 95.

232. *AVENA SATIVA*, *Linn.* B. P., vol. ii, p. 1217 : "Cultivated sparingly." F. B. I., vii, 275. Watt, *Ec. Dict.*, vol. i, p. 356 : "Of recent introduction into Indian agriculture. It was first grown in Northern India round cantonments and stud depôts." Probably a native of the northern parts of Europe.

233. *BAMBUSA NANA*, *Roxb.* B. P., ii, p. 1232 : "Native of China." F. B. I., vi, 390 : "Native of China and Japan." Roxb., *F. I.*, p. 306.

234. *BAMBUSA VULGARIS*, *Schrad.* B. P., ii, p. 1233 : "Native of Malaya." F. B. I., vii, 391. Voigt, *H. S. C.*, p. 718 : "*Dendrocalamus tulda*, var." Roxb., *F. I.*, p. 305 : treated as a variety of *Bambusa Tulda*, Roxb.

It is of some interest to know how many species each of the different botanical regions has contributed to the *Flora advena* of Bengal. The percentages indicated are calculated on the total of the exotic species given in the preceding enumeration. In cases of doubt the most probable native country has been assumed as the native country.

[N.S.]

I. Eurasian species.

A. Temperate European species in general, and species indigenous in the Mediterranean Region, Western Asia, and Songaria. 11·2%. *Rosa gallica*. *Fragaria vesca*. *Avena sativa*. *Nigella sativa*. *Papaver somniferum*. *Senebiera pinnatifida*. *Alyssum maritimum*. *Lepidium sativum*. *Thlaspi arvense*. *Capsella Bursa-pastoris*. *Hibiscus syriacus*. *Punica Granatum*. *Myrtus communis*. *Rosa centifolia*. *Rosa alba*. *Rosa rubiginosa*. *Xanthium spinosum*. *Chrysanthemum coronarium*. *Antirrhinum majus*. *Ricinus communis*. *Cannabis sativa*. *Allium ascalonicum*. *Allium ampeloprasum*. *Allium Cepa*. *Hemerocallis fulva*. *Allium sativum*.

B. Japan, China, and Indo-China. 9·8%. *Hibiscus Manihot*. *Hibiscus mutabilis*. *Clausena Wampi*. *Triphasia Aurantiola*. *Litchi chinensis*. *Euphorbia Longana*. *Rosa indica*. *Rosa sinica*. *Rosa multiflora*. *Eriobotrya japonica*. *Gardenia florida*. *Chrysanthemum indicum*. *Lobelia radicans*. *Campsis grandiflora*. *Olerodendron fragrans*. *Cinnamomum Camphora*. *Sapium sebiferum*. *Ficus pumila*. *Cycas revoluta*. *Thuja orientalis*. *Belamcanda chinensis*. *Iris chinensis*. *Livistona chinensis*.

C. The Eastern Peninsula, the Andamans, and Ceylon. 5·2%. *Pterocarpus dalbergioides*. *Quisqualis indica*. *Diospyros Kaki*. *Mikania scandens*. *Torrenia Fournieri*. *Millingtonia hortensis*. *Calli-carpa cana*. *Broussonetia papyrifera*. *Casuarina equisetifolia*. *Caryota mitis*. *Typhonium inopinatum*. *Bambusa nana*.

D. The Malay Archipelago and the Philippines. 8·5%. *Hibiscus hirtus*. *Hibiscus radiatus*. *Hibiscus Rosa-sinensis*. *Averrhoa Carambola*. *Averrhoa Bilimbi*. *Citrus decumana*. *Pterocarpus indica*. *Melaleuca Leucodendron*. *Eugenia malaccensis*. *Diospyros philippensis*. *Polyscias fruticosa*. *Ixora stricta*. *Vallaris pergulana*. *Cinnamomum zeylanicum*. *Aleurites moluccana*. *Codisium variegatum*. *Cycas Rumphii*. *Eurycles amboynensis*. *Typhonium Roxburghii*. *Bambusa vulgaris*.

II. Polynesian species. 0·4%.

Spondias dulcis.

III. African species.

A. Continental, chiefly Tropical Africa. 4·7%. *Adansonia digitata*. *Indigofera sumatrana*. *Indigofera articulata*. *Guizotia abyssinica*. *EouPELLIA grata*. *Jacquemontia cærulea*. *Meriandra bengalensis*. *Euphorbia Tirucalli*. *Sansevieria trifasciata*. *Sansevieria cylindrica*. *Pennisetum typhoideum*.

B. Madagascar, the Mascarenhas (and the Cape). 5·10%. *Bauhinia monandra*. *Poinciana regia*. *Colvillea racemosa*. *Albizia richardiana*. *Vangueria edulis*. *Cryptostegia grandiflora*. *Stephanotis floribunda*. *Euphorbia splendens*. *Euphorbia Bojeri*. *Ravenala madagascariensis*. *Moræa iridoides*. *Amaryllis belladonna*.

IV. American species.

A. United States. 1·7%. *Helianthus tuberosus*. *Phlox Drummondii*. *Campsis radicans*. *Nicotiana rustica*.

B. Tropical and Subtropical America in general. 16·7°/°. *Malvastrum coromandelianum*. *Malvastrum spicatum*. *Anoda hastata*. *Malachra capitata*. *Guazuma tomentosa*. *Arachis hypogæa*. *Parkinsonia aculeata*. *Neptunia plena*. *Desmanthus virgatus*. *Leucæna glauca*. *Enterolobium Saman*. *Turnera ulmifolia*. *Turnera trionifolia*. *Opuntia Dillenii*. *Passiflora suberosa*. *Passiflora fœtida*. *Carica Papaya*. *Hamelia patens*. *Flaveria repanda*. *Synedrella nodiflora*. *Allamanda cathartica*. *Thevetia neriiifolia*. *Ipomœa Nil*. *Herpestis chamædroides*. *Scoparia dulcis*. *Ruellia tuberosa*. *Lippia geminata*. *Hyptis capitata*. *Hyptis suaveolens*. *Salvia coccinea*. *Mirabilis Jalapa*. *Bivina humilis*. *Jatropha Curcas*. *Jatropha multifida*. *Peperomia pellucida*. *Euphorbia graminea*. *Euphorbia heterophylla*. *Cipura paludosa*. *Furcraea* sp.

C. Mexico and Central America. 11·9°/°. *Argemone mexicana*. *Swietenia macrophylla*. *Phaseolus multiflorus*. *Pithecolobium dulce*. *Psidium Guyava*. *Tagetes patulus*. *Tagetes erectus*. *Lagascea mollis*. *Zinnia elegans*. *Cosmos sulfureus*. *Tithonia tagetiflora*. *Galinsoga parviflora*. *Tridax procumbens*. *Plumiera acutifolia*. *Ipomœa tricolor*. *Ipomœa Batatas*. *Nicotiana plumbaginifolia*. *Russelia juncea*. *Tecoma stans*. *Martynia annua*. *Antigonon leptopus*. *Euphorbia pulcherrima*. *Iris pavonia*. *Tigridia pavonia*. *Agave Veræ-Cructis*. *Agave Wightii*. *Agave Cantala*. *Polianthes tuberosa*.

D. The Antilles (and Central America). 11·5°/°. *Anona squamosa*. *Anona reticulata*. *Tribulus cistoides*. *Swietenia Mahagoni*. *Anacardium occidentale*. *Crotalaria saltiana*. *Crotalaria Brownei*. *Crotalaria incana*. *Pimenta officinalis*. *Passiflora quadrangularis*. *Passiflora adenophylla*. *Eupatorium odoratum*. *Tridax procumbens*. *Achras Sapota*. *Rauwolfia canescens*. *Lochnera rosea*. *Asclepias curassavica*. *Evolvulus nummularius*. *Quamoclit coccinea*. *Heliotropium curassavicum*. *Lantana trifolia*. *Lantana Camara*. *Strachytarpheta indica*. *Duranta Plumieri*. *Pedilanthus tithymaloides*. *Zephyranthes tubispatha*. *Hippeastrum equestre*.

E. Andesean Region. 6·0°/°. *Bixa Orellana*. *Phaseolus vulgaris*. *Eupatorium Ayapana*. *Zinnia pauciflora*. *Helianthus annuus*. *Helianthus argyrophyllus*. *Solanum sisymbriifolium*. *Solanum Lycopersicum*. *Solanum tuberosum*. *Physalis peruviana*. *Nicotiana Tabacum*. *Browallia elata*. *Euphorbia geniculata*. *Cipura paludosa*.

F. Brazil. 6·1°/°. *Talinum patens*. *Phaseolus lunatus*. *Ipomœa purpurea*. *Capsicum annum*. *Capsicum frutescens*. *Bougainvillea spectabilis*. *Bougainvillea glabra*. *Jatropha gossypifolia*. *Manihot utilisissima*. *Ananas sativus*. *Eucharis grandiflora*. *Hippeastrum rutilum*. *Hippeastrum reticulatum*. *Hippeastrum stylosum*.

G. La Plata Region. 0·9°/°.

Ipomœa Learii. *Croton sparsiflorus*.

H. Tropical Cosmopolitans. Exact native country quite unascertainable. *Wissadula rostrata*.

The percentage contributions are therefore—

Europe and Asia, north-west of India	...	11·2 %
Asia, north-east, east and south-east of India, including Malaya and Polynesia	23·9 %	%
Africa	...	9·8 %
America	...	54·7 %

America has, as is seen, contributed more than one-half of the total of introduced species.

A glance over the main list of introduced species reveals the fact that the various natural orders found in Bengal have gained very unequally by the access of foreign plants. To give a precise idea on this point I subjoin a list of the natural orders occurring in Bengal with the number of indigenous species in bold (clarendon) type, and the number of immigrants in ordinary type, together with the percentage increase calculated on the number of indigenous species. From this enumeration I exclude the species found in Orissa, Chhota Nagpur, and Chittagong but not found in Bengal proper and Behar. Chittagong belongs very essentially to the Eastern Peninsula, and the south-western and western portions of Chhota Nagpur together with Orissa have their marked affinities with the Central Provinces and the Circars. By including Behar we include virtually the eastern and northern portions of Chhota Nagpur, especially the region of the coal-fields. Our area comprises therefore the whole of the real Bengal country together with Bihar and accidentally the more accessible portions of Chhota Nagpur. We exclude Farther Chhota Nagpur, Orissa, Tippera, and Chittagong.

Ranunculaceæ	...	...	4—1—25 %
Dilleniaceæ	...	...	3—0
Magnoliaceæ	...	...	1—0
Anonaceæ	...	...	16—2—12·5 %
Menispermaceæ	...	...	6—0
Nymphæaceæ	...	...	5—0
Papaveraceæ	...	...	0—2
Fumariaceæ	...	...	1—0
Crucifere	...	...	10—5—50 %
Capparidaceæ	...	...	9—0
Bixaceæ	...	...	4—1—25 %
Polygalaceæ	...	...	5—0
Caryophyllaceæ	...	...	7—0
Portulacaceæ	...	...	3—0
Tamariscaceæ	...	...	2—0
Elatinaceæ	...	...	2—0
Hypericaceæ	...	...	1—0
Guttiferæ	...	...	6—0
Ternstroëmiaceæ	...	...	1—0
Dipterocarpaceæ	...	...	2—0
Malvaceæ	...	...	35—12—34·3 %

Sterculiaceæ	...	...	16-1-6.2 °
Tiliaceæ	...	...	22-0
Linaceæ	...	...	2-0
Malpighiaceæ	...	...	1-0
Zygophyllaceæ	...	...	2-1-50 °
Geraniaceæ	...	...	7-2-28.6 %
Rutaceæ	...	...	11-3-27.3 %
Simarubaceæ	...	...	2-0
Ochnaceæ	...	...	1-0
Burseraceæ	...	...	1-0
Meliaceæ	...	...	8-2-25 °
Olacaceæ	...	...	7-0
Ilicaceæ	...	...	1-0
Celastraceæ	...	...	4-0
Rhamnaceæ	...	...	8-0
Ampelidaceæ	...	...	20-0
Sapindaceæ	...	...	8-2-25 %
Anacardiaceæ	...	...	4-2-50 %
Moringaceæ	...	...	1-0
Leguminosæ	...	...	222-21-9.5 %
(a) Papilionææ	...	...	171-11-6.4 %
(b) Caesalpinieæ	...	...	29-4-13.8 %
(c) Mimoseæ	...	...	22-6-27.3 %
Rosaceæ	...	...	4-10-25.0 %
Saxifragaceæ	...	...	2-0
Crassulaceæ	...	...	2-0
Droseraceæ	...	...	2-0
Haloragaceæ	...	...	2-0
Rhizophoraceæ	...	...	6-0
Combretaceæ	...	...	14-1-7.1 °
Myrtaceæ	...	...	8-5-62.5 %
Melastomaceæ	...	...	5-0
Lythraceæ	...	...	20-0
Onagraceæ	...	...	5-0
Turneraceæ	...	...	0-2
Passifloraceæ	...	...	0-5
Cucurbitaceæ	...	...	32-0
Datiaceæ	...	...	1-0
Cactaceæ	...	...	0-1
Ficoidaceæ	...	...	5-0
Umbelliferae	...	...	14
Araliaceæ	...	...	2-1-50 %
Cornaceæ	...	...	2-0
Caprifoliaceæ	...	...	1-0
Rubiaceæ	...	...	50-4-8 %
Compositæ	...	...	76-21-27.7 %
Stylidaceæ	...	...	2-0
Campanulaceæ	...	...	6-1-16.6 %
Plumbaginaceæ	...	...	3-0
Primulaceæ	...	...	3-0
Myrsinaceæ	...	...	5-0

Sapotaceæ	...	...	4-1-25%
Ebenaceæ	...	...	3-2-66%
Styracaceæ	...	...	2-0
Oleaceæ	...	...	11-0
Salvadoraceæ	...	...	2-0
Apocynaceæ	...	...	19-7-36.5%
Asclepiadaceæ	...	...	29-3-10.3%
Loganiaceæ	...	...	4-0
Gentianaceæ	...	...	9-0
Polemoniaceæ	...	...	0-1
Hydrophyllaceæ	...	...	1-0
Boraginaceæ	...	...	14-1-7.1%
Convolvulaceæ	...	...	43-8-18.4%
Solanaceæ	...	...	14-10-71.4%
Scrophulariaceæ	...	...	49-5-10.2%
Orobanchaceæ	...	...	4-0
Lentibulariaceæ	...	...	8-0
Bignoniaceæ	...	...	5-4-80%
Pedalinaceæ	...	...	1-0
Martyniaceæ	...	...	0-1
Acanthaceæ	...	...	56-1-1.8%
Verbenaceæ	...	...	33-7-21.2%
Labiatae	...	...	29-4-13.8%
Nyctaginaceæ	...	...	2-3-15.0%
Amarantaceæ	...	...	25-0
Chenopodiaceæ	...	...	9-0
Phytolaccaceæ	...	...	0-1
Polygonaceæ	...	...	27-1-4.8%
Aristolochiaceæ	...	...	3-0
Piperaceæ	...	...	6-1-6.6%
Lauraceæ	...	...	11-2-18.2%
Elæagnaceæ	...	...	1-0
Loranthaceæ	...	...	7-0
Santalaceæ	...	...	1-0
Euphorbiaceæ	...	...	67-18-26.9%
Urticaceæ	...	...	34-3-8.8%
Casuarinaceæ	...	...	0-1
Salicaceæ	...	...	1-0
Ceratophyllaceæ	...	...	1-0
Coniferae	...	...	0-1
Cycadaceæ	...	...	0-2
Hydrocharidaceæ	...	...	9-0
Burmanniaceæ	...	...	1-0
Orchidaceæ	...	...	49-0
Scitamineæ	...	...	31-2-6.4%
Bromeliaceæ	...	...	0-1
Hæmodoraceæ	...	...	1-2-20.0%
Iridaceæ	...	...	0-5
Amaryllidaceæ	...	...	9-13-144.4%
Taccaceæ	...	...	1-0
Dioscoreaceæ	...	...	9-0

Liliaceæ	...	...	13-5-38.5 %
Commelinaceæ	...	...	15-0
Palmaceæ	...	...	13-2-15.4 %
Pandanaceæ	...	...	2-0
Typhaceæ	...	...	2-0
Araceæ	...	...	20-2-10 %
Lemnaceæ	...	...	6-0
Alismaceæ	...	...	7-0
Naiadaceæ	...	...	18-0
Eriocaulaceæ	...	...	8-0
Cyperaceæ	...	...	119-0
Graminaceæ	...	...	190-2-1.1 %

The total number of species which either are pure natives of the area considered or which at some time or other have immigrated from other parts of India where they were indigenous, is, as the above list shows, 1801. The number of immigrants from other countries, except various provinces of India proper, is, according to our enumeration 234, or 12.4 % on the total of indigenous plants. If Bihar had been excluded, the percentage of immigrants would have been decidedly higher. Col. Prain describes 2773 species in his *Bengal Plants*. Deducting 215 exotics there are left 2558 species; the difference between this and 1796 is 762, which would be the number of species growing in Chittagong, Tippera, Chhota Nagpur, and Orissa, but not found in Bengal proper and Bihar. As a matter of fact, that number is too low, as the stretches of country referred to are by no means completely explored. The way in which the various species which, at least originally, were exotic to Bengal and Bihar, have been introduced into these countries is to a large extent suggested by the following classification—

I. Cultivated plants.

A. Field crops.

a. Drugs and narcotics—

α. Only cultivated—*Papaver somniferum*. *Nicotiana Tabacum*, *Nicotiana rustica*.

β. Cultivated and run wild—*Nigella sativa*. *Cannabis indica*.

b. Fibre plants.

α. Cultivated only—*Sansevieria cylindrica*.

β. Cultivated and as an escape—*Wissadula rostrata*. *Crotalaria Brownei*. *Crotalaria incana*. *Sansevieria trifasciata*.

c. Dye plants, Cultivated and as escapes—*Indigofera sumatrana*, *Indigofera articulata*.

d. Oil-seeds. Cultivated—*Guizotia abyssinica*.

e. Cereals—*Pennisetum typhoideum*. *Avena sativa*.

f. Vegetables.

α. Tubers—*Ipomœa Batatas*. *Solanum tuberosum*. *Manihot utilissima*. *Maranta arundinacea*.

β. Fruits—*Solanum Lycopersicum*. *Ananas sativus*

[N.S.]

B. Cultivated in gardens.

a. Vegetables. *Lepidium sativum*. *Phaseolus lunatus*. *Phaseolus vulgaris*. *Phaseolus multiflorus*. *Meriandra bengalensis*. *Allium ascalonicum*. *Allium ampeloprasum*. *Allium Ceba*. *Allium sativum*. *Capsicum annuum*. *Capsicum frutescens*. *Helianthus tuberosus*.

b. Fruits.

a. Only cultivated—*Averrhoa Carambola*. *Averrhoa Bilimbi*. *Clausena Wampi*. *Triphasia aurantiola*. *Citrus decumana*. *Litchi chinensis*. *Euphoria Longana*. *Spondias dulcis*. *Eriobotrya japonica*. *Eugenia moluccensis*. *Psidium Guyava*. *Punica Granatum*. *Vangueria edulis*. *Achras Sapota*. *Diospyros Kaki*. *Diospyros philippensis*. *Aleurites moluccana*. *Fragaria vesca*. *Physalis peruviana*.

β. Cultivated and growing as if wild—*Anona squamosa*. *Anona reticulata*.

c. Dye plants—*Bixa Orellana* (also as if wild).

d. Trees and shrubs grown in gardens chiefly for the sake of their foliage.

a. Cultivated only—*Myrtus communis*. *Pimenta officinalis*. *Polyscias fruticosa*. *Cinnamomum zeylanicum*. *Cinnamomum Camphora*. *Sapium sebiferum*. *Broussonetia papyrifera*. *Ficus pumila*. *Cycas Rumphii*. *Cycas revoluta*. *Thuja orientalis*. *Ravenala madagascariensis*. *Caryota mitis*. *Livistona chinensis*.

β. Cultivated and as if wild—*Melaleuca Leucodendron*.

e. Flower plants.

a. Trees and erect shrubs.

a. Cultivated only—

Hibiscus syriacus. *Hibiscus Rosa-sinensis*. *Hibiscus mutabilis*. *Adansonia digitata*. *Rosa gallica*. *Rosa damascena*. *Rosa centifolia*. *Rosa indica*. *Rosa rubiginosa*. *Rosa sinica*. *Rosa multiflora*. *Gardenia florida*. *Leora stricta*. *Plumiera acutifolia*. *Tecoma stans*. *Euphorbia pulcherrima*.

β. Cultivated and self-sown—

Guazuma tomentosa. *Hamelia patens*. *Thevetia nerifolia*. *Rauwolfia canescens*. *Russelia juncea*. *Duranta Plumieri*. *Clerodendron fragrans*. *Callicarpa cana*.

b. Ramblers, climbers and twiners.

a. Cultivated only—

Rosa alba. *Quisqualis indica*. *Vallari*

pergulana. *Roupellia grata*. *Cryptostegia grandiflora*. *Stephanotis floribunda*. *Jacquemontia cœrulea*. *Ipomœa tricolor*. *Ipomœa Learii*. *Ipomœa purpurea*. *Campsis grandiflora*. *Bougainvillea spectabilis*. *Bougainvillea glabra*.

β. Cultivated and as escapes—

Mikania scandens. *Allamanda cathartica*. *Ipomœa Nil*. *Quamoclit coccinea*. *Campsis radicans*. *Lantana trifolia*. *Lantana Camara*. *Antigonon leptopus*.

γ. Undershrubs and herbs.

a. Cultivated only—

Hibiscus radiatus. *Turnera trionifolia*. *Eupatorium Ayapana*. *Eupatorium odoratum*. *Helianthus annuus*. *Chrysanthemum coronarium*. *Chrysanthemum indicum*. *Antirrhinum majus*. *Salvia coccinea*. *Euphorbia geniculata*. *Euphorbia splendens*. *Euphorbia Bojeri*. *Jatropha multifida*. *Iris chinensis*. *Morœa iridoides*. *Tigridia pavonia*. *Belamcanda chinensis*. *Amaryllis Belladonna*. *Hippeastrum rutilum*. *Hippeastrum equestre*. *Hippeastrum stylosum*. *Polianthes tuberosa*.

β. Cultivated and as escapes—

Alyssum maritimum. *Tribulus cistoides*. *Turnera ulmifolia*. *Tagetes patulus*. *Tagetes erectus*. *Zinnia pauciflora*. *Tithonia tagetiflora*. *Helianthus argyrophyllus*. *Lochnera rosea*. *Phlox Drummondii*. *Heliotropium curassavicum*. *Broussaisia elata*. *Torrenia Fournieri*. *Ruellia tuberosa*. *Stachytarpheta indica*. *Hyptis suaveolens*. *Mirabilis Jalapa*. *Rivina humilis*. *Euphorbia heterophylla*. *Cipura paludosa*. *Zephyranthus tubispatha*.

C. Forest, avenue, and hedge plants.

a. Forest and jungle trees, chiefly grown for the sake of timber; some of them also grown in gardens or avenues—

Anacardium occidentale. *Pterocarpus indica*. *Pterocarpus dalbergioides*. *Leucœna glauca*. *Bambusa nana*. *Bambusa vulgaris*.

b. Avenue trees (sometimes also singly in gardens).

a. Planted only—

Swietenia Mahagoni. *Swietenia macrophylla*. *Poinciana regia*. *Colvillea racemosa*. *Albizzia richardiana*. *Enterolobium Saman*. *Casuarina equisetifolia*.

β. Planted and also as if wild—*Millingtonia hortensis*.

c. Hedge plants.

α. Only planted—*Codiaeum variegatum*. *Furcraea* sp.

β. Also run wild—*Parkinsonia aculeata*. *Pithecolobium dulce*. *Opuntia Dillenii*. *Euphorbia Tirucalli*. *Pedilanthus tithymaloides*. *Jatropha Curcas*. *Agave Veræ-Crucis*. *Agave Wightii*. *Agave Cantala*.

II. Found only wild.

A. Field weeds—

Thlaspi arvense. *Capsella Bursa-pastoris*. *Lagascea mollis*.
Asclepias curassavica.

B. Garden weeds—

Talinum patens. *Galinsoga parviflora*. *Synedrella nodiflora*.
Lobelia radicans. *Herpestis chamædroides*.

C. Weeds growing on grass plots, roadsides, in waste places and village jungles—

Argemone mexicana. *Senebiera pinnatifida* (also in garden grounds). *Malvastrum coromandelianum*. *Malvastrum spicatum*. *Anoda hastata*. *Malachra capitata*. *Hibiscus hirtus*. *Hibiscus Manihot*. *Crotalaria saltiana*. *Desmanthus virgatus*. *Flaveria repanda*. *Xanthium spinosum*. *Cosmos sulfureus*. *Tridax procumbens*. *Evolvulus nummularius*. *Solanum sisymbriifolium*. *Nicotiana plumbaginifolia*. *Scoparia dulcis*. *Martynia annua*. *Lippia geminata*. *Hyptis capitata*. *Peperomia pellucida*. *Euphorbia graminea*. *Jatropha gossypifolia*. *Croton sparsiflorus*. *Croton* sp. *Typhonium inopinatum*.

D. Plants growing in tanks, jhils, and marshes—*Neptunia plena*.

Of all these species the most interesting are undoubtedly those enumerated under II. They were not specially indented for, but reached this country as genuine adventurers and probably mostly as stow-aways. Their time of arrival can in most cases be fixed only with a rough degree of approximation, if it can be fixed at all. Some of them, like *Thlaspi arvense* and *Capsella Bursa-pastoris*, penetrated into this country in ancient times, probably accompanying cereals on their march south-eastwards. Most of them arrived in sailing vessels from distant lands, some of them even by steamers. Pretty exact dates of arrival of the true adventurers we possess only of *Lobelia radicans* which was introduced accidentally from China and of *Typhonium Roxburghii* which found its way into the Calcutta Botanic Gardens from the Moluccas, both in Roxburgh's time.

The following chronological classification of the immigrant plants will help us in gaining some idea about the period within which the various species made their appearance in Bengal, or at least in India. For this purpose I subjoin the dates of the well-known publications which have been referred to and quoted from in the main list.

- Rheede, Hortus Malabaricus, 1678—1703.
 Rumphius, Herbarium Amboinense, 1750.
 Roxburgh, Plants of the Coast of Coromandel, 1795—1819.
 Roxburgh, Hortus Bengalensis, 1814.
 Roxburgh, Flora Indica, manuscript finished before 1820.
 Voigt, Hortus Suburbanus Calcuttensis, published in 1845.
 (Voigt was in charge of the Serampore Garden from 1834 to the beginning of 1843.)
 Hooker, Flora of British India, vol. i, 1875; vol. ii, 1879; vol. iii, 1882; vol. iv, 1885; vol. v, 1890; vol. vi, 1894; vol. vii, 1897.
 Watt, Dictionary of the Economic Products of India, 1889—1893.
 Firminger, Gardening for India, 3rd ed., 1874; 5th ed., 1904.
 Prain, Bengal Plants, 1903.

We may therefore somewhat arbitrarily distinguish the following periods :—

- Period I : up to the arrival of the Portuguese, 1498.
 Period II : up to the completed publication of the Hortus Malabaricus, 1703.
 Period III : up to the completion of Roxburgh's works in 1820.
 Period IV : up to the end of Voigt's Indian career, 1843.
 Period V : up to the completion of the Flora Indica, 1897.
 Period VI : after 1897, including Col. Prain's elaboration of the "Bengal Plants."

To period I belong—*Nigella sativa*. *Papaver somniferum* (in Bihar probably not cultivated long before 1600). *Capsella Bursa-pastoris*. *Thlaspi arvense*. *Lepidium sativum*. *Punica Granatum*. *Ricinus communis*. *Cannabis sativa*. *Allium ascalonicum*. *Allium ampeloprasum*. *Allium Cepa*. *Allium sativum*. *Pennisetum typhoides*. 13 species = 5·5%.

Period II. *Anona reticulata*. *Anona squamosa*. *Argemone mexicana*. *Bixa Orellana*. *Hibiscus hirtus*. *Hibiscus mutabilis*. *Averrhoa Carambola*. *Averrhoa Bilimbi*. *Anacardium occidentale*. *Rosa damascena*. *Psidium Guyava*. *Eugenia malaccensis*. *Carica Papaya*. *Tagetes patulus*. *Tagetes erectus*. *Helianthus annuus*. *Chrysanthemum indicum*. *Ipomœa Batatas*. *Quamoclit coccinea*. *Solanum tuberosum*. *Nicotiana Tabacum*. *Nicotiana rustica*. *Euphorbia Tirucalli*. *Ananas sativus*. *Balamcanda chinensis*. *Polygonum tuberosum*. 25 species = 11·1%.

Period III. *Bixa Orellana*. *Talinum patens*. *Hibiscus Mahoe*. *Hibiscus radiatus*. *Hibiscus syriacus*. *Hibiscus Rosa-sinensis*. *Adansonia digitata*. *Guazuma tomentosa*. *Tribulus cistoides*. *Clausena Wampi*. *Triphasia Aurantiola*. *Citrus decumana*. *Swietenia Mahagoni* (1795). *Litchi chinensis*. *Euphorbia Longana*. *Spondias dulcis*. *Pterocarpus indicus*. *Pterocarpus dalbergioides* (1794). *Arachis hypogæa* (mentioned by Rumphius). *Phaseolus*

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lunatus. *Phaseolus vulgaris*. *Indigofera sumatrana*. *Indigofera articulata*. *Parkinsonia aculeata*. *Neptunia plena*. *Desmanthus virgatus*. *Leucaena glauca*. *Pithecolobium dulce*. *Rosa indica*. *Rosa alba*. *Rosa sinica*. *Eriobotrya japonica*. *Fragaria vesca*. *Quisqualis indica* (mentioned by Rumphius). *Melaleuca Leucodendron* (1977 and 1811). *Pimenta officinalis*. *Myrtus communis*. *Passiflora suberosa*. *Opuntia Dillenii*. *Polyscias fruticosa* (1798). *Gardenia florida*. *Ixora stricta* (1798). *Eupatorium Ayapana*. *Guizotia abyssinica* (1800). *Chrysanthemum coronarium*. *Lobelia radicans* (introduced in Roxburgh's time). *Achras Sapota*. *Diospyras Kaki*. *Allamanda cathartica*. *Plumiera acutifolia*. *Lochnera rosea*. *Vallaris pergulana*. *Cryptostegia grandiflora*. *Asclepias curassavica*. *Ipomœa Nil*. *Ipomœa purpurea*. *Solanum Lycopersicum*. *Capsicum annuum*. *Capsicum frutescens*. *Physalis peruviana*. *Browallia elata*. *Millingtonia hortensis* (about 1800). *Campsis grandiflora*. *Campsis radicans*. *Martynia annua*. *Lantana trifolia*. *Lantana camara*. *Stachytarpheta indica*. *Callicarpa cana* (1798). *Meriandra bengalensis*. *Mirabilis Jalapa*. *Rivina humilis*. *Cinnamomum zeylanicum* (1801). *Cinnamomum Camphora* (1802). *Euphorbia geniculata*. *Pedilanthus tithymaloides*. *Jatropha multifida*. *Jatropha Curcas*. *Codiceum variegatum*. *Manihot utilissima* (1794). *Sapium sebiferum*. *Cycas Rumphii* (introduced in Roxburgh's time). *Cycas revoluta* (1794). *Casuarina equisetifolia* (introduced in Roxburgh's time). *Thuja orientalis*. *Ravenala madagascariensis* (1807). *Iris chinensis* (introduced during Roxburgh's time). *Cipura paludosa*. *Eurycles amboynensis*. *Hippeastrum equestre*. *Agave Cantala*. *Agave Wightii*. *Hemerocallis fulva*. *Typhonium Roxburghianum*. *Bambusa nana*. *Bambusa vulgaris*. 96 species = 41·0%.

Period IV. *Alyssum maritimum*. *Senebiera pinnatifida*. *Wissadula rostrata*. *Malachra capitata*. *Crotalaria saltiana*. *Crotalaria Brownei*. *Poinciana regia*. *Colvillea racemosa*. *Rosa rubiginosa*. *Rosa multiflora*. *Turnera ulmifolia*. *Turnera trionifolia*. *Passiflora foetida*. *Passiflora quadrangularis*. *Hamelia patens* (1840). *Vanqueria edulis*. *Eupatorium odoratum*. *Lagacea mollis*. *Zinnia elegans*. *Cosmos sulfureus*. *Helianthus tuberosus*. *Tridax procumbens*. *Thevetia nerifolia*. *Rauwolfia canescens*. *Heliotropium curassavicum*. *Nicotiana plumbaginifolia*. *Antirrhinum maius*. *Russelia juncea*. *Scoparia dulcis*. *Tecoma stans*. *Lippia geminata*. *Duranta Plumieri*. *Clerodendron fragrans*. *Salvia coccinea*. *Bougainvillea spectabilis*. *Euphorbia pulcherrima*. *Euphorbia splendens*. *Euphorbia Bojeri*. *Aleurites moluccana*. *Broussonetia papyrifera* (about 1830). *Maranta arundinacea*. *Moræa iridioides*. *Tigridia pavonia*. *Zephyranthes tubispatha*. *Amaryllis Belladonna*. *Hippeastrum rutilum*. *Hippeastrum reticulatum*. *Hippeastrum stylosum*. *Agave Veræ-Crucis*. 49 species = 20·9%.

Period V. *Malvastrum tricuspdatum*. *Malvastrum spicatum*. *Anoda hastata*. *Crotalaria incana*. *Phaseolus multiflorus*. *Bauhinia monandra*. *Enterolobium Saman*. *Rosa gallica*. *Rosa centifolia*. *Mikania scandens*. *Synedrella nodiflora*. *Galinsoga*

parviflora. *Diospyros philippensis*. *Roupeilia grata*. *Stephanotis floribunda*. *Phlox Drummondii*. *Jacquemonia cœrulea*. *Hyptis suaveolens*. *Bougainvillea glabra*. *Antigonon leptopus*. *Jatropha gossypifolia*. *Eucharis grandiflora*. *Caryota mitis*. *Livistona chinensis*. *Avena sativa*. 25 species = 10·5%.

Period VI. *Swietenia macrophylla* (1872). *Albizzia richardiana*. *Passiflora adenophylla*. *Flaveria repanda*. *Xanthium spinosum*. *Tithonia tagetiflora*. *Helianthus argyrophyllus*. *Evolvulus nummularius*. *Ipomœa tricolor*. *Ipomœa Learii*. *Solanum sisymbriifolium*. *Herpestis chamædroides*. *Torrenia Fournieri*. *Ruellia tuberosa*. *Hyptis capitata*. *Peperomia pellucida*. *Euphorbia heterophylla*. *Euphorbia graminea*. *Croton sparsiflorus*. *Croton sp.* *Ficus pumila*. *Sansevieria trifasciata*. *Sansevieria cylindrica*. *Furcraea sp.* *Typhonium inopinatum*. 25 species = 10·5%.

A comparatively small number of the enumerated species have had Bengali names bestowed on them. According to the way in which they have been named they may be grouped as follows. The list is, however, not complete.

I. Species with simple Bengali names the origin of which cannot be further traced except that some of them are found in (later) Sanskrit literature.

1. *Anona squamosa*—আতা, ātā.

2 and 3. *Tagetes erectus* and *Tagetes patulus*—গেণ্ডা or গৌঁদা—gēnda, the former being the বড় গৌঁদা—bara gēnda, the latter the ছোট গৌঁদা—chōta gēnda.

4. *Ricinus communis*—ভরাণ্ডা, bhērāṇḍa, and এরণ্ড ēraṇḍa, the Sanskrit form of the name.

5. *Cannabis sativa*—গাঁজা, ganja.

6. *Bixa Orellana*—লটকন, laṭkan. The connection with লটকন drooping, hanging, is not at all clear. Also called নটকোনা, not-kōnā.

7. *Hibiscus Rosa-sinensis*—জবা, jabā. This flower appears to have been used in pūjās from old times, and the word jabā is Sanskrit. As it is almost certain that *Hibiscus Rosa-sinensis* is not indigenous in India, but is a native of the Malay Archipelago, the most probable hypothesis is that it was brought to India when Java, like Ceylon, was practically an integral part of a Greater India.

8. *Pennisetum typhoideum*—বাজরা, bājra.

II. A second group consist of species the Bengali names of which have a poetical ring about them—

1. *Helianthus annuus*—সূর্যমুখি or সূর্যমুখী, sūrjja mukhī, with its face towards the sun, the English sunflower.

2. *Hibiscus hirtus*—সূর্যমণি, sūrjjā maṇi, the sun-gem.

3. *Mirabilis Jalapa*—কৃষ্ণকলি, krishna kēli, Krishna's delight (?), নন্দদুলাল, Nanda dulāl, the pet son of Nanda, the father of

Krishna. The exact history of *Mirabilis jalapa* is yet wrapt in mystery.

4. *Belamcanda chinensis*—দশ বাহু, dash bāhu, ten arms.

5. *Agave Veræ-Crucis*—মুকুট ফুল, mukut phul, “flower like the crown worn by a bridegroom.” The name is really that of the flower.

III. Species the Bengali name of which is formed by the aid of the name of some part or property of a plant or of some article in common use with or without a qualifying adjective or noun.

1. *Argemone mexicana*—শৃগাল কণ্টক, shrigāl kaṅṭak, শেয়াল কাঁটা shēyāl kāntā, the “jackal’s thorn,” also বড় শেয়ালকাঁটা bara shēyāl kāntā, to distinguish it from the শেয়ালকাঁটা proper, which is *Cnicus arvensis*.

2. *Euphoria Longana*, the Longan আঁশফল, ānsh phal.

3. *Thevetia nerifolia*, কল্কে ফুল, kalkē phul, from কল্কে the hukka bowl, and ফুল flower.

4. *Meriandra bengalensis*, কর্পূর পাতা, karpūr pātā, from কর্পূর = camphor, পাতা = leaf.

5. *Polianthes tuberosa*, রজনী গন্ধ, rajanī gandha, “night scent.”

IV. Species whose Bengali names are modifications of their foreign names—

1. *Anona reticulata*, নোনা, nōnā, or লোনা, lōnā, with the not uncommon interchange of l and n. The Dictionary of Economic Products gives lūna as a synonym of ātā. It is very doubtful whether লোনা is ever used as a name for *Anona squamosa*. The word Anona is said to be derived from the Malay name *Manoa*, dialectice *menona*.

2. *Papaver somniferum*—পোস্ত, pōsta, really the name of the seeds, পোস্ত ঢেঁড়ী, pōsta dhēri, being the capsule. The word পোস্ত does not seem to be Indian; is it Persian?

3. *Averrhœa Carambola*, কামরাঙ্গা, kāmraṅgā, or কামরঙ্গা, kāmraṅgā; similar in Sanskrit. The word may be a corruption of the Malay name of *Averrhœa Carambola*.

4. *Averrhœa Bilimbi*—বিলিম্বি, bilimbi, probably derived from the Malay name of the tree.

5. *Swietenia Mahagoni*—মেহগনী, mēhaganī, মহগনী mahagnī, হঙ্গন hangan.

6. *Litchi chinensis*—লিচু, lichu, from the Chinese name of the fruit.

7. *Anacardium occidentale*—কাজু বাদাম, kāju bādām : Cashew Nut.

8. *Rosa damascena*, *Rosa centifolia*, and some other roses introduced from the West—গোলাব, gōlāb, from the Persian *gul* or *gulab*.

9. *Punica Granatum*—ডালিম, dālim, দালিম, dālim, দাড়িম, dārim, names directly derived from the corresponding Sanskrit name of the fruit; আনার from the Persian *anar* or *nar*.

10. *Psidium Guyava*—পয়ারা, pēyārā, or পিয়ারা, piyārā, very probably derived from the Spanish pera=pear, or the corresponding Portuguese name. The Eastern Bengal name গইয়া, goyā, is clearly derived from guava or guyava.

11. *Carica Papaya*—পঁপিয়া, pēpiyā, from the Mexican name of the plant or fruit.

12. *Physalis peruviana*—টেপারি, tēpāri.

13. *Nicotiana Tabacum*—তামাক, tāmāk, তামাকু, tāmāku, tobacco, from *tabaco*, a kind of pipe out of which the natives of Antilles smoked the dried leaves of *Nicotiana Tabacum*.

14. *Ananas sativus*—আনারস, ānāras, probably from South American (Peruvian) name Nanas. It has also been suggested that the name may be derived from আনার the Pomegranate, and রস, ras, scent, smell—a less probable hypothesis.

V. Species in the formation of whose Bengali name the vernacular name of some indigenous or previously known plant is utilised, without or with the addition of some distinguishing noun or adjective, the indigenous plant either belonging to an allied species or genus or otherwise bearing some suggestive resemblance.

a. The case is one of simple transference of a name—

Aleurites moluccana—আখরোট, ākhrōt, from the kernels of *Aleurites moluccana* tasting somewhat like the kernels of the true akhrot, the walnut.

b. The distinguishing name is that of a country or the corresponding adjective. Here বিলাতী, foreign, European, English, often only meaning introduced by Europeans, plays a prominent part.

1. *Spondias dulcis*—বিলাতী আমড়া, bilāti āmrā, from আমড়া = *Spondias mangifera*.

2. *Arachis hypogæa*—বিলাতী মুগ, bilāti mung, from মুগ = *Phaseolus radiatus*.

3. *Parkinsonia aculeata*—বিলাতী কিকর, bilāti kikar, from কিকর = *Acacia arabica*.

4. *Pithecolobium dulce*—বিলাতী আমলি, bilāti āmli, from আমলি = *Tamarindus indica*.

5. *Neptunia plena*—বিলাতী পানী নাঙ্গক, bilāti pāni nājak, from পানী water, and নাঙ্গক = *Mimosa pudica*.

6. *Albizia Richardiana*—বিলাতী আমলকী, bilāti āmlakī, from আমলকী = *Phyllanthus embelica*.

7. *Myrtus communis*—বিলাতী মেন্দি, bilāti mendi, from মেন্দি = *Lawsonia alba*.

8. *Diospyros Kaki*—বিলাতী গাব, bilāti gāb, from গাব = *Diospyros embryopteris*.

9. *Solanum Lycopersicum*—বিলাতী বেগুন, bilāti bēgun, from বেগুন = *Solanum Melongena*.

10. *Solanum tuberosum*—বিলাতী আলু, bilāti ālu, from আলু, the tuber of various species of *Dioscorea*.

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11. *Hyptis suaveolens*—বিনাটী তুলসী, bilāti tūlsi, from তুলসী = *Ocimum sanctum*.

12. *Pedilanthus tithymaloides*—বিনাটী শিজ, bilāti shij, from শিজ = *Euphorbia Nivulia*.

13. *Casuarina equisetifolia*—বিনাটী কাউ, bilāti jhāu, from কাউ = *Tamarix gallica*.

14. *Nicotiana rustica*—অংগ্রেজী তামাকু, angrēji tamāku, from অংগ্রেজী = angrēji, English.

15. *Capsicum annuum, grossum*—কাফুরী মরিচ, kāphrī marich, মরিচ = *Piper nigrum*.

16. *Pithecolobium dulce*—দক্ষিণী বাবলা, dakṣiṇī bāblā, the "Deccan babul," from বাবলা = *Acacia arabica*, more commonly called Bilāti āmli (see above).

17. *Capsicum frutescens*—লঙ্কা মরিচ, Lanka marich, from লঙ্কা = Ceylon, মরিচ = *Piper nigrum*.

18. *Euphorbia Tirucalli*—লঙ্কা শিজ, Lanka sij, see Nos. 12 and 16.

19. *Eugenia malaccensis*—মালাকা জাম্বুন, mālākā jāmrul, মালাকা Malacca, জাম্বুন = *Eugenia alba*.

20. *Citrus decumana*—বাতাবী নেবু, bātābī nēbu, from বাতাবী-Batavia, নেবু = *Citrus medica, acida*, the Indian Lime.

21. *Triphasia Aurantiola*—চীনে নারেন্গা, chinē nārēngā, the "China Orange."

22. *Arachis hypogaea*—চীনা বাদাম, chinā bādām: the "China Almond."

c. The distinguishing name is some adjective or some noun in the nominative or genitive case which either indicates some prominent characteristic or the locality where the plant grows.

1. *Nigella sativa*—কাল জীরী or কাল জীরক, kāla jirā or kāla jīrak, from কাল = black, জীরক = the seed of *Cuminum cyminum*.

2. *Rosa alba*—স্বত গোলাব, svēt gōlāb, the "white rose."

3. *Thevetia neriifolia*—হলদি করবী, haldi karabi, from হলদি = turmeric, here the colour turmeric, and করবী = *Nerium odorum*.

4. *Jatropha gossypifolia*—লাল ভেরাণ্ডা, lāl bhērānda, from লাল = red, ভেরাণ্ডা = *Ricinus communis*.

5. *Bambusa nana*—ছোট বাঁশ, chōta bāñsh, "the small bambu."

6. *Hibiscus mutabilis, var. plena*—স্থল পদ্ম, sthal padma, from স্থল = dry land, and পদ্ম = *Nelumbium speciosum*.

7. *Guizotia abyssinica*—রামতিল, Rām til, from তিল = *Sesamum indicum*; রাম the well-known hero of Hindu mythology; the word, when prefixed to a plant name, indicates something taller, bigger, coarser, in contradistinction to সীতা, Sitā, the gentle and faithful wife of Rāma, whose name preceding a plant name indicates something smaller, more tender, or more delicate. Thus—রামফল, Rāmphāl, is the gritty, coarser fruit of *Anona reticulata*, and সীতামফল, Sitāphāl, is the more tender and more delicately scented fruit of *Anona squamosa*.

8. *Allamanda cathartica*—হর ককড়া, har kakrā from হর = *Terminalia Chebula*, ককড়া thorny.

9. *Rosa indica*—কাঁটা গোলাব, kaṅṭa gōlāb, “the thorny rose.”

10. *Nicotiana plumbaginifolia*—বন তামাকু, ban tāmāku, “the jungle tobacco.”

11. *Jatropha Curcas*—বাগ ভেরাঙা, bāg bhērāṅā. The first part of the name is evidently of Hindustani origin: باغ baḡ = garden, ভেরাঙা being the Bengali form of the name for *Ricinus communis*. বাগ ভেরাঙা would mean therefore “the garden castor-seed plant” in distinction to the true এরঙ, the *Ricinus communis* cultivated in fields. There exist other forms of the name of *Jatropha Curcas*, namely বাঘ ভেরাঙা, which would mean “the Tiger’s castor-seed plant,” which has not a clear meaning, and গাব ভেরাঙা, which would indicate a resemblance to the গাব, gāb, i.e., *Diospyros embryopteris*: unfortunately the most vivid imagination could not find many features in common between *Jatropha Curcas* and *Diospyros embryopteris*. As the form গাব ভেরাঙা is undoubtedly in use, we have evidently to deal with a not uncommon case of metathesis.

In conclusion I may be allowed to remark on the scantiness of specimens of Bengal plants in our local herbaria. There exists a fair number of specimens of so-called “useful” plants, but as far as wild plants are concerned, the collections are lamentably poor. It is evidently a case of “Thou art so near and yet so far!” It is to be hoped that mofussil colleges will develop into centres for botanical studies, and that their authorities will make it one of their duties to start museums containing complete collections of the plants growing within the limits of the Division in which the educational institution is situated. Such a collection should not only contain the dried specimens themselves, but copious notes on the mode of occurrence, the time of flowering and fruiting, the colour of the different parts of the flowers as well as the fruits, on various physiological facts, such as the time of opening and closing of the flowers and drooping of leaves and many others, the uses to which the plants are put by the peasantry, and any existing vernacular name, excluding, however, fancy names invented for the occasion.

DECEMBER, 1908.

The Monthly General Meeting of the Society was held on Wednesday, the 2nd December, 1908, at 9-15 P.M.

The HON. MR. JUSTICE ASUTOSH MUKHOPADHYAYA, M.A., D.L., President, in the chair.

The following members were present:—

Dr. N. Annandale, Mr. J. C. Brown, Babu Monmohan Chakravarti, Mr. G. R. Clarke, Mr. D. Hooper, Dr. Girindranath Mukhopadhyaya, Dr. J. E. Panioty, Rev. A. C. Ridsdale, Dr. C. Schulten, Mahamahopadhyaya Haraprasad Shastri, Mr. G. H. Tipper, Dr. Satischandra Vidyabhusana, Mr. E. Vredenburg, Rev. A. W. Young.

Visitors:—Babu Jaganmohan Chakraborty, Mr. R. W. Church, Major F. De B. Young, and Dr. E. Sommerfeldt.

The Minutes of the last meeting were read and confirmed.

Fifty-seven presentations were announced.

The General Secretary reported:—

(1) That Mr. T. D. Edleston and Mr. J. F. Duthie had expressed a wish to withdraw from the Society.

(2) That the election of Dr. J. S. Brooke as a member of the Society has been cancelled at his own request.

The following four gentlemen were balloted for as Ordinary Members:—

Captain G. B. Biddick, R.A.M.C., Staff Surgeon, Fort William, proposed by Major L. Rogers, I.M.S., seconded by Lieut.-Col. W. J. Buchanan, I.M.S.; Captain Owen St. John Moses, M.D., F.R.S.E., I.M.S., Resident Physician, Medical College, proposed by Major L. Rogers, I.M.S., seconded by Lieut.-Col. W. J. Buchanan I.M.S.; Captain Hugh Barkley Steen, M.B., I.M.S., Resident Medical Officer, Eden Hospital, proposed by Major L. Rogers, I.M.S., seconded by Lieut.-Col. W. J. Buchanan, I.M.S.; Lieut.-Col. John Gregory Jordan, M.B., I.M.S., 9, Russell Street, proposed by Major L. Rogers, I.M.S., seconded by Lieut.-Col. W. J. Buchanan, I.M.S.

The following papers were read:—

1. *Note on a Copper-plate Inscription found at Pachar in Jhansi District. By C. A. SILBERRAD, B.A., B.Sc.*

I received recently information of the finding of a copper-plate inscription at Pachár (पचार), a village 12 miles N.E. of

Jhansi City, from the Tahsildar. Inquiry showed that it had been originally dug up some 40 or 50 years ago by one Ganeshju while excavating the foundations of his house. The exact spot is now unknown, but it was somewhere on the raised mound (consisting of the usual débris of old houses, etc.) on which the village stands. The inscription was in possession of one Bindrabān, son of Kalli, Brahman, one of the Zamindars of Pachár, and he has presented it to Government. The plate has been sent to Dr. J. P. Vogel and will be deposited in the Lucknow Museum ; while the inscription, with a translation, will be published in the *Epigraphia Indica*.

A preliminary translation made by P. Vinaik Rao, Sanskrit Teacher of the Macdonnell High School, Jhansi, shows that the inscription records the grant by "Maharaja Paramárdhi of Kalinjar" (the well-known Chandel Raja of Kalinjar, Mahoba, etc.) to one Pandit Sri Keshava Sharma, Brahman, of so much lands as can be ploughed by ten pair of bullocks or sown with some $21\frac{1}{2}$ maunds of seed. The inscription is dated the 8th of the light half of Kartik Samvat 1233, or A.D. 1176, and the land is recorded as situated in the village of Biláspúr in the Parganna of Karigawa ; the village of Lewa is also mentioned as obviously in the immediate vicinity.

Lewa (लेवा) is the name of a village only 3 miles west of Pachár, and there are several villages named Kargawan (करगवाँ) near Jhansi ; by far the largest and most important, however, is one situated 5 miles N. E. of Chirgaon and 9 miles N. E. of Pachár. But no village or hamlet of the name of Biláspúr appears on the present map anywhere in this neighbourhood.

A local inquiry in Pachár, however, revealed the fact that there is a tradition that in former times ("10 to 15 generations ago") that village itself was owned by Naik Brahmans and named Biláspúr. Its present owners are Ahirs of the Pacheri clan who say they came from the neighbourhood of Babína (17 miles south of Jhansi). There are, moreover, in Pachár distinct evidences of Chandel buildings. The chief is a small square temple, about eight feet square and the same height, of the usual Chandel pattern (of the simplest kind). It consists of roughly squared slabs and columns of granite carved in the less elaborate Chandel style. This temple is situated in the heart of the village some ten feet below the present level of the surface there. Steps lead down to it, and the earth is prevented from falling in by a brick wall all round the space where the temple stands. There is a tradition that a Bairági from Jatára (in the Orchha State, 20 miles south of Mau-Ránípúr in the Jhansi district), by name Pahlav Dás, told the villagers some 40 or 50 years ago that there were four more such temples near this one, two at a short distance to the east, one to the north, and a fourth the exact location of which is unknown. All these temples were said to be buried, and (if existent) so remain to this day. This same Pahlav Dás is also said to have pointed out the site of a disused Chandel well which has since been excavated. This is situated about one furlong east

of the village; it is lined below the level of the surface with the large bricks characteristic of Chandel work.

At Lewa there is a 'Baoli' (large well) lined with squared stones some of which are clearly of Chandel workmanship, and a granite slab that clearly formed originally part of a Chandel building has been utilized to form a Sati stone bearing an inscription which, however, is quite illegible. The Sati stone is of the usual Bundela type common all over the district, and is quite unconnected with the Chandels.

At Kargawan pieces of granite bearing Chandel carvings have been built into the walls of an old Mahratta fort, and there is said to be an old well now filled in, lined with the large Chandel bricks.

Chandel ruins and carvings occur in many other villages throughout the whole district, from the extreme north-east near the junction of the Dhasan and Betwa to the extreme south where are the famous Chandel sites of Deogarh, Cháandpúr, Dudhai and Madanpúr.

2. *Sikim copper coins.*—By MONMOHAN CHAKRAVARTI, M.A., B.L., M.R.A.S.

This paper will be published in a subsequent number of the *Journal*.

3. *Some Rare Sanskrit Works on Grammar, Lexicography and Prosody recovered from Tibet.* No. 2.—By DR. SATISCHANDRA VIDYABHUSANA.



The Adjourned Meeting of the Medical Section of the Society was held at the Society's Rooms on Wednesday, the 9th December, 1908, at 9-15 P.M.

LIEUT.-COLONEL G. F. A. HARRIS, I.M.S., in the chair.

The following members were present:—

Rai Hiralal Bose Bahadur, Dr. U. N. Brahmachari, Lieut.-Col. W. J. Buchanan, I.M.S.; Dr. G. C. Chatterjei, Miss R. Cohen, Captain F. P. Connor, I.M.S.; Dr. O. M. Eakins, Dr. H. Finck, Sir Thomas Holland, K.C.I.E.; Lieut.-Col. F. P. Maynard, I.M.S.; Major J. Mulvany, I.M.S.; Lieut.-Col. H. W. Pilgrim, I.M.S.; Dr. T. F. Pearse, Captain H. B. Steen, I.M.S.; Major L. Rogers, I.M.S., Honorary Secretary.

Visitors:—Dr. A. M. Leake and Dr. Jagatpati Ray.

The Minutes of the last meeting were read and confirmed.

Clinical cases were shown by Lieut.-Col. Harris.

A discussion on "Tubercular diseases in Bengal" was introduced by Lieut.-Col. G. F. A. Harris, M.D., F.R.C.P., I.M.S.; and communications on the same subject were made by Majors C. R. Stevens, L. Rogers, and Captain F. P. Connor, I.M.S., and the subject adjourned until the following meeting.



PRINCIPAL PUBLICATIONS OF THE SOCIETY.

- Asiatic Researches, Vols. I—XX and Index, 1788—1839.
Proceedings, 1865—1904 (now amalgamated with Journal).
Memoirs, Vol. 1, *etc.*, 1905, *etc.*
Journal, Vols. 1—73, 1832—1904.
Journal and Proceedings [*N. S.*], Vol. 1, *etc.*, 1905, *etc.*
Centenary Review, 1784—1883.
Bibliotheca Indica, 1848, *etc.*

A complete list of publications sold by the Society can be obtained by application to the Honorary Secretary, 57, Park Street, Calcutta.

PRIVILEGES OF ORDINARY MEMBERS.

- (a) To be present and vote at all General Meetings, which are held on the first Wednesday in each month except in September and October.
- (b) To propose and second candidates for Ordinary Membership.
- (c) To introduce visitors at the Ordinary General Meetings and to the grounds and public rooms of the Society during the hours they are open to members.
- (d) To have personal access to the Library and other public rooms of the Society, and to examine its collections.
- (e) To take out books, plates and manuscripts from the Library.
- (f) To receive *gratis*, copies of the *Journal and Proceedings* and *Memoirs* of the Society.
- (g) To fill any office in the Society on being duly elected thereto.

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