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## ASIATIC SOCIETY OF BENGAL.

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PART I.

Nos. I. to IV.—1866.

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“It will flourish, if naturalists, chemists, antiquaries, philologists, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.”



SIR WM. JONES.

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# CONTENTS.



## No. I.

(Published 15th June, 1866.)

Outlines of a Plea for the Arabic Element in Official Hindustani. —By J. BEAMES, Esq., C. S., ... ..	1
A Translation of the Chapter on Ordeals, from the Vyâvahâra Mayukha.—By Professor GEORGE BÜHLER, Elphinstone College, Bombay, ... ..	14
Rough Notes on some of the Antiquities in the Gayâ District. By W. PEPPE, Esq., ... ..	49
Literary Intelligence, ... ..	60

---

## No. II.

(Published 31st August, 1866.)

Descriptions of Ancient Remains of Buddhist Monasteries and Temples, and of other buildings, recently discovered in Benares, and its vicinity.—By the Rev. M. A. SHERRING, L. L. B., and CHARLES HORNE, Esq., C. S., ... ..	61
Assyro-Pseudo-Sesostris.—By HYDE CLARKE, Esq., Member of the German Oriental Society, of the Society of Northern Antiquaries of Copenhagen, of the Academy of Anatolia, of the Institution of Engineers of Vienna, Local Secretary of the Anthropological Society, ... ..	87
Notes on some of the Temples of Kashmir, especially those not described by General A. CUNNINGHAM in his Essay publish- ed in the Journal of the Asiatic Society of Bengal for September, 1848.—By W. G. COWIE, Esq., M. A., Chaplain on duty in Kashmir during the summer of 1865, ... ..	91
Remarks on Barbier de Meynard's edition of Ibn Khordâdbeh and on the Land-tax of the empire of the Khalyfs.—By Dr. A. SPRENGER, ... ..	124
Literary Intelligence, ... ..	147

---

## No. III.

(Published 2nd November, 1866.)

A Notice of the Çaunaka Smṛiti.—By Professor GEORGE BÜHLER, Superintendent of Sanskrit Studies, Punah College, ... ..	149
---	-----

	Page
Notes on Atranji Khera or Pi-lo-shan-na of General CUNNINGHAM, (vide Continuation of Report for 1862-63, No. VIII. page 15.)—By C. HORNE, Esq. C. S., ... ..	165
Notes on some Buddhist Ruins at Doob Koond.—By Captain W. R. MELVILLE, in charge, Gwalior Survey, ... ..	168
Some Objections to the Modern Style of Official Hindustani.—By F. S. GROWSE, Esq, M. A. Oxon, B. C. S., ... ..	172
Description of the Chandrarekhágarh near Sashtání, Pergunnah Nyegur, Zillah Midnapore.—By W. J. HERSCHEL, Esq., B. C. S., ... ..	181
Notes on a Tour in Manbhoom, in 1864-65.—By Lt.-Col. E. T. DALTON, Comr. of Chota-Nagpore, ... ..	186
Notes on a Copper plate Inscription from Sambhalpur.—By BA'BU RÁJENDRALÁLA MITRA, ... ..	195
Literary Intelligence, ... ..	197

---

No. IV.

(Published 6th July, 1865.)

Notes on the History and Topography of the Ancient Cities of Delhi.—By C. J. CAMPBELL, Esq., C. E., ... ..	199
Notes on Pilgrimages in the Country of Cashmere.—By Major D. F. NEWALL, R. A., ... ..	219
A Vocabulary of English, Balti and Kashmiri, compiled by H. H. GODWIN AUSTEN, Capt., H. M.'s 24th Regt. Assist. Gt. Trigl. Survey, ... ..	233
Notes on Gupta Inscriptions from Apsar and Behar.—By Bábu RÁJENDRALÁLA MITRA, ... ..	268
Literary Intelligence, ... ..	275

---

## LIST OF PLATES.

---

	Page
I. Pillared portico at Nair, ... ..	50
II. Stone figure at Genjun, ... ..	53
III. Rough Section and Plan of the Koch temple, ...	55
IV. Oomga temple, ... ..	58
VI. Rough Plan of Tilia Nala Vihar Chaitya, ... ..	72
VII. Buddhist Vihar in the Rájghát Fort,—ceiling, ...	74
VIIa. View of Buddhist Vihar in the Rájghát Fort, ...	68
VIII. Buddhist Vihar in the Rájghát Fort,—details of Pillars, ... ..	65
IX. Bhanyar Temple, Colonnade, ... ..	92
XIV. Temple at Lidar, ... ..	98
XV. Buddhist Chaitya (ceiling,) ... ..	67
XVI. Rough Plan of Atranji Khera, ... ..	166
XVII. Conch Temple, ... ..	54
XVIII. Roof of Pandrethan, ... ..	118
XIX. Temple in the lake at Manusbal, ... ..	111
XX. Figure of Sesostris at Ninfi, ... ..	88
XXI. Hindu Temple at Chandrarekhágarh, ... ..	184
XXII. Plan of the Masjid Kutb ul Islam, ... ..	202
XXIII. Elevation and details of ditto, ... ..	218
XXIV. Map of the sites of the old cities of Delhi, ... ..	214
XXV. Facsimiles of Inscriptions on a stone pillar in the Behar Fort, ... ..	270

---



## INDEX TO PART I.

	Page
<i>Achulpow</i> , on the Kallee Nudée, visit to, ... ..	166
ACVALA'YANA, many passages of the Çaunaka Káriká agree with the sutras of, ... ..	154
<i>Adampur Mahallá</i> , ancient mounds in the, ... ..	68
<i>Ádi Bishweshwara</i> , description of, ... ..	83
<i>Ádilábád</i> , fort of, ... ..	214
ÁDITYAS, names of the twelve, ... ..	31
ÁDITYA SENA, ... ..	268
Adoption, Çaunaka's Law of, ... ..	164
Adultery and theft, ordeals in cases of, ... ..	15
Ain-i-Akbary, extract from the, ... ..	218
Áláí Durwázá built by Ala Udín, ... ..	203
ALA' U'DÍN, description of the site of the entrenchment of, ... ..	206
ALA' U'DÍN'S extensive improvements of the Kutb Ul Islam, ... ..	203
ALTAMSH'S tomb, peculiarities in, ... ..	202
ALY HASANY'S account of weights, ... ..	127
<i>Amarnáth</i> , pilgrimage to, ... ..	219
ÁNANDA SWÁMI, author of S'aiva sudhákara, ... ..	198
Aphsar and Behar Inscriptions, Notes on, ... ..	267
Arabic Element in Official Hindustani, a Plea for the, ... ..	180
Arabic used in the language of law-courts of India, ... ..	174
Árhái Kangura mosque, description of the, ... ..	76
A'SOKA'S pillars, Lat Bhairo one of, ... ..	73
Aureus of Constantinople, Standard of Musulman weights, ... ..	125
AURANGZEBE destroyed the temple where Lat Bhairo stood, ... ..	73
AURANGZEBE'S mosque near Bishweshwara temple, ... ..	80
AUSTEN, Capt. H. H. G., Vocabulary of English, Balti and Kashmiri, ... ..	233
<i>Avantiswámi</i> temple, description of the, ... ..	121
<i>Avantiswámi</i> , pillars at, ... ..	94
Bála and Vridhha, defined, ... ..	17
Battis Khambhá, description of, ... ..	75
BEAMES, J., Esq., Outlines of a Plea for the Arabic Element in Official Hindustani, ... ..	1
<i>Bela</i> , ruins near, ... ..	50

	Page
<i>Benares</i> , absurdity of deriving the word from Burna and Assi,	86
———— antiquity of, ... ..	61
———— certain Annals of, ... ..	70
———— extent of the city of, ... ..	62
Bhagavatí sutra of the Jains, Dr. Weber's Essay on,	198
Bhaniyar temple, description of the, ... ..	91
<i>Bharmajo</i> temple, description of the, ... ..	69
BIHA'RI DAS, author of the Satsaiyá, ... ..	174
BONA DUTTA, founder of the Boonyar temple, ... ..	97
BONÁR RAJA, founder of Rajghaut fort, ... ..	64
<i>Budaon Mahallá</i> , small mosque in the, ... ..	68
Buddhist Chaityas, at Rájghát, ... ..	67
———— origin of Lat Bhairo and Battis Khambhá,	75
———— Vihar, Rájghát, ... ..	64
———— and cloisters altered by Mahomedans, ... ..	65
BÜHLER, Professor G., Translation of the chapter on Ordeals from the Vyavahára Mayukha, ... ..	14
———— Notice of the Çaunaka Smṛiti, ... ..	149
<i>Burabur Hills</i> , figures removed to Newree from the, ... ..	50
<i>Burna</i> , the boundary of Benares, ... ..	63
Çaiva sūdhákar of Ananda Swámi, ... ..	197
ÇAMPBELL, C. J. Topography of the ancient cities of Delhi, ...	199
Çanja, a system of Musulman weights, ... ..	126
ÇA'NTA VARMA', ... ..	268
Çaunaka Smṛiti, Contents of the, ... ..	151,
———— Çantis peculiar to the, ... ..	153
———— more extensive than a Grihyasutra, ... ..	153
———— Laghu and Brihat, ... ..	150
———— Genuineness of the first three verses of the, doubted, ... ..	150
Çaunaka Káriká written by a Vaishṇava, ... ..	155
Chaityas at Rájghát, description of the Buddhist, ... ..	67
CHAND, the bard of the last Hindu King of Delhi, ... ..	174
CHANDRAK, sent Umr Sing and Beja Sing to the Doob Koond temple, ... ..	171
CHANDRA RA'JA', founder of the Chandra Garh, ... ..	185
<i>Chandrarekhá Garh</i> , measurements of the, ... ..	181
CHAUCER, ridiculed for French words, ... ..	3
Choukhambhá mosque, description of the, ... ..	79
<i>Chullandaraka</i> , gift of the village of, ... ..	195
<i>Churra</i> , Deválayas at, ... ..	187
CLARKE, Esq. H. E., On Assyro-Pseudo-Sesostris, ... ..	87
Cloisters of Buddhist Vihars altered by the Mahomedans, ...	65
Court-language of the Bengal Presidency unintelligible because it is highly cultivated, ... ..	10
———— heterogeneous origin of the, ... ..	5
COWIE, Rev. G. W., On the Temples of Kashmir, ... ..	91

	Page
Coins, silver Hindu, found at the Atranji Khera, ... ..	167
<i>Cossai</i> , banks of the, colonized by the Srawaks, ... ..	186
Court-language, convenience of the, ... ..	5
Cubic measure, Qafyz, ... ..	128
DALTON, Lieut.-Col. E. T., Tour in Maunbhoom, ... ..	186
DÁMODARA fought with the Hunas, ... ..	268
Dattaka Mimánsá quotes <i>ślokas</i> from <i>Çaunaka</i> , ... ..	149
<i>Delhi</i> at the time of Timur, ... ..	214
—, chronology of the different cities of, ... ..	216
—, various cities of, ... ..	214 et seq.
<i>Deokund</i> , ruins near, ... ..	53
<i>Dhulmi</i> , antiquities of, ... ..	191
DIODORUS SICULUS, account of Sesostriſ by, ... ..	88
<i>Doob koond</i> , repaired by Pandu and his brothers, ..	171
Drubgama temple, description of the, ... ..	116
Durjankari-panchánana of Rangáchári Swámi, ... ..	147
<i>Dyamun</i> , description of temples at, ... ..	169
Egyptian measure, the <i>Irdabb</i> , ... ..	130
English language, foreign elements in the, ... ..	1
Eunuchs, how to be judged, ... ..	17
Fire, ordeals by, ... ..	33
<i>Firuzábád</i> , city of, ... ..	215
<i>Futtehgarh</i> , description of the temple at, ... ..	113
Garbhálambhana, rules of, given in the <i>Çaunaka Smṛiti</i> and the <i>Rig Veda Grihya sutra</i> , ... ..	154
<i>Gayá</i> , antiquities of, ... ..	50
<i>Genjun</i> , ruins near, ... ..	52
Geography of Ibn Khordabéh, ... ..	125
GROUSE F. S., Esq., Objections to the modern style of official Hindustani, ... ..	172
<i>Gulzar Mahalla</i> , Maqđum sahib in the, ... ..	72
GUPTAS, probable connexion of the, with Lat Bhairo, ... ..	73
— of Apsar, ... ..	267
— of Bhitari ruled in Behar, ... ..	271
HARIRI and Muhammad, languages of, ... ..	8
HASHKA GUPTA, ... ..	268
Hellenes observed Iberian Mythology, ... ..	90
HERODOTUS's account of the expedition of Sesostriſ, ... ..	87
HERSCHEL, W. J., Esq., Chandra-rekhá-garh, ... ..	181
Himyaritic dialects spoken by troops of Yaman, ... ..	9
Hindí current in Akbar's Court, ... ..	174
— and foreign words compared, ... ..	176
— different kinds of, ... ..	<i>ib.</i>
Hindustani benefited more by Semitic than by Indian ele- ments, ... ..	4
—, official, ... ..	1, 172
HODGSON's notice of the affinity between the Caucasian and the Himalayan Valleys, ... ..	90

	Page
HORNE, C., Esq., Atranji Khera or Pilushanna, ... ..	165
----- Buddhist remains in Benares, ... ..	61
IBN BATUTA'S travels, translation of, ... ..	124
IBN KHORDABEH, MSS. of, ... ..	126
Inscription, copper-plate, from Sambalpur, translation of, ... ..	195
----- on Alamgir's Masjid, ... ..	77
Inscriptions, Major Dixon's Sanscrit and Canarese, ... ..	60
----- from Apsar, ... ..	275
----- " Behar, ... ..	267
<i>Jahanpanah</i> , Citadel of, ... ..	215
Jain origin of the Bishweshwar temple, ... ..	81
JIVITA GUPTA, ... ..	268
QODAMA'S account of the Sawad revenue, ... ..	136
Káriká, the original work of Çaunaka, ... ..	154
KASHYAPA, the "Ocean" desiccated by, ... ..	220
KÁTYÁYANA, works of Çaunaka known to, ... ..	149
Kausika Gotra, Brahmans of the, ... ..	196
Kávyá Prakás'a of Mahesa Chandra, ... ..	147
Kirta Bisheshwar temple and Alamgiri mosque, ... ..	77
<i>Kispa</i> , ruins near, ... ..	52
<i>Kohil</i> , temple at, ... ..	116
<i>Konch</i> , ruins near, ... ..	53
KONA DEVI', ... ..	268
KRISHNA GUPTA, ... ..	267
KUMA'RA GUPTA, ... ..	268
<i>Kunamoh</i> , temples at, ... ..	123
Kutb Minar, description of, ... ..	204
Kutb Minar ascribed to Ananga Pal, ... ..	207
Kutb ul Islam, description of, ... ..	199
<i>Lalkote</i> , description of, ... ..	206
<i>Lall Mahal</i> , remains of, ... ..	217
Language of the Arabs corrupted by Mahomedan conquest, ... ..	9
<i>Lanka</i> , description of temple on the island of, ... ..	111 et seq.
Lat Bhairo Buddhist Vihar, ... ..	73
----- Mahomedan Cemetery, ... ..	74
<i>Lidar</i> , temples at, ... ..	97
Lingam, measurement of the, at Atranji Khera, ... ..	167
<i>Lomasa Rishi</i> , cave of, ... ..	51
MÁDHAVA GUPTA, ... ..	268
Mahá Deví, ... ..	268
MAHA SUDEB RAJA'S grant of land, ... ..	195
MAHA SENA GUPTA, ... ..	268
Mánava Dharmas'ástra notices Çaunaka, ... ..	149
<i>Manasbal</i> , description of the temples of, ... ..	110 et seq.
<i>Maqdm Sahib</i> , remains of Buddhist chaitya at, ... ..	71
<i>Martand</i> , description of the middle chamber in, ... ..	118
----- pillars at, compared with those of Bhaumajo, ... ..	93
Maruts, names of the seven, ... ..	31

	Page
Mátris, names of the seven, ... ..	31
Máshá, ordeals by hot, ... ..	45
<i>Maushari</i> , site of, not determined, ... ..	268
MELVILLE, Capt. W. R., Buddhist ruins of Doob Khund, ...	168
MIRA SAHEB's tomb near Tilia Nala, ... ..	71
Mithqal weights, ... ..	126
Moqaddasy, editor of, ... ..	124
Months suited for ordeals in general, ... ..	17
Nágari characters abandoned on the adoption of Persian dialect,	177
<i>Nair</i> , ruins near, ... ..	50
NARAIN SHAH, description of the temple of, ... ..	112
NEWALL, Major D. F., Pilgrimages in Kashmir, ... ..	233
<i>Newree</i> , figures near the village of, ... ..	49
<i>Nigumbode</i> , temple of, ... ..	215
Nirnaya-sindhu alludes to Çaunaka, ... ..	149
NUNJI, Sri Buddha and Chinamusta, temples dedicated to, ...	171
Oaths may be administered to both parties in an ordeal, ...	16
Offerings, burnt, in ordeals, ... ..	33
OMAR I. sent Othman to survey Babylonia, ... ..	133
<i>Oomga</i> temple, description of the, ... ..	58
Ordeals, papers on, by Ali Ibrahim Khan, Professor Stenzler and Mr. Macnaghten, ... ..	14
——— to be applied where human evidence fails, ... ..	14
——— immediate and mediate, ... ..	14
——— invocation common to all, ... ..	20, 22
<i>Pacheta</i> , Raja of, ... ..	194
<i>Padinapore</i> , pilgrimage of, ... ..	221
<i>Palee</i> , ruins near, ... ..	50
Pandit, (the) a monthly journal started at Benares, ... ..	147
<i>Pandrethan</i> , description of, ... ..	117
——— pilgrimage to, ... ..	221
——— Lidar temple copy of that at, ... ..	99
Panjabi Dictionary examined, ... ..	173
<i>Páthán Sugandheçwara</i> , description of temples at, ... ..	115
<i>Payach</i> and Lidar drains compared, ... ..	98
PEPPE, W. Esq. Antiquities of Gya, ... ..	49
Persian, the effects of the abolition of, in law-courts, ... ..	175
Ploughshare, ordeals by, ... ..	47
Poison, ordeals by, ... ..	43
Premsagúr, the language of, ... ..	173
PRINSEP's ground plan of the Bishesar temple, ... ..	81
Putra Sangraha vidhi, text and translation of the, ... ..	157
RA'JENDRALA'LA MITRA, Bábu, Shambhalpur Inscription, ...	195
——— Gupta Inscriptions from Apsar and Behar, ... ..	261
<i>Rájghat</i> fort, key of Benares, ... ..	64
Rámáyana's account of the Kols, ... ..	193 et seq.
RANGA'CHA'RI SWA'MÍ, author of <i>Durjana Kari Panchánana</i> , ...	147

	Page
Rig Veda, Mantras quoted in the Çaunaka Káriká from the, .	154
RITTER doubted the Egyptian character of the monument of Sesostris, ... ..	88
Rudras, name of the eleven, ... ..	31
Sabhábilása, the only Persian word in the, is the name of the writer, ... ..	174
<i>Sambhalpur</i> and <i>Sarabhapura</i> , identity of, ... ..	198
<i>Sanaka taláo</i> , stone pillars at, ... ..	84
SANKARA GAURESWARA, description of temple at, ... ..	118
Sankshepa Sankara Jaya, edition of, ... ..	195
Sanscrit, Greek, German, Latin, and English words compared, .	5
Sanscrit manuscripts of the Royal Asiatic Society, ... ..	60
<i>Sarabhapura</i> , conquered by Mahá Sudeva rájá, ... ..	195
Sarap, Serab, Serak, or Srawak, earliest Aryan colonists, ...	186
<i>Sarnath</i> encompassed by Benares, ... ..	63
Sarvánûkramani, an account of the writers of the Rig Veda Çaunaka, ... ..	149
Sasanian king Jobad, revenue of the Sávád under him, ... ..	133
Sávád, revenue of the, according to Qodama, ... ..	136 et seq.
Scales, ordeals by, suited to women, ... ..	16
——— ordeals of, directions for, ... ..	23 et seq.
Seasons for special ordeals, ... ..	17
Semitic language, endogenous character of the, ... ..	4
SESOSTRIS, images of, ... ..	88
——— monument of, near Ninfi, ... ..	87
<i>Shahjehanabad</i> , city of, ... ..	215
<i>Shahpur</i> , fort of, ... ..	215
<i>Shahpur</i> ruins, age of the, determined, ... ..	208
SHERRING, Rev. J., Buddhist remains at Benares, ... ..	61
Silver standard in Persia, ... ..	133
<i>Siri</i> , description of, ... ..	206
Son, an only, not to be given away or adopted, ... ..	163
SPRENGER, Dr. A., Ibn Khordabeb and land-tax of the Khalyís, ... ..	124
Square measure of the Arabs not much known, ... ..	131
Srawaka settlements broken up by Hos and Lurka Coles, ... ..	186
SUKSHMA SIVA, ... ..	268
<i>Takt-i-Sulimani</i> , description of, ... ..	119
<i>Tapoban</i> , Rama, halted at, ... ..	185
<i>Tewan</i> , description of a temple at, ... ..	114
Timira Násaka of Bábu Siva Prasád, ... ..	179
<i>Trendaraka</i> , <i>Sarabhapura</i> in the district of, ... ..	196
TULSI DASA, ... ..	174
TURGHAI KHAN's invasion discussed, ... ..	208
Urdu authors, age of the, ... ..	174
Urdu compared with languages of modern Europe, ... ..	1
Urdu and Hindi, distinction between, not recognised, ... ..	178
Vádivivádabhanjana, edition of, ... ..	279

	Page
<i>Vápya caves</i> , boulders close by, ... ..	51
VIKRAMA'DITYA, the rájá of Pat Kote claims descent from, ...	190
VISHNU, Avatars of, ... ..	192
Vyávahára mayukha permits a widow to adopt a son, ...	164
----- authorities quoted in the, ...	15 et seq.
<i>Wangat</i> , description of the temples at, ... ..	10 et seq.
Water, ordeals by, ... ..	39
Weights and measures of the Arabs, remarks on, ...	125 et seq.
Weights, grain, of different kinds, among the Mussulmans, ..	126
Widow, the right of a Hindu, to adopt a son,...	150
YA'JNAVALKYA'S vyavasthá for heavy accusations, ... ..	14
Yoga Aphorisms, Mr. Cowell's edition of the,...	60



JOURNAL  
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PART I.—HISTORY, LITERATURE, &c.

No. I.—1866.

*Outlines of a Plea for the Arabic Element in Official Hindustani.*—By  
J. BEAMES, Esq., C. S.

[Received 17th April, 1865.]

It is the fashion at present to lavish a good deal of abuse on the language generally employed in our law courts in this country.

This unfortunate variety of human speech is condemned as barbarous, a medley of heterogeneous elements, a pedantic, clumsy, unintelligible jargon, and the rest. After seven years' daily experience and use of it, I venture to take up the cudgels in its behalf. I consider it as the most progressive and civilized form of the great and widespread "language of the horde." Not only is it compendious, eloquent, expressive and copious, but it is the only form in which the legitimate development of the speech of the Gangetic tribes could show itself. Those who condemn it, in a spirit of short-sighted pedantry and affectation, must, if they are prepared to abide by the logical consequences of their opinion, condemn also those languages of modern Europe, which, by virtue of following the same course as the Urdú, have succeeded in overstepping the narrow limits of their birth-places, and becoming the common property of half the world. To object to the free use in Hindustani of words derived from Arabic and Persian, is as absurd as to object to the free use of Latin and Greek derivatives in English. As a merchant, by skilful trading with borrowed capital,

may become a *millionaire*, so English by readily borrowing and making good use of its borrowed stores, has raised itself from an obscure low German patois to the most extensively used medium of communication between distant countries.

I. The parallel between English with its Teutonic and Latin elements, and Urdú with its Sanskrit and Semitic components, is no newly discovered thing. It has been used again and again, with more or less learning, to help us to deplore the iniquities of our *omla* and *mukhtárs*.

The comparison, however, cuts both ways. It may perhaps help us to find something to admire in the phraseology of a *rubakári* or the cunningly woven sentences of a pleading.

First then, of English. English is a dialect, as every one knows, of Plate-Deutsch, allied to the Hoch-Deutsch, the tongue of Göethe and Schiller, by the ties of a common descent from the early Gothic, the sister of Sanskrit. It has been brought into contact with many other forms of speech, some closely, others remotely, akin to it. Celtic of Scotland and Wales; Scandinavian of Norway and Denmark; Latin; Norman French, a blending of the two last named; early French, the Frankish struggling still against the Latin element; Latin again, barbarized by monks and lawyers; French again, from the wars of the Henries and Edwards; Spanish, from the Elizabethan wars, bringing with it a substratum of Moorish Arabic; French again, of Racine and Moliere in the days of the degraded Stuart kings, from the court of the "Grand Monarque;" Dutch with William of "glorious, pious and immortal memory;" finally a sprinkling of Turkish, Persian and Russian from our travellers, and many words from Latin which crept in in a roundabout way from time to time through our neighbours the French and Italians.

All these elements skilfully worked up, patiently pieced together, carefully incorporated into the solid English groundwork, have composed the bright, varied and harmonious mosaic of our modern mother-tongue.

There were doubtless pedants and grumblers ready to find fault at each stage of growth in English. The Saxon clod of the time of the Conqueror objected to the terms 'beef,' 'veal,' 'pork,' 'mutton,' which were then supplanting his pure English 'ox,' 'calf,' 'pig' and

'sheep.' Chaucer's introduction of French words into his poems won for him the ridicule of his contemporaries. But in spite of ridicule and learned objectors, the language assimilated these foreign words and profited by the process.

The German on the other hand has absorbed very little of the Latin or other foreign elements.

It has endeavoured to meet the wants of civilization and progress by combinations of indigenous words, rather than by borrowing. In other words it has done what our purists wish the Hindustani to do. The result is known to every one. Great as are the expressiveness and power of composition of the German language, its usefulness as a practical, working, every-day speech is far below that of English or any other European language. We have only, for instance, to compare a few German words with their English equivalents to see where lies the flexibility, expression, and delicacy of sentiment.

"*Gefangenschaft*" (literally 'catch-hold-ship') would scarcely be felt as an advantageous change for 'custody.' Use might reconcile us to "*Begripship*," but 'custody' means more than mere holding fast.

*Vergnuegsam* ('For-enough-some') is but a barbarous substitute for 'contented,' which latter gives us the idea of being contained and secure in certain limits;—while the former is a barren enunciation of merely having enough. Not to mention the unpleasantly harsh collision of consonants.

*Verurtheilung*, sentence. Here the English word is far the more manageable than the clumsy circumlocution of "fore-out-telling" or "parting."

*Vervollkommen*. "To complete" is again better than "To fore-full-come."

*Wiederaufleben*, revival, "das wiederaufleben der Gelehrsamkeit (the again-up-living of be-lore-some-hood) is rather a roundabout substitute for the neat and concise English, "the revival of learning."

*Wiederherstellungsmittel*. Here is a nice morsel for throat and teeth. It looks very alarming, but only means "a restorative," and the English word gives the meaning quite as fully as the monstrous German compound. *Wieder* = re; *herstellung* = stor (stauz) 's; *mittel* = ative.

*Zusammenberufen*, to convoke.

*Zurückziehen*, to retract, withdraw; "withdraw" is formed from our own Teutonic stores.

The fact is that in making compound words, the English has the advantage of using the short and expressive Latin prefixes, *pro*, *re*, *con*, *per*, *in*; whereas the German, rejecting these commodious foreigners, has to fall back on the unwieldy natives; *Wieder*, *zusammen*, *zurück*, *wider*, *heraus*, &c. The result is that its compounds are of uncomfortable length, and are rather circumlocutions than direct expressions of the idea involved.

Turning now to Hindustani for Teutonic, let us put Indian as expressing the class of languages from which the old Hindi Bhashas are derived and for Latin or Romance let us put Semitic. Then the proposition I would maintain stands thus: The Hindustani language meets the requirements of civilization better by borrowing freely from Semitic sources than by forming words and compounds from Indian sources.

To borrow a metaphor from Botany, the Semitic languages are endogenous, the Indo-Germanic exogenous. The former grow by additions from within, the latter by accretions from without.

Accretions, it is evident, are limited solely by their power of adhering to the original trunk. Or perhaps it would be better to say accretions may be multiplied up to the sustaining limit of the parent stem.

Endogenous growth on the other hand is limited by the space it can squeeze out for itself in the *enciente* of the older formations. With a strong parent stem like German or Sanskrit, accretive compounds may be formed almost without limit. Sanskrit thinks nothing of a twenty-syllabled compound, and a word like 'herausbekommen' is as nothing to German organs. In Arabic, and Hebrew, on the contrary there is the trilateral root, which may be made to evolve many dozens of new words, but all within the limits of the three radical letters aided by a handful of serviles. The result is that the Semitic languages can express more in a small compass than the Indo-Germanic can. A prefixed *alif* or *mim* will often have as much power as 'con' 'pro' 're' or half a dozen Latin or Greek words strung together; thus from *nazara* to see, the simple lengthening of a vowel gives us "nâzir," a word, the technical and ordinary meaning of which, cannot be expressed in any Indo-Germanic language without a compound. *e. g.*

1. Sanskrit, *Adhyaksha*.  
*Upadrishtá*.  
*Adhikári*.  
*Avekshítá*, all compounded with a preposition.
2. Greek, *Epistatés*.
3. Latin, *Inspector*.
4. German, *Aufseher*, *Inspektor*.
5. English, *Overseer*, *Inspector*.

Illustrations may be multiplied by any one who possesses a few dictionaries. To be able to express ideas of a complex nature by short and simple words is an undeniable advantage. When a language has two or more sources from which it can draw, native sources giving it only long cumbrous compounds, foreign ones giving it neat and convenient uncompounded words, it is only natural that the latter should be chosen. The Bengali, like the German, has chosen to trust to its Indian resources; and the result is a collection of ‘sesquipedalia verba’ of the most alarming description, and what is more to the purpose in these practical days, it is yielding visibly to the more progressive Hindustani.

On the score of convenience then I defend the present court language. If we look at the historical question again, we find good reason for the use of foreign words. Hindi is in its origin Sanskrit, with a substratum of Turanian elements, the extent and exact direction of whose influence has never been fully worked out. I believe it to be much greater than is usually supposed. The language thus constituted, was brought into contact with fresh Turanian influences through the Mogul invasions. In the same manner Persian, Pushtoo and Arabic were brought to bear on it. The point of contact was western Hindustan and the Punjab, but gradually the foreign influence penetrated the whole country. It must be remembered also, that along with an influx of foreign languages came an entire change in the civil and religious organization of the country. Whole provinces were converted to a religion whose most sacred duties can be expressed only in Arabic. Offices were created on the model of those in Cabul and Persia. Systems were introduced which had long flourished in Central Asia among the Mantchus and the Kirghis.

Hence a large importation of foreign words in religion, government,

arms and art, which ended in the establishment of the Urdú or camp language, a language destined advisedly for the palace, the court, the camp, the market. Its father the Hindi, its mother the Arabic, it borrows freely from both its parents.

Up to this point most men will agree with me that the free use of Arabic and Persian is defensible both on the grounds of the origin of the language as well as of convenience.

The two great accusations brought against the language, however, are ; first, that the Arabic and Persian words are used in an incorrect, garbled and distorted way, and secondly, that the language itself is unintelligible to the mass of the people. I proceed to discuss these objections a little more in detail.

II. First, then it is asserted that the use of Arabic and Persian words in the way they are employed by native officials is mere pedantry ; that the words are used in wrong senses and often utterly misapplied, that participles are used as nouns, nouns as verbs and so on.

Now this may mean either that munshi Arabic is incorrect according to the rules of grammar of the times of the Kurán ; or that it is wrong according to the usages of the modern colloquial and written Arabic.—If the former of these two theories is advanced, I meet it by a simple and positive denial of its truth. A few examples may be taken as tests.

*Ashkhás.* The Arabic *shakhs*, of which this is the legitimate and regular plural, means, literally separation, or the distinguishing of one thing from another ; or more strictly, the act or condition of being separate and distinct. *Shakhs* is therefore the exact equivalent of the English word “individual,” a word which is good modern English enough ; and *ashkhás*, signifying the persons or individuals concerned in a lawsuit, is therefore a more accurate word than the Hindi *log* ; which really means, “the world,” or the collected body of human beings, and is quite out of place in designating a special class or number of people.

*Mudda’i*, from *da’a*, he called.

(Freytag—*vocavit, advocavit, provocavit*,) is the regularly formed active participle of the 8th conjugation, and literally and exactly means a claimant or prosecutor ; “*Arrogans vel sili vindicans rem contra aliquem* ;” and is therefore a more expressive word than “*bádi*,”

which simply means a speaker; or “*firyádi*” which, besides being a foreign word, means literally one who cries out, a weeper, lamenter; which a plaintiff often is not.

*Mudda’á ’alayhi*, literally “the complained against him,” or “he who is complained against;” being the passive participle of *mudda’i*, with the preposition and pronominal affix *’alayhi*. *Pratibádi*, “he who speaks back again” is far less comprehensive.

*Hasbu’ttafsili’l’zayli*, “according to the specification below” is good and grammatical Arabic, and in its Persianized form “*hasb-i tafsíl zayl*” gives a neat and convenient official formula for the roundabout Hindi “*jaisá ki nichhe likhá huá hai*,” which cannot be formed into a compound adjective or otherwise manipulated.

*Inkizá*, “completion,” is the regular verbal noun of the seventh conjugation of the verb *kazáya* the original meaning of which, as I have elsewhere shewn, is “cutting off, finishing, defining, decreeing,” the word is used frequently in pure Arabic in the same sense.

*Ba’d inkizá-i mohlat*, “after the expiry of the term,” is correct enough, and almost incapable of being tersely expressed in Hindi without recourse to some half obsolete word of Sanskrit origin.

*Bi muktazá*; according to; in the phrase, “*bi muktazá rái ’adúlat*,” “according to the opinion of the court,” the root *kazáya* in the eighth conjugation, has the sense of deciding. The expression *bi muktaza* is used in Arabic authors as the equivalent of “*secundum*” “*ad.*” I should be glad if some of our critics would express this phrase in modern Hindi in terms equally neat, and as generally intelligible.

*Inkisháf*; *istiswáb*; *intizám*; *ikbál*; are further instances of words which may be found in Arabic and Persian classics in the same sense as they bear in Hindustani. It is useless to multiply instances, were I to give half of the words used correctly by our Munshís I should have to write a volume, not an essay.

To turn next to words which are used by Hindustani writers in a sense different from their classical usage, also words which are not found at all in the classics; we find them tolerably numerous, and they form in fact the chief stumbling-blocks to the purists. The word “*istimzáj*” for instance is not found in good Arabic or in those Persian authors who use Arabic words. The root ‘*mazaja*’ means *he mixed*, and the noun “*mizáj*” implies ‘mixture’ and is used for that mixture

of feelings and passions which constitutes the temperament of a human being; in other words, his 'disposition.' *Istimzâj* is used by our Hindustani writers to signify, "wishing to know what the sentiments of a person (*mizâj*) are on a certain point," *i. e.*, asking for permission. In other words, the noun *mizâj* is taken as the root from which a sort of denominative verb in the tenth conjugation is formed *istamzâja*, and from this again a regular verbal noun *istimzâj* is formed. Now I admit that such a process is not found to exist in Arabic with regard to this verb, but such a process is found with regard to other words; and we do not know enough of the state of the various dialects of Arabic in the thirteenth century to be able to affirm that such a word may not have been used in some of them; and that it may not have been brought into India by some of the "mixed multitude," who accompanied the earlier Musalmán invaders. We have no right to suppose that those writers who, three or four centuries ago, created the Urdú tongue, borrowed their Arabic solely from the classical dialect of the Kuran. So far was the Kuran from being written in the ordinary colloquial style, that we know Muhammad himself was in the habit of pointing to it as one of his greatest miracles, and that the unapproachable purity of its diction is to the present day a subject of admiration to all the faithful. The conversazione of Hariri again, from which so many of our European scholars draw their ideas of Arabic, is a professedly pedantic work, and it is never pretended that the ordinary Arab of the period talked in such elaborate strains. We must seek for the origin of many of our modern Indo-Arabic words in the language of the lower class of which, to this day, we know next to nothing. That the language of the towns even in Muhammad's time had lost much of its early purity is shewn, *inter alia*, by the customs of the townsmen of sending their children into the desert to learn from the mouths of the Badawin the unadulterated tongue. The prophet himself is said, in this way, to have spent some years among the tribe of Saad a branch of the Kuraysh.

After the death of Muhammad the decay of the spoken language was very rapid. One of the latest and best authorities on this subject says; "Every language without a written literature tends to decay more than to development by reason of foreign influences; and the history of the Arabic exhibits an instance of decay remarkably rapid

and extraordinary in degree. An immediate consequence of the foreign conquests achieved by the Arabs under Muhammad's first four successors, was an extensive corruption of their language: for the nations that they subdued were naturally obliged to adopt, in a great measure, the speech of the conquerors, a speech which few persons have ever acquired in such a degree as to be secure from the commission of frequent errors in grammar, without learning it from infancy. These nations, therefore, and the Arabs dwelling among them, concurred in forming a simplified dialect, chiefly by neglecting to observe those inflections and grammatical rules which constitute the greatest difficulty of the classical Arabic." (Lane's Arabic Dictionary. Preface; p. vii. London, 1863.)

The inference I draw from the above remarks is, that we have no right to compare the Arabic used in modern Hindustani with the Arabic of classical writers, and to condemn it, if it does not agree with theirs. Still less have we any right to compare it with the elaborate Arabic of the grammarians. The Indo-Arabic of the present day is the legitimate descendant of the Arabic brought into India by the early conquerors, and we may safely give them credit for having spoken their own language correctly, even though that language was not precisely the same as that spoken by Muhammad and his tribesmen. When Abu Bakr raised the standard of Islam and sent out the armies of the faithful to the conquest of Syria, warriors from Yaman and Hadramaut joined his troops. These must have spoken Himyaritic dialects, differing widely from the dialects of Mecca and Medina. Bar-Hebrous, in his Syriac "History of the dynasties," speaks of the Arabs always as "Tayoye," or men of the tribe of Tai, whose dialect differed considerably, not only in the use of words, but in grammatical forms, from the literary standard of Arabic.

Moawuja's army was composed almost entirely of Syrians; and the Arab troops which conquered Persia were largely composed of the same semi-foreign element. There is thus ample ground for supposing that the form of Arabic which the conquering troops of El Islam brought with them into Persia, and which so powerfully influenced that language, was not the form which is reproduced in the Kuran and in the classical works of western and central Arabia. Here again

I confine myself to hinting at a probable source of Indo-Arabic; to follow up these suggestions thoroughly, would require an intimate knowledge of all the forms of spoken Arabic, and would lead me too far from the present enquiry. I trust, however, that I have shewn that our Munshi Arabic should not be hastily judged by comparison with an almost foreign standard.

III. The second assertion, that the court language is unintelligible to the mass of the people, is partly true, partly false. The real fact is that the court language, being the highest and most cultivated form of Hindustani, is intelligible to the people exactly in proportion to their education. To the highly educated native it is perfectly intelligible; to the illiterate rustic it is as Coptic or Chinese. Precisely the same may be said of any language which can boast of a literature. The literary style always will be, must be, in fact, from its very nature, above the comprehension of the masses.

Put the *Times* or the *Saturday Review* into the hands of a peasant, and see how much he will understand of it. Never was there a more absurd and unreasonable demand made of any cultivated tongue, than that it should exhibit copiousness and expressiveness, and at the same time not be above the understanding of the boor. The ideas of the Indian rustic do not soar above the petty wants and homely occupations of his every-day life, except in a few instances. When they do, he uses Persian or Arabic words to express them. His own Hindi does not help him. A considerable number of simple Arabic and Persian words enters into the vocabulary of the peasant, and they are as familiar to him as they are to the educated pleader or official. Some exist side by side with words of Sanskrit origin, and have a special sub-shade of meaning attached to them. Others stand alone, having no equivalent in the Hindi.

Of the first class are such words as *wakt*, time in general; and *bela* or *vela*, a special time of the day; *tarf* and *ur* or *diq*; *makán* and *ghar*; *rasta* and *sarak*; *darwáza* and *dwár*; *kitáa* and *khet*; *ábád karná* and *jotna*; *zamín* and *maññi*; *'aurat* and *randí*; *sarhad* and *siwáná*; and many others. Of the latter class, *ma'lúm*, *matlab*, *tabdíl*; *ziyáda*, (*jásti*), *ziyádati*, *roshan*, *badma'ásh*, *súrat*, *tajvíz*, *zarúr*, *tamám*, *niháyat*, *mál*, *mawáshí*, (*maweshi*), *tarah*, *wáste*, *muáfik*, *jabr*, *zabardast*, *zulm*, *zálím*, *gharíb*, *parwarish*, (*parwasti*), *jawáb*.

*jangal*, *maidán*, *durust*, and a long list besides. Any one of these words may be heard from the mouth of the most ignorant ryot in the most secluded parts of the country, as any one who has travelled much in India knows. This large class of foreign words has almost, if not entirely, displaced the corresponding Hindi terms. If any one doubts this, let him read the following list, and judge for himself which of the two he is most familiar with in the mouths of the people—these Hindi words or their foreign equivalents :—

<i>Foreign.</i>	<i>Hindi.</i>
ma'lum.	parkásh.
matlab.	parojan.
tabdíl.	pher.
ziyada.	adhik (aur.)
roshan.	pargaṭ.
badma'ásh.	gundá, luchá.
súrat.	rúp.
tajvíz.	(no equivalent.)
zarúr.	uchit (more common in Bengali than in Hindi.)
tamám.	sára, sab.
niháyat.	bahut.
mál.	dhan.
mawáshi.	gorú.
tarah.	prakár, (Bengali.)
wáste.	liye.
muáfik.	sá (as an affix.)
jawáb.	uttar.
jangal.	ban (very inadequate.)
maidán.	bádh.
&c.	&c.

A few of these words express adequately the meaning of the corresponding Persian word, but how many of them are known to educated people? I do not here speak of the English official, who may be expected only to know the simple surface words which meet him in his every day work; but I would ask any educated native how many Hindi words he uses in his ordinary conversation with men of his own and other classes.

As I am here only outlining a defence of my side of the question, I will pass on to another argument. Hindi is not one language. It is ten or fifteen or more different dialects. The following list, taken from a work which relates the early efforts of the Serampore missionaries to introduce the Bible in his own tongue to the home of every ryot, will shew how great the diversity is.

<i>Dialect.</i>	<i>Locality.</i>
Brijbhás'há,	Agra, Muttra.
Canojia,	Cawnpore, Futtehgurh, Etawah, Bareilly, Alligurh.
Koshala,	Oudh.
Bhojpúri,	Benares, Ghazipoor, Arrah.
Hariáni,	Hariana, Hissar, Rohtak.
Bundelkhandi,	Bundelkhund.
Boghela,	Boghelkhund, (Central India.)
Harroti,	Malwah.
Oojjainee,	Ujayin.
Oodeypooree,	Udaypúr.
Márwári,	Marwar.
Jaypuri,	Jaypur.
Bikánirí,	Bikanír.
Bhattanirí,	Bhattanir.
Magara,	Behar, Patna.
Tirhutiya or	Tirhoot, Purneah.
Maithil,	Bhaugulpoor, Monghyr.

Now, I would ask those who wish us to abjure Persian and Arabic and draw from "the well of *Hindi* undefiled," which of all these dialects is to be considered as undefiled. If to the above dialects we add Marathi, Guzaratti, Sindhi, Ooch, Punjabi, Dogra, Cashmeree, Parbuttia, Moonugee, Palpa—all of which are more or less Hindi—the difficulty of selecting our standard becomes almost insurmountable; for in these various forms of Hindi not only do the vocables differ, but the very declensions and conjugations, the very root and fibre of the language. Thus for the genitive case affix, we have *ká, ke, ki*, Hindi: *dá, de, dí, diáu*, Punjabi: *cha, che, chi, chya*, Maráthi: *sa, se, si* &c. Sindhi, and so on. The verb *honá* to be, undergoes a wonderful variety of inflections. Not to multiply instances, it may suffice to say

that there is no such thing as a Hindi standard of speech which is at once intelligible to all classes, in all parts of Hindustan. For a common standard you are driven to the Urdu, which has selected and embalmed the purest and most widely used forms of the old Hindi. Just as in England, if we threw aside our classical English tongue with all its foreign importations, we should find ourselves in a chaos of Hampshire, Somerset, Yorkshire, Lowland Scotch and other jargons; so would it be in India. Who that has not lived among the people understands the following words, common though they are in the mouth of the Hampshire peasant? *to brize, to dount, fessey, to hov, kittering, mokin, rumwards, skrow, stable, tuly, wivvery, wosset, yape, to yaw.* Examples without number might be given by any one who recollects the peasant-talk of his own county in England. No one in his senses would recommend our generally adopting any of these words, good old Celtic and Saxon though they be, and yet we are asked in India to recommend and assist in a precisely similar process. The fact is that the languages of modern times have all arisen from a fusion of cognate dialects, just as most nations have been formed by coalitions of kindred tribes. By throwing aside that which was peculiar to themselves, and retaining all those words and inflections which they possessed in common, modern nations obtained a national basis of speech on which to engraft words borrowed from foreign sources; and thus were built up English, French, Italian, Spanish, Turkish, and all the leading languages of our times. That the Gangetic tribes, by a happy coincidence, have been able to follow the same course, and, by fusing the rough Hindi dialects into one, to add thereto many expressive foreign words, is a circumstance which, far from being lamentable or a sign of decay, entitles the language so formed, to rank among progressive and civilized tongues. If the rudest of the peasantry cannot understand the cultivated language of their educated compatriots, it is not therefore advisable to despoil the language of its legitimate gains, to bring it down to the level of grihasths and gwálás. Rather let the latter be educated till they do understand. The difficulty which the peasant finds in understanding the Court language has been immensely overrated, and is only due to his imperfect education. The true remedy for the difficulty is not to be found in an insane attempt to impoverish a fine and copious language, but in making it more widely known to all classes in India.

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*A translation of the Chapter on Ordeals, from the Vyāvahāra Mayukha.*  
—By Professor GEORGE BUHLER, *Elphinstone College, Bombay.*

[Received 2nd June, 1865.]

The following translation of the Mayukha's chapter on Ordeals was originally prepared by a Bombay Shāstri at the request of my learned friend, Mr. Wh. Stokes, and intended to be inserted in the reprint of Mr. Borradaile's translation of the Mayukha, which was being published under his superintendence in Madras. When I looked over the Shāstri's work, I found that it would be of no use, as his translation was frequently unintelligible, and often decidedly wrong. I therefore retranslated nearly the whole, with the assistance of Mr. Vināyak Laxman, late Hindu Law Officer of the Bombay High Court. Circumstances prevented the completion of the translation, before the printing of Mr. Borradaile's Mayukha was too far advanced to admit of its insertion.

These circumstances will explain how it happened that my attention was directed to a part of the Hindu Law, like the Ordeals, which has a purely antiquarian interest, and has become rather trite by the publication of two papers on it; one by Ali Ibrāhim Khan, *As. Res. I.*, p. 389, the other by Prof. Stenzler, *Journ. D. Morg. Ges. Vol. IX.*, as well as by the appearance of a translation of the chapter on Ordeals from the *Mitāksharā* by Mr. W. Macnaghten, (*Principles and Prec. of H. Law, Madras, 1865.*)

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Here (begin) the ordeals :

They are used to decide matters which are left undecided by human evidence. They are of two kinds (1st) such, as decide (a case) immediately, and (2nd) such, as decide it after the lapse of some time.

Amongst them Brihaspati describes those of the first kind (in the following verse) :

“The scales, fire, and water, poison, fifthly consecrated water; rice grains are declared to be the sixth; hot māsha (coins) the seventh; the eighth is the ploughshare, according to the (ancient sages); the lot is recorded as the ninth.”

Yājñavalkya declares (II. 95) that the first five (of these nine ordeals) (are to be used) in (cases involving) heavy accusations only.

“The scales, fire, water, poison and consecrated water are the ordeals (used) here (in lawsuits) for exculpation, if the plaintiff binds himself to abide by the award (*Çîrshakastha* means ready,) and to suffer the punishment, which the defendant would suffer in case of defeat.

Pitâmaha (says):

“Let him (the judge) order the scales, etc. for those, against whom the accusation is urged with great confidence; rice grains and consecrated water he should order in doubtful cases.”

*Avashṭambha* (means) confidence.

According to this passage (of Pitâmaha) consecrated water may be used when the plaintiff is full of confidence, (as well as when he is) doubtful.

In the *Kâlikâpurâṇa* (we read):

“In case of an accusation of adultery, of theft, of a connexion with women (the intercourse with whom is) forbidden, or of a *Mahâpâtaka* or of high treason, let an ordeal take place.

“When there is conflicting evidence or (any other) dispute, or if a blame is attached to the plaintiff, then shall the king order the ordeal (to take place) after the plaintiff has declared himself ready to suffer the punishment (of defeat). When there are many witnesses in an action for adultery, let the defendant undergo the ordeal, in order to clear himself without any additional punishment.”

Women, the connexion with whom is forbidden (*agamyâh*) are others than married women; such as common prostitutes.

‘*Çaste*’ means ‘in the case of an accusation.’

‘*Sâhasam*’ means ‘a crime perpetrated by violence.’

‘*Avarṇah*’ means ‘blame.’

‘*Çirah* (head) means ‘punishment.’

The specification of the accusation by the words ‘for adultery,’ is unnecessary, because this accusation has been already mentioned. Likewise are the words ‘where there are many witnesses’ (unnecessary). Therefore an ordeal may take place in every action, even if witnesses be wanting. The indication of the object of the ordeal by the words “in order to clear himself,” is proper only, (if the passage be to her) in this (sense). And it is a common saying, “In actions for high treason and accusations of an offence which causes loss of caste (the defen-

dant) should undergo an ordeal, even if the plaintiff be not ready to undergo the punishment of defeat."

Nârada (says):

Those who are suspected by kings, those who are accused by Dasyus, and those who wish to clear themselves, shall undergo an ordeal, without (any additional) punishment (in case of defeat).

The ordeal which decides a case after (the lapse of some) time, is the oath.

Nârada has declared the different kinds of this (the latter):

"(Let (him swear) by truth, (or) let him touch (whilst swearing) a vehicle, arms, a cow, grains, or gold, or the feet of the gods, or of his father or mother; or (let him swear) by his pious gifts, and his good works; or let him touch the head of his child, of his wife or of a friend; or he may also—in case of *any* accusation,—drink consecrated water."

The oaths are declared by Manu (to be resorted to) even on very trifling occasions.

Though consecrated water decides a case only after the lapse of some time, it has been enumerated in the first (division), because it is used in great accusations (also).

Yâjnavalkya (says) (II. 96):

"According to (their) pleasure either of the two may undergo (the ordeal), and the other may take (upon himself) the punishment (in case of defeat)."

This alternative (lies) only at the pleasure of the plaintiff. If he does not wish (to undergo the ordeal), (it falls) on the defendant. Let nobody *oblige* the plaintiff to undergo the punishment.

"The ordeal should be imposed upon the accused by those who know (the rules respecting) the ordeal."

These are the words of Kâtyâyana in the Divyatattva.

Here (follow) the rules regarding the different kinds of ordeals appropriate to (different) individuals.

Yâjnavalkya says (II. 98):

"The scales (are appropriate) for women, children, old, blind, or lame persons and Brâhmins; fire or water, the seven grains of Yava or poison, for a Çûdra."

(The scales are for every body) without reference to sex or caste or age.

*Bāla* (is a person) who is younger than 16 years, of whatever caste he may be. (A person who is) older than 80 years (is called) *vridha* (old).

Here (in this passage it is meant) that the scales only are intended for a Brahman (when the ordeal takes place) at the time generally (appointed for the scales), of which (more) will be spoken (below). But (when the ordeal takes place) at the time (which is fit for the employment) of fire and the like, those (ordeals) are employed even (for a Brahman)."

Therefore Pitāmaha (says) :

"All castes can, according to the rule, be cleared by (taking) consecrated water. All the (ordeals) (can be employed in case) of every one, except poison (in the case) of a Brahman."

In the Kālikāpurāṇa (we read) :

A hot gold māsha coin should always be given to a man of the lowest caste.

Nārada (says) :

"Let (the judge) always examine eunuchs, men bereft of strength, those whose mind is violently agitated, and these three, children, old and sick people, by means of the scales. But neither poison nor water, is prescribed for women ; by means of the scales, consecrated water, etc. let him enquire into the hidden truth about them. Those who are in (bodily or mental) pain, shall not clear themselves by the water (ordeal), nor those who suffer of a disease caused by gall or poison. The (ordeal by) fire is not ordained for the leprous, the blind, those who suffer of a disease of the nails, and the like. Children and women should not be immersed (into water) by those who know the Institutes of law, nor (should this be done) to sick, old or weak men. He should (likewise) not immerse into water those who have no force, and those who have been enfeebled by sickness. When they are immersed, they always die ; for little life (is left) in them. He shall not immerse them even if they have come (to court) on account (of an accusation) of an offence perpetrated with violence. Nor shall he make them take (into their hands) hot iron, nor shall he make them clear themselves by (taking) poison.

Vishṇu (says) :

"(Let him not impose any of the abovementioned ordeals) upon those,

who suffer of a disease caused by the phlegmatic humor, or who are (otherwise) sick, or women or asthmatic persons.”

Kâtyâyana (says) :

“ Let him not give the ordeal by fire to smiths, nor (that by) water to those who (by their profession) have to work in water (as divers, etc.) nor by any means poison to those who know the application of charms. Let him not order a man, who is engaged on fulfilling a religious vow or who has a disease of the mouth (to undergo the ordeal) of the rice grains.

A man who is engaged on a vrata (vratin) (means) a man who performs the milk-vow and the like.

Pitâmaha (says) :

“ Consecrated water should not be given by wise (men) to those who drink spirituous liquor, to adulterers, gamblers or atheists.”

Nârada (says) :

“ He shall avoid to give consecrated water to a man, who has committed a great crime, or who does not obey the law, an ungrateful (person), a eunuch, a despicable (person), an atheist, a man whose crimes (faults) are (generally) known.

Kâtyâyana (says) :

“ But the king should not order (the abovementioned ordeal) for people, who ought not to be touched, for those of the lowest castes, for slaves, barbarians, evil-doers ; nor for those born by *prâtilomya* (whose mother is of a higher caste than the father).

He should order for them, at the time, the ordeals which are known (to be fit) for the (season).

Known (to be fit) for them are the scales, poison and the like (each of which is fit for some proper season.)

If the person who has to undergo the ordeal is unable (to do so,) the same (Kâtyâyana) prescribes a substitute (to be chosen for him,) in the *Divyatattva*.

“ If there is no hindrance (for the person, who has to undergo the ordeal) as far as regards place or time, then let him undergo it, as it is proper. He can have it performed by another (person) ; that is the rule in the contrary case.” Anyena, by another, *hârayet*, he may cause it to be taken, (means) he may have it performed by a substitute. *Viparyaye* (in the contrary case), (means) if the person who

has to undergo the ordeal is unable (to do so), let (then another person) do what is appropriate.

In the contrary case, *i. e.* when there is a certainty that the defendant formerly did commit a great crime, such as the murder of his father or other (near relations); or when at some other time (the defendant) was suspected of some other matter, the same (Kâtâyâna) declares (that he should perform) the ordeal through a substitute.

“(In the case) of people who have killed their father, mother, a Brahman, their spiritual teacher, an old man, a woman or a child, of such as have committed a Mahâpâtaka, and especially of atheists, those who bear the sign (of another caste than that to which they belong) of women, of those who are acquainted with the use of charms and yoga (supernatural power acquired by meditation, etc.), or of those who are born in a mixed caste, of those who live or cause others to live in a course of vice;—in the case of such shameful accusations, a justice-loving king should by no means order (the accused to undergo) an ordeal. The ordeal ought to be undergone by good people appointed by these (the abovementioned sinners). Where there are no good men, there they should be cleared by their own people (undergoing the ordeal).” Svakaîh (by their own people) (means) by relations.

Here (follow) (the rules regarding) the time (when the several ordeals should take place).

Pitâmaha (says):

“Caitra (March, April) Mârگاçivas (December, January) and Vaiçâkha (April, May) are months generally (used for *all* ordeals), and they do not present obstacles to ordeals.”

The (ordeal by the) scales is ordained (to be employed) at any season, (but) one should avoid it, if the wind blows.

The (ordeal by) fire is declared (to be good) in the dewy, cold and rainy seasons, the (ordeal by) water in autumn and the hot season, that by poison in winter and dewy season.

Poison (is recommended) to be taken in the cold and dewy seasons, (but) other seasons also (at times) are included; because further on (the passage) varshe caturyavamâtrâ, etc. will be quoted.

Nârada (says):

“Consecrated water may be given at any season (of the year), (and) the scales (likewise) may (be employed) at any time.”

Pitāmaha (says further) :

“ The ordeal by fire must take place in the morning, and in the morning the scales (must be employed). The (ordeal by) water ought to be given in the middle of the day to those who wish (to learn) the real state of truth. But the clearing by means of consecrated water is ordered (to take place) during the first half of the day. But in the last quarter of the night should the poison be given, being cold.

These ordeals should take place on a Sunday, thus say the Çishtas, (i. e. those Brahmans who have studied the Vedas and Vedāngas and thereby have become authorities in law).

Now (follow the rules on) the place (where the ordeal ought to take place).

Pitāmaha (says) :

“ The scales must always be made to turn towards the east, unmovable, in a pure place, near to the flag, in the hall (of justice), or in the gateway of the king’s (palace), or on a crossing.”

Nārada (says) :

“ (Let it be placed) in the hall or at the door of the king’s palace, in a temple or on a crossing.”

Kātyāyana (says) :

“ Let him order those men who are accused of a Mahâpâtaka, to undergo the ordeal near the flag, those who (are accused to) have committed high treason, at the door of the king’s (palace); those who are born in prâtilomya should undergo the ordeal on a crossing, and wise men know that in other cases (the ordeal should take place) in the midst of the hall (of justice).”

Nārada (says further) :

“ If ordeals are not given at the proper time and place, or undergone by people who claim to be exempted from them, they always cause in lawsuits a false result ; of that there is no doubt.”

Now (follow) the rules which are common to all ordeals :

Pitāmaha (says) :

Then let the judge, who is conversant with the religious law, invoke the gods according to the following rule ; turning towards the east and joining his hands, let him speak : “ Come, come, divine Dharma, approach this ordeal, together with the Lokapâlas (eight protectors of the world) and the crowds of Vasus, Adityas and Maruts.” But if he

has brought Dharma to the scales, he should assign to the subordinate gods their several places.

The same (Pitâmaha says further) :

“ Having placed Indra in the eastern direction, and the lord of the dead in the south, Varuṇa in the west, and Kuvera in the north, he should divide the (other) Lokapâlas, etc., Agni in the intermediate points of the horizon. Indra is yellow, Yama dark-blue, Varuṇa shines like crystal, Kuvera like gold, Agni also (glitters) like gold, and Nirṛiti is dark-blue, Vâyu dark-brown, and let Içâna be red—thus he shall meditate on them in their order. To the south of Indra a wise man should place the Vasus. These eight Vasus are declared to be Dhara, Dhruva and Soma, Apah (the waters), Anila (wind), Anala (fire), Pratyûsha (early morning), Prabhâsa. Between the lord of gods (Indra) and Içâna is the place of the Adityas. The names of these twelve Adityas are declared to be Dhâtṛi, Aryaman, Mitra, Varuṇa, Içâna and Bhaga; Indra, Vivasvat, and Pûshan; and as the tenth Parjanya; then Tvashṭri, then last born, though not last (in power), Vishṇu. But the western side of Agni (between this god and Yama), they know to be the place of the Rudras. The Rudras are recorded to be eleven (namely), Virabhadra, Çambhu and the famous Giriçâ, Aja Ekapâd, Ahi Budhnya, and the unconquered Pinâkin, and Bhuvanâdhiçvara, and Kapâli, Vitâmpati, Sthâṇu, and the illustrious Bhava. Between the lord of the dead (Yama) and the Râxâsa (Nirṛiti) let him make the place of the mothers. (They are) Brâhmî, Maheçvari, Kaumârî, and Vaishnavî, Vârâhî, Mahendri, and Câmundâ, accompanied by her Ganas. They know (tell) that Ganeça's place is to the north of Nirṛiti (between him and Varuṇa).

The place of the Maruts is declared (to be) on the northern side of Varuṇa (between him and Vâyu).

The seven Mârutas are said (to be); Gaganasparçana, Vâyu, Anila, Mâruta, Prâṇa, Prâṇeça, Yiva. A wise man should bring Durgâ to the north of the scales: and they prescribe adoration to these deities, (calling each) by his name. Having given to Dharma in the proper order the (offerings), the first of which is the Arghya and the last of which consists of ornaments (in flowers, etc.), he afterwards should give to the subordinate gods the (offerings), beginning with the Arghya and ending with the (presentation of) ornaments.

(And) he should offer the adoration which begins with the (oblation of) perfumes and ends with the (oblation of the) food.

By (Brahmans) who have studied the Vedas a burnt-offering should be presented in each of the four points of the horizon. Let him offer at these offerings clarified butter, boiled rice Samidhs accompanying the act with the recital of the Sāvitrī, the Praṇava (Omkāra), and the Svāha at the end."

Havi's (oblation) (means) Charu, boiled rice. The Eastern Mīmāṃsakas declare in the Divyatattva, that the clarified butter, the boiled rice and the sacred fuel (Samidhah) are offered conjointly, just as at the two Sāmnāya-ishtis, because the deities, (to whom they are offered), are not opposed to each other.

That is wrong.

For (it is declared) in the Sūtra of Aṅgalāyana and the rest : " He cuts off two portions of ājya, he places fuel once on the boiled rice, he cuts off (portions) of the boiled rice twice from the middle and the fore-part (of the heap), and he sprinkles the rice which he has cut off (with ghee). This is the rule for cutting off."

Sruva means, (here) fuel, because it has also this meaning.

(Besides) the conjoint oblation (of the various offerings) is impossible, because (in each case) a different instrument (for completing the oblation) is prescribed (by the Sūtra) hastasya.

But in the case of the two Sāmnāya ishtis the conjoint of oblation (of the ghee, fuel and rice) is proper, because (there) only one instrument, the juhû, is used.

The same (Pitāmaha says) :

"The accused having written the (crime) of which he is accused, on a scroll (of paper) together with the following Mantra, places that (scroll) on his forehead.

And the Mantra (is the following),

"Sun and moon, wind and fire, heaven and earth, the waters, (man's own) heart, and Yama, day and night, the two twilights and Dharma know man's actions."

Nârada (says) :

"Then the judge (who ought to be) a Brahman, who has studied the Vedas and the Vedāngas, who possesses fame and a good character, who has extinguished (the passions of) his mind, who has forsaken

envy, who keeps his promises, pure, clever, rejoicing in the welfare of all creatures, who has kept a fast (on the day of the ordeal) in wet clothes, (who has bathed in his clothes), who has cleaned his teeth with water, having worshipped all the gods according to the (prescribed) rule.....

Yâjnavâlkya (says II. 97),

“(The judge) having called the accused who has bathed in his garments and fasted from sunrise, shall cause him to undergo the ordeals in the presence of the king and the Brahmins.”

Pitâmaha also (says) :

“Ordeals always (should be ordered) to be performed by the accused when he has fasted one or three days, who is pure, and dressed in a wet garment.”

The same (author says) :

“Surrounded by good men, the king should (order him to) perform this clearing (through an ordeal) and should (order him to) gladden the sacrificial priests, house-priests, and spiritual teachers by presents. A king who orders the ordeal to be performed in this way, after having enjoyed heart-gladdening pleasures, having obtained great fame, he becomes fit to be (united with) Brahma.

Now follows the rule on the (ordeal) of the scales.

Pitâmaha (says) :

“The king should order (his people) to construct a hall for the scales, which (is) broad, high, resplendent, where a man will not be defiled by dogs, Chândâlas or crows, possessing an instrument for (shutting) the doors, protected by watchmen, which contains (jars with) water and the like, which is well *furnished*.”

Nârada (says) :

“Let him (the king) order (scales) to be made there, of any Khâdira wood, except Çukla Khâdira, which must be free from clefts; Çuklavarjita (lit. except white) means except white Khâdira wood.

“If there is no (Khâdira) (it should be) made of Çimçapa, or (if that be wanting) of Çala, which must be free from holes, or (it may be made of) iron-wood (arjuna), or Tindukî, or of Tiniça or red sandalwood.

Mâhava gives the following reading (of the passage arjuna—candana) : The arjuna, Tilaka, Açoka, Tiniça, (or red sandal tree) (should be used).

He should use such like woods for the scales.

Such like (evamvidhâni) means (that he may use) also others, as

Uḍumbara-wood (Indian fig-tree) and the like ; thus (says) Madana.

For this very reason,

Pitāmaha (says) :

“ Having cut (any) tree, that is fit to be used at the sacrifice, preceding the action, as in the case of the sacrificial post, with Mantras (prayers from the Veda), and having worshipped the guardians of the world, wise men should make the scales. The Mantra are addressed to Soma, and to Vanaspati during the cutting, and muttered only. Preceding the action by a Mantra as in the case of the Yûpa (means having muttered) : “ O tree, protect him, etc.”

The two Mantras addressed to Soma and Vanaspati, are both spoken during the cutting, because on account of the Mantras being muttered their object is not visible. (Which Mantras are called) saumyâh, addressed to Soma, that is known. The Mantra addressed to Vanaspati is : Vanaspate Çatavalçosvaroha, (R. V. III. 8.) The transferring of the qualities of the Yûpa to the scales (by the words) asya yûpavat i. e. in the case of this as in the case of the Yûpa, causes the repetition of something established (before).

Pitāmaha (says) :

“ But the scales should be made (in length) four hastas, and the side-posts as long, the space between (the scales and the posts) should be one hasta and a half.”

Vyâsa (says) :

“ But two hastas of each side-post (of the scales) are to be dug into the ground.”

Pitāmaha (says further) :

“ The scale beam is to be made four-cornered, firm, and straight, and hoops should industriously be placed in three places (middle and the two ends).”

The same (goes on) :

Having fastened the two basins to the two ends (of the beam), let him place kuça-gras, the tops of which are directed to the east, also on the two basins.

Let him weigh those who undergo (the ordeal) on the western scale, on the other (he shall place) clean clay, bricks or ashes, (but he shall avoid stones, potsherds, bones.

Nârada (says) :

“ Having firmly tied the scales (plates) to the two rings (at the ends) of the scale-beam, let him place in the one scale the man, in the other a stone. On the northern side scale let him place the man, on the southern (side) the stone. (Or) let him fill the basin with bricks, dust or clods of earth.”

The same (Nârada) declares the manner of examining (the respective weights of the man and stone);

“ (Before the weighing) the examiners (should) always (make) the scale-beam even by means of two mason’s plummets, and (people who are) expert (in this business) should (always, when weighing,) pour water on the scale-beam.”

“ That scale-beam on which the water does not flow, is what one should know—to be *even*.”

Pitâmaha (also) prescribes the two plummets (to be used) in order (to produce) evenness :

“ At the two ends should he make two arches (torana), (which should be) higher than the scale-beam by ten fingers, and a mason’s plummet (should hang down from each arch (torana) made of clay, tied (to the arch) by a string, touching the corner of the scale-beam.”

Pitâmaha (further says) :

“ Having weighed the man first, he should make him descend from the scale; but he should always adorn the scales with wimples and banners; then (a Brahman) who knows the Veda should bring the gods near to it by this rule, with drums and horns, perfumes, wreaths and ointments.”

Nârada (says) :

“ Let him first honour the scales, with red sandalwood powder, perfumes and flower-wreaths, curds, cakes, unground (rice) and the like; then he should honour the learned (Brahmans).”

Yâjñavalkya (says) : (II. 100 and 101) :

“ People who are expert in weighing should make the accused ascend the scale, (and) when they have placed (in the other scale) a weight equal to his (weight) and made a line on the scales, he should be ordered to descend. (Before he ascends the scale for the second time, the accused) should address the scales with this Mantra :

“ “ Thou, oh balance, hast been formerly constructed by the gods to be the abode of truth, therefore, oh good (goddess), speak the truth

(now), and free me from suspicion. If I have done wrong, mother, make me descend ; if I am pure, let me ascend.' ”

Nārada (says) :

“ Having bound (the accused) by oaths, he (the judge) should again make him ascend the scales in (a place) sheltered from wind and rain, having tied to his forehead a scroll (on which the accusation is written). ”

Samayaih parigrihya, having bound him by oaths. These (oaths) are given (in detail) by Vishṇu :

“ The hells of the murderer of a Brahman, the worlds where the liars go to, those are the worlds (destined) for him who practises fraud at the time of weighing. ”

Nārada declares the address (to the scales) at the time of ascending it for the second time (to be the following) :

“ Thou knowest the bad and good deeds of all creatures ; thou alone, oh god, knowest, what men do not know ; this accused man is weighed on thee, therefore deign to protect him who is under suspicion, according to truth. By truth thou excellest gods, Asuras and men.

“ Thou art truthful, O divine one, in discerning right and wrong. Sun and moon, wind and fire, heaven and earth, the waters, the heart and Yama, day and night, and the two (gods of) the twilight and Dharma know the deeds of men. ”

Pitāmaha (says) :

“ A Brahman of good character, who knows astronomy, should examine the time (when the accused has ascended the scales for the second time). Five Palas are the time allowed for the ordeal—that should be known to (those who are) expert (in the matter). But the king should employ as examiners the best of Brahmans who (will) announce the result as they see it, (who are) wise, pure not covetous. All the witnesses (after the lapse of five Palas) announce to the king (whether the accused) is guilty or not guilty. ”

Vinādyah (means) Palas ; because (it is written) in the Smṛiti, that the time (required) in pronouncing ten long syllables is called a breath, (Prāṇa, and) six (such) breaths are one viṇāḍikâ (Pala).

Nārada (says) :

“ If the man who is being weighed, rises, he shall doubtlessly be guiltless ; if (the scales) remain even, or if it sinks, he shall be guilty. ”

*Vṛiddhīh* (lit. increase, means) rising. *Hāni* (lit. abandonment means) sinking.

Pitāmaha (says):

“If (the scales remain) even, (the judge) should know that he is a little guilty; but a very guilty man sinks.”

The smallness (of the guilt is implied, if the accused has) committed a crime once (or) without intention.

But when it is asserted in the (scroll of impeachment) which he wears on his forehead, that the crime has been (either) committed only once or without intent, and there is a conflict of evidence regarding the crime only, then, if the ordeal has been instituted and evenness (of the scales has been the result), it must be repeated, because in such (a case) the fault cannot be a small one.

Therefore Bṛihaspati (says):

“A man who (remains) level with that (counterweight) should be weighed again; a man who rises shall have won (his cause).”

Kātyāyana names another reason for repeating (the ordeal):

“If the scale, or the beam, or the string should break, or if there should be a doubt about the guiltlessness (of the accused), he (the judge) should examine the man again.”

Vyāsa (says):

“If the scale, or the beam, or the two hooks, or the string or the upper beam (which joins the two posts) break, the king should allow (the accused) to try to clear (himself) a second time.”

But these (opinions of the lawyers) refer (to cases) where the reason for the breakage is visible. But if no reason for the break is apparent, he is certainly guilty.

For in another Smṛiti (we read):

“If the scales, or the beam, or the two hooks, or the string, or the upper beam, should break, then he shall declare (the accused) guilty.”

*Kava* the basins of the scales.

*Axa* (axle, means) the upper beam (joining the two *feet* or side beams) which holds the scale beam.

The eastern (lawyers say):

“Only the weighing is repeated, not the whole ceremony with (all its) parts (as prayers, etc.)”

Madana (says):

“ In order to avoid defects, the proceedings with all their details should be repeated, in the same manner (as before).”

Now follows the description of the proceeding.

The person who has to conduct the ordeal goes, on an auspicious day, to one of the before-mentioned trees and cuts it, whilst reciting the Mantra: “ O plant, protect me.” Then he mutters (the verse), “ Somodhenum” (R. V. I. 91-20)—Gautama is its Rishi, Soma the deity, the metre is Trishṭubh, and the manner of its recitation is Japa (muttering) Somodhenum, etc—, and (the verse), “ Vanaspate (RV. III. 8, 11”) its Rishi is Viçvâmitra, the son of Gâdhi, its deity Vanaspati, its metre Trishṭubh, the manner of reciting it is Japa, “ Vanaspati çatavalçah, etc.” Then he worships the guardians of the world, Indra and the rest, each separately, and makes the scale-beam four hastas long, four fingers thick, four-cornered in the middle, and at both ends four fingers thicker, and in the middle fitted with a hook or ring which is turned upwards, and at each end with a grapple or ring which is turned downwards.

Some (lawyers) say, that he then should make an altar, seven or five hastas long and four fingers high. Then he shall there or in another clean place dig into the earth, two hastas deep, two four-cornered posts six hastas long, and surmounted by tops. Above the earth will remain four hastas (of the posts), besides the top portion; the distance between those two posts should be two hastas or one hasta and a half. Between the two tops he shall place a piece of the wood which is fitted with a grapple (lit. crab), a ring, a hook or the like instrument turned downwards, for fastening the scale-beam to it. From that (beam) hangs the scale-beam with its upper hook or ring or the like, and two boards should be tied to the ends (of the beam), each with three strings. Having dug into the earth a pair of posts, (the one) to the south (the other) to the north, at a distance of two hands (from each other), at the eastern end, of the scale-beam, he shall place a joining-piece over them. This is the arch (*torana*) and that should be ten fingers higher than the balance. He shall make an (arch) of this kind also on the western side of the scale-beam. In order to know if the scales are even, he must make two mason’s plummets, of clay, in the shape of balls, hanging down from the arches, tied to them by strings, and touching the ends of the scale-beam. He shall spread on the scales Kuça-grass blades with their tops turned to the east. Then

the Prâḍvivâka, having fasted one (day), shall make the accused, who has fasted one (day), or in case of heavy accusation, if he can do it, three (days), and who has bathed in his garments, ascend the western scale on a Sunday after sunrise, and having placed in the eastern scale stones, bricks, clay, or the like, shall make (this weight) equal (to that of the accused). Truthful Brahmans and goldsmiths shall make an enquiry into this (if the scale-beam stands even) by throwing water (on it) and the like. Then (the Prâḍvivâka), having made a line (in the scale) in order to know the place, where (the accused) was sitting at the time of being weighed (for the first time), he shall make him to descend.

Then the accused, having named the place and the time (where and when the ordeal takes place), and having vowed, "In order to prove my innocence, I will undergo this ordeal," shall elect, by presenting clothes and the like, besides the Prâḍvivâka four priests (to perform the following sacrificial ceremonies).

The great doctors in Smṛiti lore say, that also the Svastivâcana should be performed. The Prâḍvivâka, standing with his hands joined, shall bring Dharma to the scales (pronouncing the following prayer), accompanied by the sound of musical instruments, "Om, come, come, divine Dharma, approach this ordeal together with the guardians of the worlds, the Vasus, Âdityas, and, the flocks of the Maruts." Afterwards he shall bring the subordinate deities.

He uses for bringing Indra (near), "Omindramviçva" (R. V. I. 11-1,) which verse (was seen by) Madhuchandas, (and has for its deity) Indra, (and for its metre) Anuṣṭubh. The application (of the verse remains) everywhere the same. (Having muttered) "indramviçva, etc." (and having with these words) "Indra come, mayest thou stand here," brought Indra to the eastern (corner of the place), he should meditate on the yellow colour. (He then speaks the verse) "Yamâya somam," (R. V. X. 14-13) (of which) Yama (is the Ṛishi), Yama (the deity), and Anuṣṭubh (the metre). (Having muttered the verse) "Yamâya somam," (and having by the prayer) "Yama come hither, mayest thou stand here," brought Yama to the southern (corner), he should meditate on the dark-blue colour. (He then recites this verse) "Tvamnah," (R. V. IV. 1, 4 of which) Vâmadeva (is the Ṛishi), Varuṇa (the deity), and Trisṭubh (the metre). Having muttered "Tvamnosgne

varunasya," (and having with the prayer) "Varuṇa come hither, mayest thou stand here," brought Varuṇa to the western (corner), he should meditate on the colour of crystal.

Having brought Kuvera with the prayer from the Yajurveda "Rājādhirājāya" (and with this prayer) "Kuvera come hither, mayest thou stand here," to the northern (corner), he should meditate on the colour of gold. (He then recites the verse) "Agnim," (R. V. VIII. 44, 3) (of which the Ṛishi is Medhātithi, (the deity) Agni, (the metre) Gâyatrî. Having muttered "Om agnim dūtam" (and having brought Agni (with the words) "Agni come hither, mayest thou stand here," to the corner sacred to Agni (south-east), he should meditate on the colour of gold. (He then recites the mantra), "Moshu" (R. V. I. 38, 6), (of which the Ṛishi is) Ghora of the race of Kaṇva, (the deity) Nirṛiti, (the metre) Gâyatrî. Having brought Nirṛiti (by muttering) "moshuṇah," (and) "Nirṛiti come hither, mayest thou stand here," (to the south-western corner), he should meditate on the dark-blue (colour).

(He then recites this mantra) "Tavavâyo" (R. V. VIII. 26-21,) of which the Ṛishi is Vyaçva, the deity Vâyū, (and the metre) Gâyatrî. Having brought Vâyū (by muttering "Tavavâyav," etc. and, "Vâyū, come, etc." as before (to the north-western corner), he should meditate on the brown (smoke) colour.

(He then recites), "tamiçānam," etc. (R. V. I. 89, 5) (whose Ṛishi is) Gautama, (whose deity is) Içāna, (whose metre is) Jagatî. Having brought Içāna by muttering "tamiçānam," etc. (and) "Içāna come," etc. as before (to the north-eastern corner), he should meditate on the red colour.

To the right of Indra he should bring (the eight Vasus (with this verse): "Imayâtra vasavah" (R. V. VII. 39, 3), (whose Ṛishi is) Vasishṭha, the son of Mitra and Varuṇa, (whose deities are) the Vasus, (whose metre is) Trishṭubh. He should mutter "imayâtra, etc." (and the invocation) "Vasavas come hither, stand here."

The eight Vasus are declared to be; Dhara, Dhruva, Soma, Apah, Anîla, Anala, Pratyûsha, Prabhâsa.

He places between Indra and Içāna the twelve Ādityas (with this Mantra); "tyāmnu" (R. V. VIII. 561) (whose Ṛishi is) Sammada Matsya, (whose deities are) the twelve Ādityas, (whose metre is the) Gâyatrî. (He should mutter) "tyām nuxatriyâ, etc."

Dhâtri, Aryaman, Mitra, Varuṇa, Amṣa, Bhaga, Indra, Vivasvat, Pûshan, Parjanya as the tenth, next Tvasht̥ri, then Vishnu last not least, these are declared to be the twelve Ādityas, by their names. He brings to the western side of Agni the eleven Rudras (by this verse) "ârudrâsah" (R. V. 5. 1.), (whose Ṛishi is) Çyavaçva, (whose deities are) the eleven Rudras, (whose metre is) Jagatî. (He should do so by muttering) "ârudrasah" (and the prayer,) "Rudras come hither." As the eleven Rudras are recorded Virabhadra, Çambhu and the glorious Giriça, Ahir-budhnya, Aja Ekapâd, and the unconquered Pinâkin, Bhuvanadhîçvana, and Kapâlin, the lord of men, Sthânu, Bhava, and Bhagavat. Between Yama and Nirṛiti he places Brahman (masc.) (with this verse) "Brahmâ yajnânâm" (whose Ṛishi is) Vâmadeva, Gotama's son, (whose deity is) Brahman (masc.), (whose metre) Trishṭubh. (He should do so by muttering) "Brahmâyajnânâm" (and this invocation, "Brahman come) hither." (And he brings to the same place) the mothers (with this verse) "Gaurîrmi-mâya," (R. V. I. 164, 41) (whose Ṛishi is) Dirghatamas, (whose deity is) Uma, (and whose metre is) Jagatî. (He should do so by muttering) "gaurîrmi-mâya," (and the invocation)" O mothers, come hither, stand here."

The seven mothers are Brâhmî, and Maheçvari, Kaumâri, Vaishnavî, Vârâhî, Indrânî, Câmundâ. To the north of Nirṛiti he places Ganeça (with this mantra), "Gaṇânâmtvâ" (R. V. II. 23, 1), (whose Ṛishi is) Gṛitsamada, (whose deity is) Gaṇidhipati (the lord of hosts), and the (metre) Jagatî. (He should do so by muttering) "Gaṇânâmtvâ" (and the invocation "O Ganapati, come) "hither, etc. etc." To the north of Varuṇa (he places) the Maruts (with this mantra), "Marut yasya" (R. V. I. 86, 1), (whose Ṛishi is) Rahugana, (deity) the Maruts, (metre) Gâyatri. (He should do so by muttering) "Marut yasya" (and the invocation, "Maruts, come) hither," etc.

The Maruts are declared to be seven, viz., Gaganasparçana, Vâyu, Anila, Mâruta, Prâṇa, Prâṇeça, Jîva.

At the north side of the scales (he places) Durgâ (with this mantra) "jâtavedase," (R. V. I. 99, 1, (whose Ṛishi is) Kaçyapa, (deity) Durgâ, (metre) Trishṭubh. (He should do so by muttering) "jâtavedase" (and the invocation "Durgâ, come) hither," etc.

When thus he has placed these deities, he should worship them

(saying) "I give the Arghya to Dharma, adoration." Having in this manner and the like, at every new gift, repeating these words, given to Dharma the Arghya, water for the feet, water for rinsing the mouth, the honey-mixture, water for rinsing, a bath, clothes, a Brahmanical cord, water for rinsing the mouth, and finally ornaments, such as a crown, bracelets, and having presented the gifts beginning with the arghya and ending with the ornaments (as above) to Indra and the rest, (pronouncing) their respective names preceded by the word Om, and standing in the dative case (Om indrāya arghyam prakalpayāminamah, etc.) according to the fit time for giving the gift, and having (then) presented to Dharma perfumes, flowers, frankincense, lamps and eatables, such as curds, cakes, unground rice, he shall also present perfumes, etc., to Indra and the other gods in the manner before described. And the perfumes, flowers; etc. must, when Dharma is worshipped at the ordeal of the scales, be coloured red: to Indra and the other (gods) they may be offered in the state in which they are obtained. The judge shall perform the ceremony which ends with this (act just described).

Then the burnt-offerings are to be offered by four priests, after common fires have been kindled in the direction of the four points of the horizon.

Then having pronounced the Gâyatrî together with the word Om, (and) again Om followed by the word svâhâ, they shall offer of each of (these, viz.) clarified butter, boiled rice and firewood, one hundred and eight oblations to Savitṛi. Then the accused shall write the matter he is accused of, on a scroll and the prayer "Sun and moon, wind and fire, heaven and earth, the waters, the heart and Yama, day and night, and the two twilights and Dharma know the acts of man." Then he (the judge) should correct (the writing) and place the scroll on the accused's forehead; and these ceremonies which begin with the placing of the gods and end with placing of the scroll on (the defendant's) head, are common to all ordeals.

Then the Prâḍvivâka shall address the scales with this prayer:

"Thou, O scale, art created by Brahman in order to examine the evil-minded. Because (thy name contains) the letter *dh*, thou art Dharma. Because through that letter, thou causest constantly to be known (to men) a bad man, therefore thou art called dhâtâ. Thou

knowest the good and evil deeds of all creatures. Thou alone knowest everything which men know not. This accused wishes to be cleared, therefore deign to save him, according to justice, from the suspicion (cast upon him).” Then the accused addresses the scales in the following manner):

“Thou, O scale, art the abode of truth, having been made (so) formerly by the gods. Therefore, O good one, speak the truth and free me from suspicion. Li, O mother, I am a sinner, then make me descend; if I am innocent, let me rise upwards.

Then the Prâḍvivâka makes the accused, to whose forehead the scroll has been tied, reascend the scales in (exactly the same) place, and sitting (in the same manner) as (at the first weighing), and remain there (on the scale) for the space of five Palas. In that time (the accused’s) innocence or guilt must be examined and announced by holy Brahmins to the king and to the members of the court. Then he descends and gladdens the Prâḍvivâka, the Brahmins and the priests (who have officiated) by rewards. Then, having dismissed the gods (with these verses) “Brahmanaspati arise” (Rigveda I. 40, 1) and “go ye crowds of gods,” etc., he gives everything (the presents offered to the gods) to the judge.

Now (follow) the rules for (the ordeal by) fire.

Pitâmahâ (says):

“I will declare the rules (for the ordeal) by fire, as they are ordained by the institutes of law. Let him order to be drawn eight circles, and also in the eastern (direction) a ninth. The first circle is declared to be sacred to Agni, and the second to Varuṇa, the third to Vâyû, the fourth to Yama, but the fifth to Indra, the sixth to Kuvera, the seventh to Soma, the eighth to Savitri, and the ninth to all the gods: thus know those, who know the Vedas.”

But Madana has declared: “They know that the eighth is sacred to all the gods, but that which is the ninth (drawn in the eastern direction) (should be) great and sacred to the earth; they should be smeared with cow-dung and sprinkled with water.”

The same declares the size of the circles.

“(Measured by) thirty-two fingers should be the distance that separates circle from circle. The space occupied by the eight circles should be 256 fingers.”

*Maṇḍalât*, "from circle" (means) from the beginning of the circle.

The space occupied by a circle and the intervals between it and the next, should be thirty-two fingers; that is the meaning (of the passage).

Amongst these the circle occupies (a space of) sixteen fingers, and the interval between two circles as much, because *Yājñavalkya* says; "it ought to be known, that (each) circle occupies sixteen fingers, and the interval (between two) as much."

If the foot-print of the person who is to be cleared (by the ordeal) (occupies) more than sixteen fingers, then the distance between the two circles should be made less than sixteen fingers. If the (foot-print) of the person who is to be cleared (by the ordeal) (occupies) less than sixteen fingers, then another circle, just as broad as his foot-print, ought to be drawn inside the circle occupying sixteen fingers.

But if *Nârada* has written (these words), "thus two hundred, exceeded by forty (should be the measure), if (one) measures the space by fingers," that is to be understood (of the first eight circles), leaving out the portion of ground between the eighth and ninth circle, because it is not necessary for the accused to step through that.

If the reading of the *Kalpataru* is; "the ground prepared is thus said to be (two hundred) and twenty-four (fingers)," the number of the fingers must be added up, leaving out the first circle, where the accused stands (and takes the fire on his hands).

"Blades of *Kuça*-grass ought to be placed in every circle, according to the injunction of the institutes of law, and the accused should place his foot on these; that is the rule."

In the *Mitâxarâ* and in the *Madanaratna* (we read):

"He should offer in the fire one hundred and eight oblations of clarified butter, in order to propitiate (it)."

And *Vijnâneçvara* (says), that this burnt-offering should be offered with the prayer, "To *Agni*, the purifier, *Svâhâ*."

*Nârada* (says):

"A man who is by caste a smith, or expert in working with fire, or otherwise acquainted with the proceeding, should heat the iron in the fire—a ball of iron (heated till it becomes) of the colour of fire, throwing sparks, well prepared."

Pitāmaha (says) :

“ Having made a ball of iron, without corners, (perfectly) smooth, equal to eight fingers (in circumference) and to fifty palas (in weight), he should heat it in the fire.”

In the Kâlikâ Purâṇa (we read) :

“ The king should give to the accused an iron (ball), weighing fifty palas, twelve fingers in circumference, consisting (as it were) of fire only, (heated by) blowing (with bellows).”

But Çankha and Likhita declare that the ball must weigh sixteen palas, (in the passage) beginning thus :

“ But having taken, into his joined hands, a fire-coloured ball sixteen palas in weight, enveloped in seven Aḡvattha-leaves.” And this (ball weighing sixteen palas) is for a weak man.

The ball should be heated three times, because Nârada says : “ this (ball) being heated for the third time.”

There (at this ordeal) after the ball has been heated for the first time, it is thrown into water ; when it has been heated (for the second time), it is (again) thrown into water ; and whilst it is again being heated the Prâḡvivâka should perform (the ceremonies), beginning with the bringing near of the gods, and ending with the placing of the scroll on the forehead (of the accused).

Then (at this stage of the proceedings) Pitāmaha mentions a peculiarity in the worship of the fire :

“ Then the king should order the fire to be worshipped with red sandy ointment and perfumes, and also with red flowers.”

Hârita (says) :

“ He (the accused) should then place himself, facing the east, with outstretched fingers, in wet garments, clean, having tied to his forehead the scroll.”

The words “ the accused ” must be understood.

Pitāmaha (says) :

“ He shall place himself in the first circle, facing the east, with his joined hands (stretched towards the) east, being pure.”

Nârada (says) :

“ In all wounds or contusions (which he may happen to have) in his hand, let him make (marks in the shape of) swan’s feet ; and he should look at them again (after the ordeal) (and he should make)

the hands variegated by dots (with a coloured substance)."

Yājñavalkya (says) :

"Having marked his hands, by crushing (in them) some rice, he should place (in them) seven Aṣvattha-leaves and tie them as often with a string."

(The word) tâvat, "often," qualifies the action.

Vijnâneçvara means to say therefore "he should tie it seven times."

Madana (on the other side) says :

"Tāvatsutram, 'so much string' means a collection of strings by so much, therefore he should tie (the leaves) once with seven strings taken together."

Pitāmaha (says) :

"Let him place in his hands seven Pippala-leaves, unground rice, flowers, curds, and tie them there with a string."

The verses with which the Prâdvivâka addresses, on this occasion, the fire contained in the ball, will be declared in the Prayoga.

Yājñavalkya (says) :

" 'Thou, O Agni, goest into the interior of every creature, O purifier, O sage, speak the truth in regard to my good and bad deeds, like a witness.' He shall place into both the hands of the accused, who has thus spoken, a fire-coloured, smooth iron ball, fifty palas in weight."

Pitāmaha (says) :

"Then the king, who is intent upon exercising justice, or a (man) ordered (to do so), shall place it (the ball) with pincers in his hands."

Nârada (says) :

"Having taken it (the ball) into his hands, being ordered (to do so) by the Prâdvivâka, (and) standing in one (of the circles) he shall walk over seven others, walking straightforward."

Pitāmaha (says) :

"He (the accused) should not walk quickly but steadily and slowly, he should not overstep (any) circle, nor should he place his foot into the intervals, and having reached the eighth circle, he shall throw it (the ball) down into the ninth, (if he is) a wise man."

But the ball must be thrown down into the ninth circle, which is covered by Kuça-grass.

For thus the Kâlikâ Purâṇa (says) :

"And he should walk (through) seven circles, each sixteen fingers

by measure, and (over) as much (distance) in the intervals. Having walked (this distance), he shall throw (it) down on fresh Kuça-grass (which is strewn in the ninth circle)."

Pitāmaha (says) :

"Then he should place in his (the accused's) hands, rice with its husk, or barley (yava). But if he rubs them to pieces without hesitation and shows no change (then in his hands) at the end of the day, he shall declare him to be innocent."

Kātyâyana (says) :

"If the accused stumbles, or is burnt anywhere else (than in his hands), the gods do not consider that burn (as a proof of guilt) ; he shall allow him (to perform the ordeal once) more."

Yājñavalkya (says) :

"If the ball falls from his hands, or a doubt (arises whether it has been done properly), he should take it (the ball) again."

Now (follows) the manner of proceeding.

After the place has been purified in the morning, the nine circles should be drawn in the evening. Having made the first amongst these sixteen fingers broad, he divides a space of thirty-two fingers (just) before (the first circle) in two parts. The second part (of these) he makes of the size of the (accused's) foot, the rest becomes the interval. And having finished in this manner, beginning from the third and ending with the eighth circle, and having before (the last) left a space of sixteen fingers in breadth, he makes a ninth circle of an undefined size. And thus the space (occupied) by the eight circles and (eight) intervals together, is two hundred and fifty-six (fingers). Eight grains of (yava) barley measured across their thickest part, or three rice grains in their husks measured from top to end, are declared to be equal to a finger.

A span (vitasti) contains twelve fingers. A hasta 'ell' (or 'cubit,' from elbow to top of fingers) is (equal to) two spans. A Daṇḍa, 'yard' is (equal to) four ells. Two thousand yards make one Kroça, and four Kroças make one Yojana.

The span and the other (measures) will be used (in passages occurring) below.

Then the judge, after having worshipped, in their order, the gods presiding over the nine circles, of which the western is the first, viz.

Agni, Varuna, Vâyu, Yama, Indra, Kuvera, Soma, Savitṛi, and all the gods, (and) having kindled a common fire in a place that lies to the south of the space occupied by the circles, offers one hundred and eight oblations of butter, (saying): "To Agni the purifier, svâhâ!" (This is done) in order to propitiate (Agni).

Then having placed into that fire a round, smooth, iron ball, without corners, eight fingers in circumference and weighing fifty palas, he performs, whilst it is being heated, the ceremonies described in the rules for the ordeal by the scales, beginning with the bringing near of Dharma and ending with the burnt-offering; (and) when it is being heated for the third time, the Prâḍvivâka should address Agni, who dwells in the iron ball, with the following verse:

"Thou, O Agni, art the four Vedas, thou art called at the sacrifices, thou art the mouth of all gods, thou art the mouth of all speakers of divine knowledge, thou livest in the bellies of the creatures, therefore thou knowest (their) guilt and innocence. Because thou purifiest from sin, therefore thou art called the purifier. To the guilty show (thy power), O purifier, shine with brilliancy.

"But be propitious to those who are of innocent mind, O thou who eatest the oblations.

"Thou, O Agni, walkest in the interior of all creatures as a witness. Thou, O god, knowest what men do not know. This man, who is accused, wishes to be cleared, therefore deign to save him from suspicion, according to truth."

In order to clean the iron, having thrown the heated iron-ball into water, it should be again heated and again thrown into the water, and then again heated,—it is the third heating.

The judge, after having taken up the well-heated, fire-coloured iron-ball, which has been thus addressed, with a pair of pincers, and holding it before the person, who undergoes the ordeal, who has fasted, bathed, is in his wet garment, wears the scroll on his forehead, and stands in the western circle, he places it into his hands.

The latter (before taking it) addresses it with the following (verse):

"Thou, O fire, dwellest in all creatures, O purifier, speak thou the truth in regard to my guilt or innocence, O sage!"

The "preparation of the hands" consists, in crushing rice in them

and joining them, in marking the black and red spots, the wounds and weals in them and the like with lack-juice and the like, in placing in them seven equal Aṅgathā-leaves, or (on failure of them) seven Arka leaves, or seven Āmī-leaves or seven Dūrva-leaves, rice grains, *i. e.* rice-grains wetted with whey and flour, and in tying up (the whole) seven times with seven white threads. Then the person who undergoes the ordeal, should walk through the circles, beginning with the second and ending with the eighth, and having thus made seven steps, throw the iron-ball, which he holds in his joined hands, into the ninth circle.

Then he should again crush rice (in his hands), and if his hands are not burnt he is innocent.

Now follows (the rule for the ordeal by) water.

Pitāmaha (says) :

“Now I will declare the rule (for the ordeal) by water, the eternal law. A wise (judge) should order to be made a place (purified by the application of cow-dung), then he should devoutly worship arrows with lamps and incense, and a bow made of bamboo, with auspicious flowers and incense, and afterwards perform the ordeal.”

The construction is; “he should worship the arrows with lamps and flowers.”

The worship must take place in the (purified) space.

Nârada describes the size of the bow :

“The strong bow ought to be understood to be one hundred and seven fingers long, (the bow of) middling (strength) one hundred and six, and the weak bow one hundred and five; this is the rule regarding the bow. But let a wise (judge) shoot three arrows with the bow of middling (strength), having made a target at the distance of one hundred and fifty hastas.

Saptaçatam (lit. seven hundred) means one hundred and seven fingers long. In the same manner must be interpreted the expressions shaçatam (six and hundred), pancaçatam (five and hundred).

Kâtyâyana (says) :

“And he should make the arrows (used) at the ordeal without iron tops, only consisting of a piece of bamboo; but the bow-man should shoot strongly.”

Nârada (says) :

“But going to a place full of water, he should make an arch, as

high as the ear of the accused, on even and pure ground. He should first worship Varuna with perfumes and fragrant garlands, with honey, milk, clarified butter, etc., being of collected mind. A Brahman, Xatriya or Vaiçya, who is neither a friend nor a foe (of the accused), should be placed in the water where it reaches up to his navel, (and he must be) a man strong like a post."

Pitâmaha (says) :

"First the king should place in the water a man, (strong) like a post, and then having ordered the person who undergoes (the ordeal) to go into the water, facing the east, he should then bring near (by invocation) the gods, and address the water."

The gods, i. e. Dharma and the rest (*see above*).

That he should perform the (ceremonies), beginning with the bringing near of the gods and ending with the placing of the scroll (on the accused's forehead), this and the like (and) the verses addressed (to the water) must be looked for in the (description) of the manner of proceeding.

Vyâsa (says) :

"'By truth protect, O Varuna ;' having conjured the water (thus), and taking hold of the thighs of the man who stands up to his navel in the water, he (the accused) should enter the water."

*Xam* means water; *abhîçâpya* (lit. having conjured) means having addressed.

Bṛihaspati (says) :

"When he has made the (accused) man enter the water he should discharge three arrows."

Pitâmaha (says) :

"The bow-man should be a Kshatriya or a Brahman, who follows his (a Kshatriya's) occupation, (who is) not hard hearted, of subdued passions, dressed and pure."

Kâtyâyana (says) :

When (the arrows) have been discharged, the submerging ought to take place, and at the same time the starting (to fetch the arrows.)

The meaning of the word *samakâlîka* "at the same time," is that (it is to take place) at the same time as the submersion.

Nârada and Pitâmaha (say) :

"A young, swift man should go according to his utmost power from

the place of shooting to where the middle arrow (lies). Another man of the same qualities, having received the middle arrow, should quickly go back to the place, whence the (first) man came. But if the arrow-bearer, arriving, sees him not, and (he is) in the water, then he shall declare him to be cleared, otherwise he shall be guilty, though he may show only one limb, or if he has gone to another place from that where he entered before. 'One limb' means the ear.

And Kátyâyana (says) :

"Of whom he does only see the (top of the) head, and neither the ears, nor the nose, at his entering in the water, him also he should declare to be innocent."

Pitâmaha (says) :

"The (place where) the arrow falls is to be used (as the starting point for the second runner), and not a (place to which the arrow may have glided)."

Nârada (says) :

"Those two runners who are the swiftest among fifty, should be appointed there (at the ordeal) in order to bring the arrow."

Now (follows) the manner of proceeding.

The place of (the ordeal by) water (is described as follows).

A river, the ocean, a lake, a natural water-course, a pool or a tank and the like (places) containing quiet water, should be used. One should avoid a small or unclean (place), and one that is full of grass, reed, waves, mire, alligators, leeches, fish and the like, one which is quick-flowing and the like. There, in water which reaches up to the navel, a pillar for (fulfilling) the law should be made from a tree whose wood can be used at the sacrifice. Near this, on the western bank an arch, reaching up to the ear of the accused, should be made.

A bamboo bow of one hundred and six fingers length, and three arrows made of bamboo, without iron tops, should be placed near this. A target is to be placed on cleared ground, one hundred and fifty ells from the arch. Then after having worshipped the bow and the arrows with white sandal-wood and garlands, having brought Varuṇa (by invocation) to the water and worshipped him, and having completed the above described (ceremony), which begins with conveying of Dharma to the bank of the water and ends with the burnt-offering,

and having tied the scroll with the accusation to the forehead of the accused, the judge should address the water as follows :

“ O water, thou art the breath of living creatures, thou wast first produced at the creation, and thou hast been declared to be a means of purifying things and living beings, therefore show thy (power) in discerning between guilt and innocence.”

The person who is to be cleared also should address (the water) :

“ Through truth protect me, Varuṇa.” Then the accused should approach a very strong man, who supports himself by the pillar of the law, who has his face turned to the east and stands in the water up to his navel. Then a Kshatriya or a Brahmana, who follows his (the Kshatriya's) occupation, should vigorously shoot the three arrows without iron tops towards the target.

Then, whilst one swift man has taken up the middle arrow, and, having left the place where it rolled to (on the earth), placed himself on the spot where it fell, another swift (man) must stand at the foot of the arch whence the arrow was discharged.

And the swift (one) must be the swiftest amongst fifty runners.

Then, when the judge, who stands at the foot of the arch, has clapped his hands three times, the accused must submerge himself and the swift man, who stands near the arch, must begin to run very quickly. And the submersion has to take place by catching the thighs of the (man) who supports himself on the pillar of the law. Then when he (the first runner) has arrived at the place where the middle arrow fell, the man who stands there and took up the arrow runs very quickly towards the arch. If he finds the accused submerged, then he is innocent. He is also innocent, if the top of the head only is visible ; (but) not (innocent), if his ear or any other member is visible, or he has moved from where he had dived to any other place.

Now follows the rule for (the ordeal by) poison.

In (regard to) this, Nārada (says) :

“ A Brahman (the judge) with collected mind, turning his face towards the north or east, having fasted, should give the poison, before gods and Brahmans, after having worshipped Maheçvara with incense, food and Mantras, (to the accused) who stands before the Brahmans facing the south.”

The same declares the quantity of the poison.

“ In the rainy season the measure is recorded to be four barley grains, in the hot season five, in the cold season seven, in autumn even less than that.”

Less (means) three barley grains.

The cold season indicates also the dewy season, because these two (words Hemanta and Çiçira) are always used as a compound.

But the spring is fit (for this ordeal) because it is common to all ordeals.

Vijnâneçvara declares that the measure (of the poison) is also then seven barley-grains.

The poison should be given (mixed) with thirty times as much ghee. Because Kâtyâyana says, “ but the poison should be given to men in the forenoon in a cool place, mixed with thirty times as much ghee, well pounded.”

Yâjnavalkya (II. 110) has declared the address to the poison: “ O poison, thou art Brahman’s son, firm in the duty of (making known the) truth, save me, according to truth, from this accusation; become ambrosia to me.”

Nârada (says):

“ Sitting down in the shade, he must be watched the rest of the day, without taking food. Manu says, that if he overcome the force of the poison, he is innocent.”

In case of excess of the measure of the poison the same ordains another interval of time:

If he remains healthy for 500 Pâlas (about 500 seconds), then he is innocent and may take medicine.

And the symptoms of (the working of) the poison (have been described) in the Vishatantra.

“ The first attack of the poison causes the erection of the hair (on the body), (then follow) sweat and dryness of the mouth, after that arise (frequent) changes of colour, and trembling of the body. Then the fifth attack causes the immobility of the eyes, loss of speech and hiccupping. The sixth, hard breathing and loss of consciousness, and the seventh, the death of the person. There (at this ordeal) he (the accused) should take the poison, after it has been placed before Mahâdeva, by the judge, who has fasted.”

Now (follows) the rule for (the ordeal by means of) water taken from the bath of a god.

Pitāmaha (says):

“He (the judge) should make (the accused) drink the water (from the bath) of that god whom (the accused) worships especially, but if he worships (all) the gods equally, he should make him drink (the water from the bath) of Aditya. Thieves and people who live by the sword, he should order to drink (the water from the bath) of Durgâ; but he should not make a Brahman drink the water from the (bath) of Aditya.”

Bṛihaspati (says):

“The (bathing water of the god) whom the accused worships exclusively, is his (the gods) weapon; having sprinkled the god he should make the accused drink three handfuls of the water.”

Nârada: “Having called the accused and placed him in the circle (drawn at the beginning of the ceremony), facing the sun, he should make him who has bathed according to the beforementioned rule, is dressed in his wet garments, and is pure, drink three handfuls of the water.”

Nârada:

“Having worshipped that god (who is especially addressed at the ordeal), and sprinkled him with water, and told (the accused) the (greatness of the) sin (in case he lies), he should make him drink three handfuls (of the water).”

There (at this ordeal) the judge, having fasted (from sunrise) and worshipped the god in the forenoon, and having taken (the god's) bath, and performed (the ceremonies) beginning with the bringing near of the gods and ending with the placing of the scroll on the forehead of the accused, should address the water with the Mantra prescribed at the 'ordeal by water.' Likewise should the accused address the water with the formerly-mentioned (Mantra), and then drink afterwards.

Bṛihaspati (says):

“He who does not suffer any misfortune in regard to children, wives or property within a week or a fortnight, shall doubtlessly be (considered) innocent.”

Now (follows) the rule (for the ordeal by) rice grains.

In regard to this Pitāmaha (says):

“ I will declare the rules for the (ordeal by) rice grains, as it is described by its particular characteristics; but the maxim is, that the ordeal by rice grains should be allowed in case of theft only, not otherwise.”

He should order grains of Çâli, not of any other (kind of rice), to be made white. Unsullied (by impurities) he should expose them in an earthen vessel to the sun, and should keep them mixed with water from the bath (of the god) for one night, and should perform the ceremonies beginning with the bringing near of the gods according to the rule during the night.”

Kâtyâyana also (says) :

“ At the eating of rice grains mixed with the water of the god's bath, he (the accused) shall be considered clean, if he spits them out clean (not mixed with blood, etc.); he (who does) otherwise (is) guilty, and should be punished.”

Pitâmaha (says) :

“ He should declare that man guilty, who is seen to bleed, whose jaw or palate is torn, or whose body trembles.”

Now (follows) the rule for (the ordeal) by hot mâsha—grains (made of metal).

Pitâmaha (says) :

“ I will declare the rule for (the ordeal by) hot mâshas (which is) good for (the judge) clearing (merit). He should have made an iron or copper vessel of sixteen fingers (in circumference) and four fingers deep, or an earthen round (vessel). He should have it filled with clarified butter and oil (to the weight of) twenty palas. Then he should place into it, (when it is) well-heated, a golden mâsha—grain. (The accused) should take out the hot mâsha, with the thumb and (first) finger. If he does not move the ends of the fingers, or no blister comes, he whose fingers are not hurt is (considered) innocent according to the law.”

The same describes another mode (of undergoing this ordeal). Being pure, he (the judge) should order clarified butter prepared from cow's (milk) to be heated in a golden, silver, copper, iron or earthen (vessel), and he should throw a beautiful golden, silver, copper or iron coin, which has once been washed with water, into the (liquid). When it is full of small and great gyrating waves and cannot be touched with

the nails, then he should examine it on a wet leaf, whether it makes loudly the sound *Churu*, and then he should address it once with this Mantra :

“ Thou, O ghee, art the best means of holiness, and ambrosia at the sacrifice ; O purifier, burn thou the bad man, be cool like snow to the innocent.”

Then he should make (the accused), who must come, after having bathed, in wet clothes, without having eaten or drunk, take that coin which lies in the ghee. The examiners (Brahmans appointed thereto as in the ordeal by the scales) should examine his first finger. If there are no blisters, he is innocent, otherwise guilty.”

Now follows the rule for (the ordeal by) the ploughshare.

Bṛihaspati (says) :

“ The ploughshare must be made of iron, twelve palas in weight. Eight fingers be its length and four its breadth. A thief should once lick strongly that with his tongue, when it is heated to the colour of fire. If he is not burned, he shall be innocent, otherwise he is guilty.”

Now (follows) the rule for the (ordeal by) lot.

Pitāmaha (says) :

“ Now I will declare the examination of murderers, persons who raise (unjust) claims, and of persons who refuse to perform a penance for a crime of which they are accused, by means of (lots bearing the figures of) Dharma and Adharma. He should cause to be made (one lot) of silver, bearing the figure of Dharma ; and one of lead, bearing the figure of Adharma ; or he should draw on (two) pieces of the inner bark of the birch-tree Dharma and Adharma in white and black. Having sprinkled (the two lots) with the five products of the cow, he should worship (them) by presenting sandal-ointment and flower-wreaths. But to (Dharma) white-flowers (should be presented), and black flowers to Adharma. Having performed this and smeared (the images with cowdung), he should place the two (lots) in two heaps (of cowdung). The two heaps must be made round, of cowdung or (clean) earth, and must be placed in a new earthen jar, without being marked. In a clean place, smeared (with cowdung) in the presence of (the images of) the gods and of Brahmans, he should then bring near the gods and the guardians of the points of the horizon, as formerly (described). But before bringing Dharma near,

he should write the *Pratijnâpatra*, (a paper declaring the resolution of the accused to perform the ordeal and the crime of which he is accused.) Then the accused (saying,) "if I am free from guilt, may (the lot of Dharma) fall into my hand," should take one (of the heaps) without hesitating. If he has taken "the lot of Dharma" he shall be cleared, but if he has taken the lot of Adharma, he loses his cause. Thus has been declared in short the examination of by the two (lots symbolising) innocence and guilt."

*Bṛihaspati* (says) :

"Figures of Dharma and Adharma must be drawn on two leaves (in) white and black. Having addressed (Dharma and Adharma) with the verses which convey life to them and others, and with the *Sâma*-melodies beginning with the *Gâyatrî*, he should worship them with perfumes and white and black flowers. Having sprinkled them with the five products of the cow and placed them into two heaps of earth, and made (the heaps) equal in size without marks, he should place them in a jar. Then (the accused) should take one heap out of the jar without hesitation. If he has taken "the lot of Dharma" he shall be considered free from guilt, and is to be honoured by the persons conducting the ordeal.

Now (follows) the manner of proceeding.

Having drawn a white figure of Dharma and a black figure of Adharma on two leaves, and having given life to the image of Dharma by this (mantra) : "Am, hrîm, krôm, ham, yam, ram, lam, vam, çam, sham, sam, ham ; I (am) he (Brahma) ; may breath come here (to this image) and remain long and happily, Svâhâ ;" he (sings) the *Sâmans* beginning with the *Gâyatrî-sâman* if he knows the *Sâmans*.

(Then) he again pronounces this Mantra (Am, etc.) (and substituting for the word Dharma's breath, etc.), "Dharma's soul is here." (Afterwards) he pronounces the same once more, substituting for the words "Dharma's breath," etc., "Come hither, Oh mind, Oh eyes, Oh ear, Oh nose, O breath, (come hither) all ye organs of Dharma, remain here, Svâhâ !" Having thus given a soul to the image of Dharma, and having uttered the *Gâyatrî-sâman*, if he knows the *Sâman*-melodies, if not, the *Gâyatrî*-verse preceded by *Vyâhritis* and the syllable Om, he performs the ceremony of bringing near (the gods) and the rest. Having honoured the (images of) Dharma and Adharma in their order

with white and black flowers, and having taken the five products of the cow, (pronouncing) the syllable Om, and sprinkling (the images), he lays each of the images, Dharma together with white flowers and Adharma together with black flowers, into a heap of earth and places (these two heaps) in a new jar. The judge then performs the ceremonies beginning with the bringing near of Dharma and ending with the burnt-offering, prepares a Pratiñāpatra on which also the Mantras are written, and ties this leaf to the forehead of the accused. The accused saying, "If I am pure of guilt, may (the image of) Dharma come into my hand," takes one of the two (heaps) in the jar. If he has taken the image of Dharma, he is to be considered innocent. Afterwards he should give a present (to the Brahmans).

Now (follow) the oaths.

Manu : "Let the judge make a priest to swear by his veracity ; a soldier by his horse, or elephant, and his weapons ; a merchant by his kine, grains and gold ; a mechanic or servile man by (imprecating on his own head if he speak falsely) all possible crimes."

Brihaspati (says) :

"In small causes oaths by (the accused's) veracity, vehicles, arms, kine, grain, or gold, by the feet of the gods or Brāhmans, by the (accused's) sons' or wives' heads are prescribed, but in accusations of crimes attended with violence the other ordeals are declared to be the means of proving (the accused's) innocence."

Yajnavalkya (says) :

"He shall be considered innocent, without doubt, to whom within a fortnight (after his taking the oath) no dreadful misfortune, caused either by the king or the gods, happens."

Dreadful (ghora) means great, because a small (misfortune) is unavoidable for men ; thus (it is written) in the Mitâxarâ.

Katyayana also (says) :

"He, to whom within a fortnight no dreadful misfortune from the king or from gods happens, is to be considered cleared by the oath." Vyāsana means âpat, misfortune. Ghora (dreadful) means exceedingly painful, because small (misfortunes) are incidental to all creatures possessing a body.

Again Kâtyâyana (says) :

"But now, if a misfortune coming from god happens to the accused

within a fortnight, he (the judge) should anxiously make him pay the property (disputed) and also a fine,—if (the misfortune) befalls him alone, and not all the people (at the same time). Sickness, a conflagration (of accused's house, etc.), the death of relations, heavy fever, eruptions, and deep-seated pains in the bones, disease of the eyes or of the throat, madness, disease of the head, and the breaking of an arm, are the diseases which befall men, (coming) from god." Misfortunes coming from the gods (are) such as the death of relations. By the (words): "(If it befalls) him alone," epidemics, such as cholera (mâri), are excluded. As in this (passage) by the (word), "his" the before-mentioned accused is referred to, sickness and the like are a sign of a false (oath), only (if they befall) the accused, and not (if they happen) to his sons or other (relations). And such (illness) ought, as before mentioned, to be grave, not trifling. With reference to this (last point) Vâcaspatimiçra (gives us) the meaning (of the passages):

"Uncommon sickness (which befalls) the accused is a sign of a false (oath). Therefore it is also declared that the death, not the sickness, of relations (is a sign of the accused's perjury)."

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*Rough Notes on some of the Antiquities in the Gayá District. —*

*By W. PEPPE, Esq.*

[Received 20th November, 1865.]

About 11 miles from Gayá, on the Patna road, there is a small village and bazar called Newree; on the right of the road there is a small temple on a mound with one or two large popul trees round it. There are several figures lying about, and there is a slab on the pukka terrace of the temple, representing a prince on horseback with attendants, one holding an umbrella or chatta over him; others are carrying various articles; one has two vessels slung on a pole, much in the same way as pilgrims now carry the Ganges water; another has a pig on his shoulders, as far as I can make out; it would seem to represent some notable person performing a pilgrimage, (see Photograph, 9 a.\*) and may have been executed to commemorate the pilgrimage of some prince. The villagers state that this slab has only been in its present place but a short time, and that it was found in a village about a mile to the

\* The photographs alluded to in this paper may be seen in the Asiatic Society's Library.—EDS.

east, but it most likely came from the Burabur hills, which are only 6 miles from here.

The little temple or "Muth" is about 100 years old, and is said to have been built by a Mussalman Zemindar, a singular instance of toleration, if true.

*Bela.*—A mile further on is the village of Bela; there is a dak bungalow here, and it is the point where the main road is left by visitors going to the Burabur hills.

To the north of the village are extensive mounds of brick rubbish, several large tanks and the ruins of several temples (judging by the number of Lingams) dedicated to Mahadeo; they lie to the east of the large mound, through and over which the main road lies. To the south of this there is a modern temple dedicated to Kalee, built by the Tikaree family, in the Adytum of which there are a number of figures, principally in fragments: there are several of a Buddhist character.

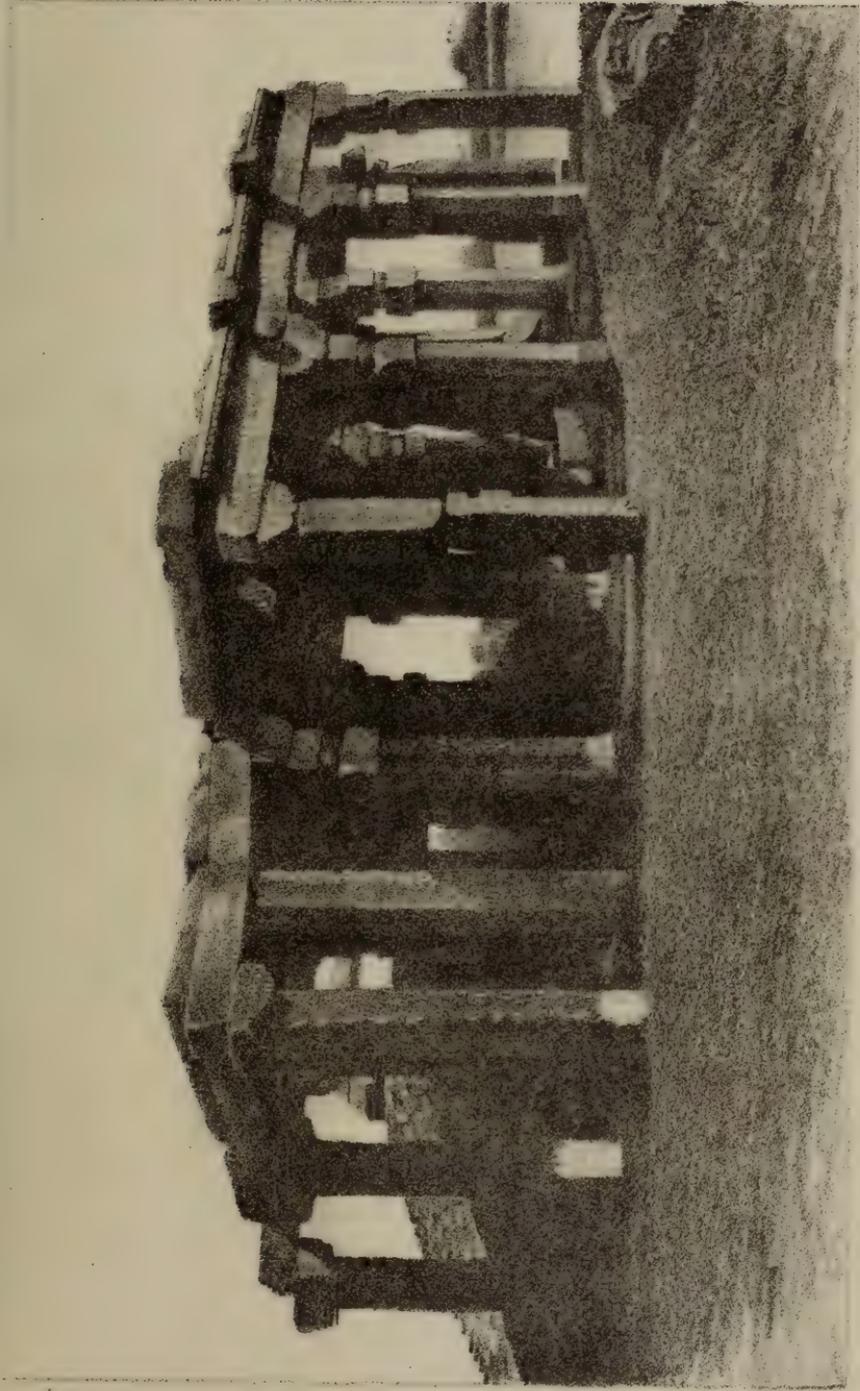
*Palee.*—About two miles further on at a village called Palee, there is a large tank, now nearly filled up, to the north of which there are several life-sized figures standing on the road side, but of no interest, and of the kind so very common in this district.

*Nair.*—About four miles further on is a village called Nair; to the east of the village through which the road runs, is the ruin of a temple, with the pillared portico still standing; (see Photographs Nos. 10 and 11, Plate I.) The pillars are of granite in one block; the temple itself would seem to have been of brick, but is now only marked by a mound of brick rubbish: its internal chamber is still standing, and now contains a lingam.

There are several statues lying about, mostly in a mutilated condition, but none of them are of much interest. There are several large tanks in the neighbourhood, both to the east and west of the road, with several lingams in situ.

Returning to Bela and leaving the Patna road there, after going about six miles to the east, is the isolated peak called Kowa Dhol, but as this has been so fully described both by Major Kittoe and Col. Cunningham, I need only describe the photographs from this and adjacent localities.

No. 12. View of Kowa Dhol from the east, showing the site of the ancient village on the right.



*Drawn on Stone by N. 1890. Har. 203. Student Goods School in Art. Dabruha*

PILLARED PORTICO AT NAIR



No. 13. The Gigantic Boodh mentioned in Col. Cunningham's report.

No. 14. A view of the Great Gurha caves, showing the entrances to the Lomas Rishi to the right and the Ladama cave to the left, and the huge block of granite, out of which they have been chiselled at the expense of so much labour: the crack or flaw in the rock which arrested the work in the Lomas Rishi is also seen to extend to the outside.

No. 15. A new view of the entrance to the Lomas Rishi cave, showing the frieze of elephants, the drawing of which will bear comparison with that of the best artists of the present day.

No. 16 is a view of the Nagarjun hill, with door-way and ascent to the Gopi cave.

No. 17 is a view of a huge boulder supported by others, forming a natural cavity or grotto which had been built up into a small chamber or cell; the only part of the work now remaining is the mass of brick rubbish on the top, which has been kept in its place by the roots of the plants growing out of it. It is immediately alongside of the Vapiya caves, a view of which I did not obtain.

Proceeding on to Durawuth—

No. 18 is a view of the Dandoker Tal from the north-west, showing the little temple on the bank of the Tal and the hills in the background.

Nos. 19 and 20 are views of the twelve-armed figure mentioned by Col. Cunningham; I have only met with one other example of this figure.

There are several figures and sculptures of interest in this neighbourhood; one is a seated figure of Boodh, surrounded by a seven-headed snake; it is called Nagjee by the natives. I also found several slabs with quaint representations of the worship of the solid temples or chaityas, see Photograph No. 21.\* These came originally from the small hill to the south of the tank. These little hills have been covered by little buildings, the character of which I have not been able to make out; I counted some 15 or 16 on one little hill; they were mostly built on the highest peaks and also crowned every projecting spur; all that remains of them now are small platforms of rough stones and mounds of brick. What their outward forms were, cannot now be guessed, nor for what purpose they were built; but most probably they were cells for the abode of recluses. I have met

\* The base of pedestal of a figure of Buddha, has the creed in Kutila characters.

with these little buildings in several localities, and will refer to them again in noticing those I found in better preservation at Cheon.

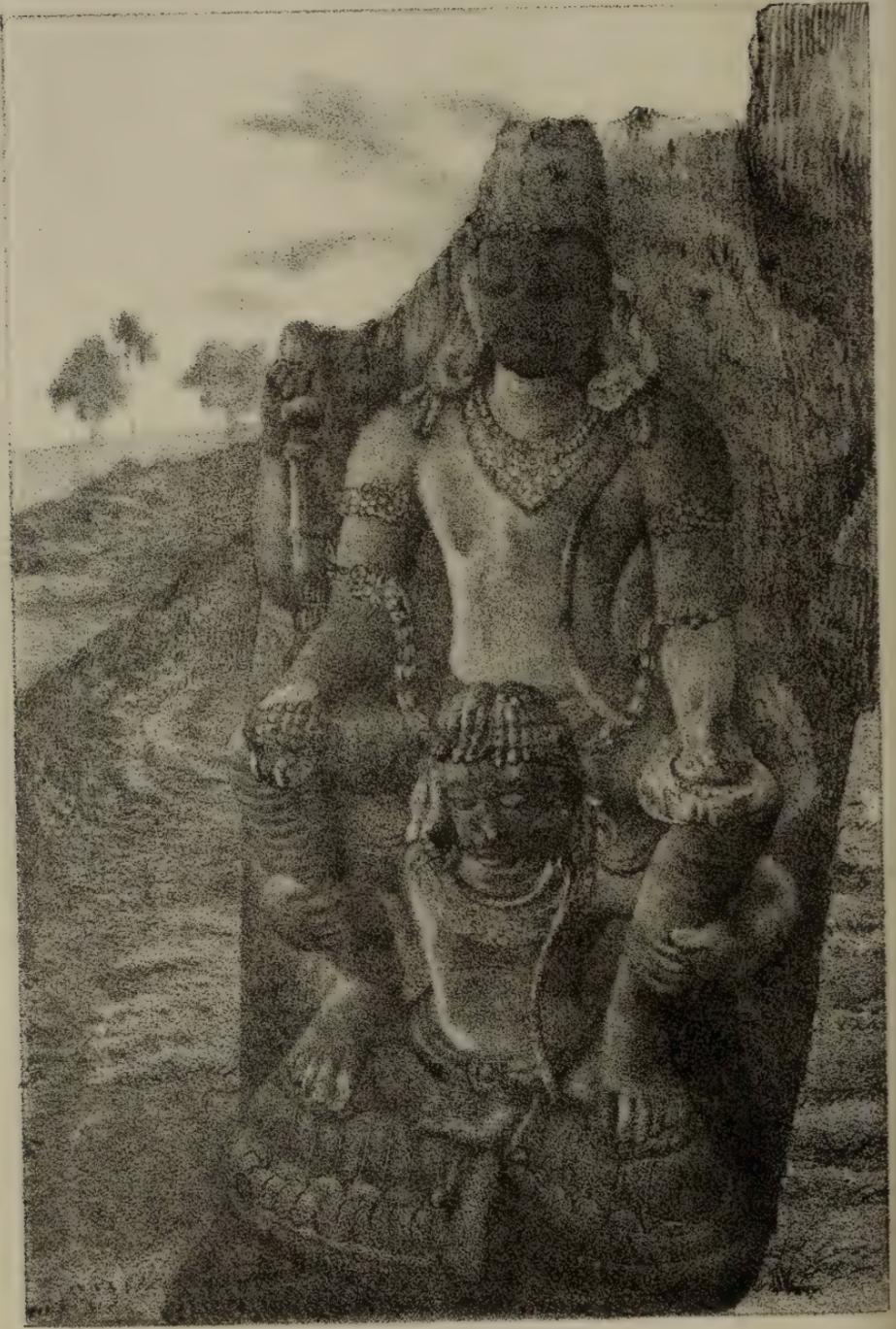
*Genjun.*—Referring to the map,\* you will see that there is a village called Genjun, about 6 miles distant, west of the Patna road, in a direct line with Durawuth. There are very extensive mounds at this village, and several large and interesting figures, one of which is represented in No. 22. It is well executed and, with the exception of the fracture, in good preservation; the figures surrounding the Boodh are representations of events in the life of Sakya Singha, with the Nirvan at the top. The figure is called Byro by the Brahmans of the village. The pedestals of several large figures as well as the lintel of a sculptured Buddhist doorway have inscriptions, but they are defaced, from the villagers having used them as whet-stones. I was informed that these figures were exhumed when the mounds were dug into for the erection of a small mud fort which adjoins these mounds: no doubt these mounds are the sites of large buildings, and their excavation would bring to light many other interesting figures.

To the north-east also a number of figures have been collected in a small brick enclosure, but they seem to be of more modern date; a figure of Gunesh is the principal one.

*Kispa.* About two miles to the south-west is a village called Kispa, where there are some very fine life-sized figures; one in the middle of the village to the east is a fine standing figure of Boodh, in capital preservation, with an inscription; near it are slabs and pillars of granite shewing that a temple had existed at this spot; the whole village stands on high ground formed of brick rubbish. To the south of the village are extensive mounds, and to the north of this there is an old mud fort. On the west side of the ditch surrounding the fort there is a twelve-armed figure, the same as the one at Durawuth, and has evidently been found when digging the fort ditch. Close by these mounds, to the south, is a small temple dedicated to Tara Devi, and a number of figures are collected in and around it; the temple itself is of the common kind seen in every village. Tara Devi is a standing figure of a Buddhist character, but it was so covered by drapery, that I could not make it out. A little to the north of this temple, and on the opposite side of a ditch cut as a water-

\* Preserved in the Asiatic Society's Library. Eds.





*Drawn on Stone by Kristo Hari Das Student Govt. School of Art Calcutta.*

STONE FIGURE AT GENJUN.

Lith: by H. Niven S. G. O. Calcutta May 1866.

course by the villagers, is a very singular figure, and the only one of the kind I have hitherto met with : see Photograph No. 22½ (Plate II.) It represents two figures, life-sized, one seated on the shoulders of the other. From the ornaments and style it is evidently Buddhist, but I am completely at a loss as to its meaning. To the north of the village, there is another little temple in a mangoe grove, with a number of figures, more or less mutilated, collected around it. I noticed a nicely sculptured Lingam of a square form, and the only specimen of the kind I have met with.

*Kutangee.*—About five miles west of this place is a village called Kutangee. There is in it a large mud fort of some pretensions, and numerous mounds of brick rubbish, some figures in fragments, but none of any interest.

*Mujheawan.*—About a koss further north, there is another large mud fort at the village of Mujheawan, and nearly every village about this have mounds and small mud forts, but I saw no figures of importance or interest.

*Kyal.*—About eight miles west of Mujheawan, there are large tanks and mounds, but no other features of importance.

*Deokund.*—South of Kyal on the borders of an extensive tract of land covered with shrub jungle is a place called Deokoond, which seems to have possessed a Buddhist temple or monastery. There is a fair held here in the month of Fagoon, when great numbers of people assemble to bathe in the tank or koond. On a former visit, I observed a number of broken Buddhist figures and miniature stupas collected under the trees : these have since been covered with a coating of mud. The temple itself is in the centre of a mass of brick rubbish, through which a road has been cut to give access to the interior chamber which is now occupied by a Lingam. A rude sort of dome has been erected immediately over the central chamber. See Photograph No. 23.

No. 24 is the gateway of a fortified serai in the old village of Daoodnuggur, so named from Daood Khan the founder, who died some 200 years ago.

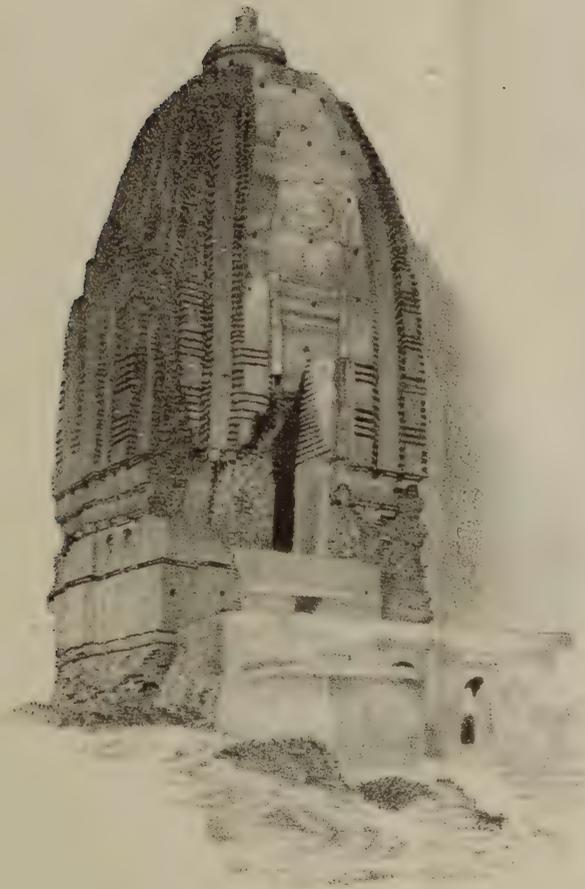
*Konch.*—On the road between Daoodnuggur and Gayá, about 16 miles from the latter, is the village of Konch ; I have already noticed the temple at this place, but the following notes may not be unacceptable. The present village consists of two parts, the bazar on both sides of

the road, and the village proper, which is about 100 yards to the north of the road. Between the two villages there are several extensive mounds of brick rubbish, and a number of scattered Buddhist figures. On the right there is an old mud fort, and it would seem that in digging the mud for its erection, the larger figures were found; the principal one is life-size, highly finished, but wanting the head; see No. 25. This is placed upright on a level with the path. Higher up on the mound to the west are the Buddhist figures with inscriptions shown in Photograph No. 26. To the south are two figures (see Photograph No. 27) of the form I have already referred to, as being the most general all over this district, and which are named according to the fancy of the Purohit, who, provided with a few of these figures only differing in the execution, has the range of the whole of the Hindoo Pantheon, and names them at his own discretion, or according to the wishes or wants of the community.

Passing through the village proper, you come to the temple mentioned by Buchanan, and of which a drawing is given in the first volume of Martin's *India*. Photograph No. 28 (Plate XII) is a view of the front of the building from the east with the opening above the entrance, leading into the upper chamber. Photograph No. 29 is a view from the southwest. The accompanying ground plan (Plate III) will give the reader some idea of its structure, and the section will show the superstructure with the arched lower chamber, and the interior recess over the entrance which resembles that in the Boodh Gayá temple. Nothing but mud has been used to cement the bricks, but the latter have been so well prepared that they fit together most accurately. There would seem to have been a coating of plaster on the outside, but this has nearly entirely disappeared. A porch had been added with an arched roof, but it has fallen in, the only arch in the original building is that of the lower chamber which is painted.

In the centre of the lower chamber there is now a lingam, and in the porch there are a number of figures. Photograph No. 30 is a slab let into the wall with a representation of the avatars. Photograph No. 31 are other figures in the same enclosure. Photograph No. 32 is a nearer view of the entrance and opening above the doorway.

Immediately outside, there are a number of granite pillars, and from their number and situation, they seem to have formed an enclosure round the temple.

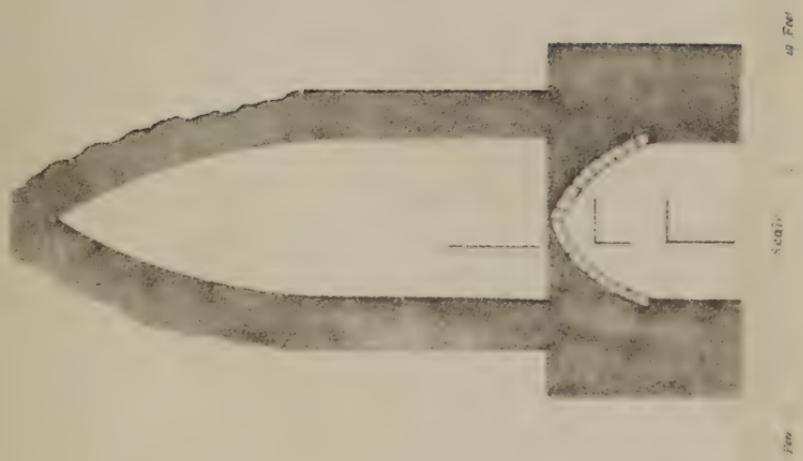


TEMPLE OF KONCH FROM A PHOTOGRAPH BY J. H. PEPPE ESQ RE  
Drawn on stone at the Govt. School of Art Calcutta, by Kristohurry Dass, Student.

LITH: BY H. M. SMITH, SURVEYOR GENERAL'S OFFICE CALCUTTA MARCH 1866.

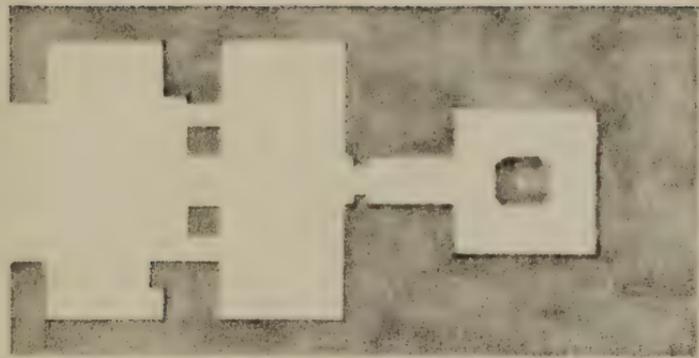


ROUGH SECTION OF TEMPLE AT KOCH



Scale  
1/200  
1/100  
1/50  
1/25

PLAN OF TEMPLE AT KOCH



Scale  
1/200  
1/100  
1/50  
1/25



In a corner of the village near the temple, there are a great number of lingams collected, of all sizes, many with 3 and 4 sculptured faces. To the east of the temple there is a small tank; on the banks there are several sumadhs or tombs, of the form which is so common at Boodh Gayá.

*Palce.*—Four miles nearer Gayá is another village called Palce, which seems to have had several temples; one at least was Buddhist, and of the same form as the one at Nair and at Poonawa. Judging by the few pillars still standing (see Photograph No. 33,) a great number of pillars have been removed. When I last visited the place, quarrying for bricks was being actively carried on. Several large lingams had been dug out of the mass of rubbish, and also a bull of the usual form, so that the temple, which was most likely originally Buddhist, had subsequently been converted into a Hindoo one. A few paces to the west close to the road there is a large lingam in situ, with a peepul tree growing in the interstices: see Photograph No. 34. Close by is the lintel of a Buddhist temple door, and the side posts are a little distance apart under a peepul tree: see Photograph No. 35. For some distance round there are traces of temples, but those described seem to have been the only ones of any size.

Almost directly south from Konch is a large village called Kabur, and adjoining it is a rather large fort marked Mudun in the maps, but I could find no local name for it. From the extensive mounds in every direction, and the appearance and size of the fort, it is of much earlier date than the generality of the mud forts so common in this district. It is attributed to the Kole Rajahs by the natives, and this is the case with everything which is earlier than the advent of the Mussulmans. I was disappointed in not finding any figures or inscriptions in the neighbourhood. There are one or two pillars of black chlorite which must have belonged to some old Hindoo Temple, but the natives informed me they had been collected for the building of a mosque by some former inhabitant of the village. There is a granite stone, itself originally a part of a pillar, inserted in a large well, but which has proved to be the dedication of the well by some obscure individual: see Photograph No. 36.

About 6 miles to the south-west is a large village and bazar called Chirkawan; it is the principal place in the Pergumah of that name. It

is built on the site of an ancient village, and there is an old mud fort adjoining. A large tank to the south-east of the village has a stone pillar in the centre, but with no inscription; it is one block of granite rudely sculptured, and is now only about 10 feet above ground. Another pillar of the same kind occurs at a village called Belar, with extensive mounds about 5 or 6 miles to the south. Two miles to the south, there is a cluster of small detached hills at the foot; almost easterly there is a village called Cheoñ (pronounced Cheo). To the east of this village, on a small eminence, there is a ruined temple still partly standing: see Photographs Nos. 37 and 38: the first shows the appearance of the temple from the south, and the second gives a nearer view of the doorway. The temple is built of squared granite blocks, with little cement or iron bands, and is evidently of the same age as those at Oomga. There is a lingam in the interior, but no other figures, and there are only a few figures about. I failed in finding any inscriptions.

Some little distance to the north, near the hill, there are several large figures all more or less mutilated, and a great number of squared granite blocks, from which it would seem that another temple existed here; and the base of the hill on the west, north and east, is covered with brick rubbish in mounds of more or less distinct shapes. The hill runs down into a low spur on the west side, and every available spur and ridge had been covered with buildings. Some of the mounds to the south are both large and high, so that there is little doubt that this must have been the site of a considerable settlement in former days; and that it was a Buddhist community, may be inferred from the prevalence of figures of a Buddhist character.

To the west is another little hill called Puchar, which is also covered with the remains of little buildings; and on the south side, half way up, there is a small cave temple with the doorway and passage still standing: see Photographs Nos. 39 and 40. The doorway is supported on pillars with the usual bracket capitals, and the roof of the passage is made with slabs of the same granite. The cave is only some ten by twelve feet, of an irregular form, as it is a natural cavity between the huge boulders, with some addition in the shape of a few bricks to close up the interstices; one of these communicates with other cavities in the hill, as a strong current of air was found to be passing into the interior, so much so that a light was extinguished, but as the opening

was so narrow, there could have been no cave beyond, else it would have been widened. The roof is a boulder supported by others at each side.

There are several fragments of images, but only two are perfect; one is a seated figure of Boodh about 3 feet high, but it is partly imbedded in the accumulation of rubbish on the floor; it has the same canopy of a seven-headed snake which I observed at Durawut, where it is called Nagjee; here it is called Langa-beer! The other figure is a female, one which, Bábu Rájendralála Mitra says, represents Mâyádeví, Mother of Boodh.

Outside, there is a small platform, in front of the entrance, of undressed stones, and a series of rude steps leads up from the foot of the hill. I may mention that there is a story current amongst the natives here, that a party of strangers arrived at this place, ostensibly as a marriage procession, that they encamped at the foot of the hill, and that in the night time they dug up a quantity of treasure which had been buried at the foot of a large detached boulder: the hole which they had dug was pointed out. They say that they were Coles or people from the South, and it was explained that these people were formerly in possession of this part of the country, and this was how they came to know that there was treasure buried here.

About a mile to the north there is another little hill which was originally crowned with a temple, judging by the number of squared granite blocks which lay strewn about, and by the stones made use of in erecting a Durga over the tomb of some Mussulman Saint.

To the south of Cheoñ, at the distance of a mile, there is another cluster of hills; the nearest village is called Deokillee; the easternmost pinnacle of the hill is crowned by a mass of brick rubbish. In the centre of this mound, facing the east, the internal chamber is intact, but the entrance was nearly blocked up. By dint of squeezing, however, a native managed to get inside, but there was no figure; the little chamber was only some 10 by 12 feet long, but the rubbish filled it to within two feet of the roof, so that it is possible there may be some figures buried in the rubbish. To the north on the same space of the hill is a small cavity amongst the boulders which had been built up and thus formed a small chamber, and in front there is a natural basin in the rock which had been added to, and thus formed a

small tank or reservoir. Lower down on the north side there are two more of these cavities; in both cases the doorway is formed of granite pillars with bracket capitals,—the entrances are blocked up with rubbish. There are several others on this side of the hill, and on the connecting spur between this hill and the next, there is a small temple or altar, with a roof of granite slabs supported by 6 granite pillars with bracket capitals; there seems to have been a superstructure of brick, but very little of this now remains; there are no figures or inscriptions from which the age may be deduced, but it is probable that they were Buddhist, for the style is exactly the same as at Cheoñ in which Buddhist figures are found, and it is most likely that all these hills, and also those at Durawut, were the abode of numerous Buddhist ascetics, and Fa-Hian states that the hills at Raggae contained several hundred grottos inhabited by devotees.

Some distance to the south-west there is another cluster of hills, and near a village called Chain there are several very large mounds covering several acres, and great numbers of granite blocks are lying about in every direction, but there are no figures or inscriptions, and it is quite impossible to guess at the age or description of the buildings which must have existed here. At the mouth of a small valley, partly where it runs into the plain, a dam had been erected for the water.

About four miles west from this is a large village, called War. There are extensive mounds to the south of the village, and there is a mud fort with a pukka citadel in rather good preservation; the wall is of brick, loop-holed all round; a range of rooms runs round the enclosure; and underneath there is another range of rooms evidently intended as store rooms and as a refuge for the families of the garrison during an attack.

About five miles to the south-east is a small village called Mudunpur, on the Grand Trunk Road, and near it, about a mile and a half to the west, on a spur of the hill is Oomga temple, which has already been described by Major Kittoe in the 16th Vol. of the Asiatic Society's Journal. Photograph No. 41 (Plate IV.) will give some idea of its appearance from the south, and of the rock on which it is built; the temple faces the east. See Photograph No. 42, which shows its front.

Higher up and on the same hill is another temple, but now in ruins: see Photograph No. 43. Scattered all over this hill and the adjoining



*Drawn on Stone by Kristo Hari Das, Student, Govt. School of Art Calcutta.*

OOMGA TEMPLE

Lith: by H. Niven S. G. O. Calcutta May 1866



one, are a great number of little temples and altars, all of them built of dressed granite, and a great profusion of figures, principally of Gunesh and lingams, of every conceivable shape and size. There is an entire absence of Buddhist figures, which shows that these erections are of a more recent date. From the translation of the long inscription given by Major Kittoe, it would appear that the temple was erected A. D. 1439. The Bamboos, which he bewails as having all died off, have sprung up again, and are as vigorous as ever.

*Deo* is distant about 10 miles from this. To the south-west the temple has a very strong resemblance to the Oomga one: see Photograph No. 44. It is of much the same size, and in capital preservation.

The village of Poonawa, visited by Col. Cunningham, is about 14 miles from Gayá to the eastward, on the Nowaderle road. Photograph No. 45 is a view of the pillared temple from the north-east. There is a strong resemblance between this temple and the one at Nair. The door is a very finely sculptured one (see Photograph No. 46), and is almost a facsimile of the one at Palee: see Photograph No. 35.

At Koorkihar there are a great number of figures; the principal one is a Boodh with representations of events in the life of Sakya Singha round the margin (see Photograph No. 47), but it is much inferior to the same figure at Genjun, (see No. 22.) No. 48 is a group of figures outside the little temple to the north of the village.

The remaining photographs are from Rotasghur in Shahabad. No. 49 is a distant view of the palace from the east side of the ravine. No. 50 is the elephant gate or principal entrance to the palace from the court-yard.

No. 52 is a view of the Mausoleum over the tomb of the chamberlain of one of the former Governors.

No. 51 is a view of the interior of the Palace.

*Gayá, 9th November, 1865.*

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*Literary Intelligence.*

Mr. E. B. Cowell has sent to press the Yoga Aphorisms of Patanjali, with the commentary generally ascribed to Vyāsa. The work, we understand, is to appear under the auspices of the Sanskrit Text Society.

Major Henry Dixon, H. M.'s 22nd Reg. M. N. I., has just published a large quarto volume containing Photographs of 113 Canarese and 10 Sanskrit inscriptions. They are from the districts of Chittledroog, Davenghiri, Hurrihur, Ballagamee, Taldagundee, Sooroob, Annantpur, Shemogah, Taicul, and Beygoor in the Mysore Territory, and contain records which will prove of great interest to the historian of the Indian peninsula. The Canarese inscriptions are taken mostly from Sati stones of the Saiva period, and a number of them have the figures of Siva and his attendants carved on the top. The Sanscrit ones are title deeds of grants of land made by the former princes of Mysore, Canara and the Carnatic. We hope some enterprising scholar in Madras will, by translating these records, render them accessible to European scholars, and Major Dixon will meet with sufficient encouragement from the Government of Madras and the public to rescue from the ravages of time other documents of the kind of which there are a great number in Mysore.

The following is an extract from a letter from Dr. R. Rost of London.

“ I mean to take an early opportunity of drawing attention to some rare Sanscrit MSS. in our possession, which are in Grantham characters, and have never been looked into. Amongst them are the Rik, White Yajur, Sāma and Atharva Vedas; Kumārila, Mīmānsātantravārtika, the Sāṅkhya Saptati with commentary (2 copies), the Mayūkhamālikā on the Sastrādīpikā, Mananam (Vedānta), and Bharata's Nāṭya S'āstra. Of the last mentioned work, there are several copies in the Brown collection at Madras; but all of them being, like our copy, in Drāvidian characters, they are sealed books to the intending editor, Mr. Hall. We have altogether nearly 200 Sanscrit MSS. in the Grantham character. I wish Mr. C. P. Brown had deposited his large collection of Sanscrit MSS. (above 2300) in London; in Madras no one cares for them.”

JOURNAL  
OF THE  
ASIATIC SOCIETY.

PART I.—HISTORY, LITERATURE, &c.

No. II.—1866.

*Description of Ancient Remains of Buddhist Monasteries and Temples, and of other buildings, recently discovered in Benares and its vicinity.—By the Rev. M. A. SHERRING, L. L. B., and CHARLES HORNE, Esq., C. S.*

[Received 20th November, 1865.]

In a former paper on the Buddhist Remains found at Bakarya Kund, Benares, which we had the pleasure of communicating to the Asiatic Society last year, it was shown how that at this spot extensive traces still exist of ancient edifices, for the most part of the Gupta period, consisting of remains of several Buddhist temples and of one vihar or monastery. It is our purpose in the present paper, to give the results of further investigations into the antiquities of this city.

Fully satisfied, as we believe most persons are, that Benares is a city of extreme antiquity, we have endeavoured to ascertain to what portions this epithet will apply. And by the term 'old' we mean not a few hundred years merely, although a city six or seven hundred years old is generally regarded as an ancient city. But we must remember that Benares lays claim to an antiquity of several thousands of years, and undoubtedly it is referred to in various ancient Hindu and Buddhist writings. Consequently, we are not satisfied with discovering in it edifices erected half a dozen centuries ago, any more than we should feel satisfied with discovering edifices of a similar date in Jerusalem, or Damascus, or Rome. The terms 'ancient' and 'old'

as used in this paper, will therefore not be applied to buildings erected 500 or even 800 years ago, but to those of a previous period.

That wonderful mass of lofty houses separated by narrow lanes and packed together in such wild disorder, appearing in fact like one immense structure of gigantic proportions, which extends along the banks of the Ganges for more than two miles, and has a circumference of at least six, although built for the most part of solid stone, and presenting largely the aspect of hoary age, has no right to the epithet of 'ancient.' Some of the buildings of which it is composed, have been standing fully five hundred years, yet there are very few indeed which have not been erected since the commencement of the Mohammedan period in India. But speaking generally, this, together with a part of the northern boundary of Benares, is the oldest portion of the present city, while that large extent of buildings lying south and west beyond it, and occupying four or five times its area, is chiefly of recent date.

The question which we have attempted to investigate, is, what is there in Benares more ancient than, say, the epoch of Mahmúd or GaznÍ, who invaded India in the year of our Lord 1001? Are there any remains of the preceding Hindu, Jain, and Buddhist periods? And is there any remnant whatever of the first Hindu period before the rise of Buddhism in the sixth century B. C., or even before it became paramount in the reign of Asoka, B. C. 250?

When, after diligent search and careful scrutiny, we endeavoured to find proofs of the existence of Benares during these earlier periods, we soon ascertained that they were scanty, and with a few exceptions unimposing. The debris of ancient Benares may be traced in the multitude of carved stones, portions of capitals, shafts, bases, friezes, architraves, and so forth—inserted into modern buildings in the northern and north-western quarters of the city. These fragments exhibit a great diversity of style, from the severely simple to the exceedingly ornate, and are in themselves a sufficient proof of the former existence of buildings, of styles of architecture corresponding to themselves, yet differing in many important respects from the styles of modern Hindu and Mohammedan structures, and coinciding with those of ancient temples and monasteries of the Gupta and pre-Gupta periods, the ruins of which are still existing in various parts of India. Were

these the only remains found in Benares, they could not fail to awaken much curious interest in the mind of the antiquarian; and he would naturally carry on a process of induction in regard to them, and would say to himself, 'here are the stones, but where are the buildings? What was their form? What their age?' And with the help of the ruins of other places, he would be able to answer most of these questions satisfactorily, and would, to a large extent, describe the buildings, to which the stones at one time belonged, and would determine the epoch of their erection. Our belief is, that the most ancient ruin yet discovered in India, exhibits nothing older than some of these Benares stones, now embedded in modern walls and parapets, and scattered about in divers holes and corners of the city.

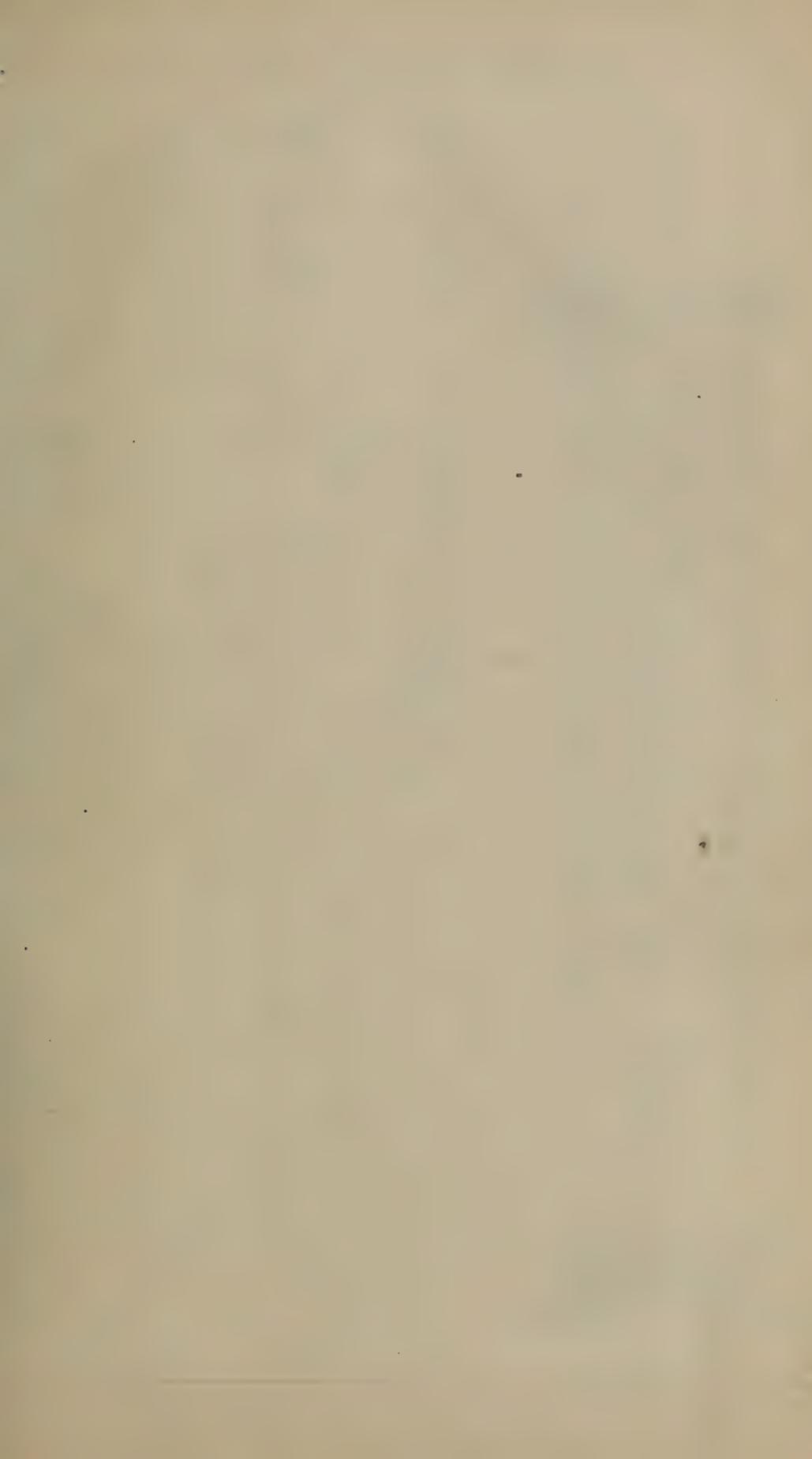
The fact that such old fragments are found in Benares, united with the circumstance that such an exceedingly small number of structural remains of any pretensions to high antiquity are traceable in it, goes far to prove that the city has been not once, but several times, destroyed, until, except in rare instances, and these chiefly consisting of foundations and basement mouldings, not one stone of the ancient city has been left upon another, and the foundations of its temples and its palaces have been torn up, so that their places are no larger known. Moreover, there is no manner of doubt, that the site of Benares has considerably shifted, and that at one time it came quite up to the banks of the river Burna, which flows into the Ganges on its northern boundary, and from which it is now distant nearly half a mile, and stretched beyond the opposite bank, until perhaps it coalesced with the ancient city which, if we may believe the Ceylon historians, encompassed Sarnath in the age when Sakya Muni arrived there to "turn the wheel of the Law," or previous to it. If this be true, the Hindu pilgrim who performs his wearisome journey of perhaps many hundreds of miles, with the object of reaching holy Kashi, and dying in the city of his fathers, is labouring under a prodigious delusion, for the city which he visits, has been chiefly erected under Mohammedan rule, and on a spot for the most part different from that which his fathers trod; and the fanes in which he worships, are not the spacious temples which his ancestors built, but either the pinched and contracted cage-like structures, which Mohammedan emperors just permitted their idol-loving subjects to erect, or modern imitations of the same.

We shall now proceed to describe such ruins and remains of ancient edifices, whether Hindu or Buddhist, which we have discovered in Benares or in its immediate suburbs.

*Buddhist Vihár—No. I.*

The remains of this vihár are in the interior of the fort at Raj Ghaut, in the outskirts of the city on its northern boundary. There is a small tongue of high land, about fifty feet above the plain below, extending to the junction of the Ganges and the Burna, which, in the mutiny, was strongly fortified, and has been styled ever since, the Raj Ghaut Fort. There is a tradition amongst the natives, that this spot was selected, ages ago, for a similar object by the famous Rajah Banár. It is probable that formerly the whole of this elevated tract was inhabited, and that the Rajah governing the city had his chief residence there. It is the natural key not only of modern Benares, but also of the country for several miles around; and a well-equipped force in possession of it would, with difficulty, be approached and dispossessed. The Government has lately abandoned this grand strategical position on the ground of its alleged unhealthiness.

A short distance to the right of the main road leading into the Fort, may be seen the remains of the vihar, which I will now describe, and which, next to the Buddhist temple at Bakarya Kund, are the most complete, and certainly are the most beautiful, of any ancient remains yet discovered in Benares. They consist of two cloisters in a continuous line, each being sustained by a quadruple colonnade, but differing both in height and in length. The smaller cloister is 66 feet long, and the larger 84 feet, and therefore the entire façade is exactly 150 in length, whilst the breadth of both is uniform, and is 25 feet. There are 8 columns in each row in the one room, or 32 in all; and in the other, there are 10 in each row, or 40 in all; so that the number of stone pillars standing in the entire building is 72. Those in the smaller cloister are barely 9 feet high, and are all square and of a uniform pattern, a slight difference only being traceable in the capitals, which are of the old cruciform shape. There is not much ornamentation on these pillars, but the chess-board and serrated patterns are abundantly carved upon the architraves. The pillars in the larger cloister, including the capital and base, are 10 feet in



BUDDHIST VIHAR - RAJ GHAUT FORT.



Portion of pillar, not to Scale

8 Scrolls on the shaft.

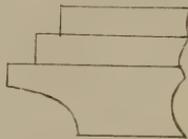
Base & capital to Scale.

1 Black & Co. Cal.

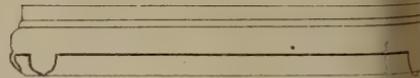


Ordinary type/ Scroll on pillars from Baharia Kuna.

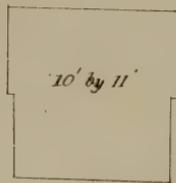
1. 2. 3. 4. Centres of Scrolls on pillars Raj-ghaut.



Raj-ghaut a Basement moulding



Lower cloister basement Moulding Raj-ghaut.



Section of Ordinary beam.



1 ft to 1 inch Section of beam Raj-ghaut

height, but the architraves above the capitals are of the same height as those in the smaller cloister, namely one foot. These pillars differ greatly both in shape and ornamentation from those just described. Some of them are covered with profuse carving cut deeply into the stone, which in many instances is so sharp and well-defined as to give the appearance of having been recently executed. The lotus plant—pod, leaf, blossom and stem—forms a conspicuous object in many of the designs, all of which are striking, but some are exquisitely chaste and elegant. The *chakwa* or Brahmani duck is represented in various attitudes on the noble scroll-work extending along the square sides of several shafts from the base to the capital. These scroll bas-reliefs equal the carvings on the Sanchi pillars in richness, whilst the designs are much more free in their conception. There were formerly human figures, probably of a grotesque form, carved upon some of the pillars, as traces of them are still distinctly discernible, but these were defaced and almost obliterated by the Mohammedans, on taking possession of the edifice and appropriating it to their own uses. The pillars are regularly arranged with regard to the Singhasan, and the finest pillars are in the centre of the cloister, in the direction of its depth; and above them, near the inner wall, the stone ceiling in two divisions of the roof is singularly carved, and, strange to say, is of the kind described by Fergusson as Jain architecture. One of them is Alhambric in character, while the other is covered with lotus blossoms carved in relief.

There is not the smallest doubt that these cloisters have been much altered from their original condition, and that principally by the Mahommedans who transformed them into a mosque, in which service they were employed even as late as the mutiny in 1857, and were regarded with peculiar sanctity by this people. On closely examining the columns, architraves and ceilings, it is plain that not only has there been a good deal of shifting of places, but new pillars carved in recent times have been added to the old, and some of the old have been cut up for repairs, and their separated portions have been scattered amongst several pillars and joined on to them. The inner massive stone wall running along the entire length of the building, is evidently unconnected with the original structure, as also is the present stone floor which is a foot and upwards higher than the old.

A trench having been dug on the east side, it was discovered that the bases of many of the columns were embedded deep below the modern stone pavement, while in the front of the smaller cloister, at a depth of about a foot, the outer moulding of the ancient floor could be traced continuously from one end to the other. Notwithstanding all these extensive alterations which the building has undergone from time to time at the hands of different masters, we cannot but think that many of the columns are standing on their proper sites, and that the edifice, although greatly changed, is still in its main features a Buddhist structure. The cloisters were transformed into their present condition as a mosque some 80 years ago, and the modern pavement was then put down.

There is reason to believe that a third cloister, corresponding to the smaller, formerly existed at the southern extremity of the larger cloister; and this supposition is greatly strengthened by the circumstance of a *Singhásan* or throne of Buddha, already referred to, being still standing by the wall in the centre of the latter, but altered from its original form, having been used by Mohammedan Mullahs as a rostrum or pulpit. The vihá, when complete, was in all likelihood a square, each side being at least the length of these three cloisters, and the chief Buddha was exactly opposite the centre of the square. What other buildings were formerly here, in addition to those now visible, can of course only be conjectured. It is probable that on three sides were cloisters, and on the fourth, namely that to the east, was a row of temples, the largest containing the principal figure of Buddha. That other buildings were once here, is certain from the various sculptured stones found near by. We observed seven pillars, sixteen isolated capitals, and four large carved stones used for architraves, some of which support a recently erected structure attached to the smaller cloister.

The venerable ruins described above, present a very remarkable appearance. In the year of the mutiny, barracks for European troops having been erected in their neighbourhood, they were converted into a vast cook-room or kitchen. Fires were lit inside on the stone floor from one extremity to the other, and consequently the roof, walls, and columns, were charred by the heat and blackened by the soot, so that now the interior of this grand edifice is most dismal and

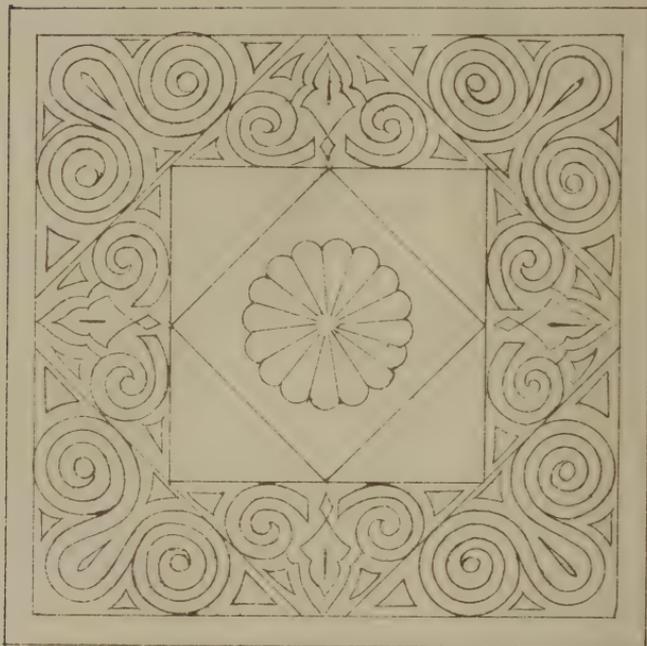


**BUDDHIST CHAITYA**

N. W. OF RAJ-GHAUT FORT.

OLD CHAITYA CEILING.

Scale 2 feet to 1 inch.



**PILLAR.**  
2 feet to 1 inch.



forbidding. Mr. Horne spent a few rupees in cleaning the building, and in removing, as an experiment, the encrusted soot from some of the carvings. Fortunately the Mohammedans or the British Government authorities, we know not which, in their care for these beautiful works of art, have embedded them in mortar from base to capital, so that many of them might be restored. The removal of the encrustations, however, will have to be accomplished with the greatest care, or else the surface stone, rendered friable by the heat to which it has been subjected, will come away with the superimposed mortar, thereby destroying the delicate edge of the carvings. We trust the Government will not grudge a few hundred rupees for the thorough cleaning of this fine specimen of Buddhist architecture. The inner stone wall and the modern pavement should also be removed.

Besides these remains, there were, until quite recently, hundreds of stones lying about in the fort, bearing traces of great antiquity. In the mutiny, many of these were collected, and were made use of for the foundations of temporary barracks which were then erected. These stones may have once belonged to the vihar just described, when it existed in its integrity, but may also have been portions of other contemporaneous buildings situated in its vicinity.

During the mutiny, Mr. Tresham, by Government order, blew up some ancient buildings standing near the vihar, and there are yet the foundations of one, which defied all attempts at its destruction. Mr. Horne also remembers a chaitya which was removed to afford space for barracks.

#### *Buddhist Chaitya No. I.*

A few hundred yards due north from the old gateway leading into the Raj Ghaut Fort is a mound of circumscribed extent, now used as a Mohammedan burial-ground, on the summit of which are the remains of an old Buddhist chaitya or temple. They consist simply of four pillars, richly carved with scroll-work, sustaining an ancient roof. At the corners of the shafts is the ordinary ornamentation resembling a chain of lotus seed-pods. The capitals are cruciform, and the bases are square with embellished faces. The ceiling is very beautifully sculptured, and is composed of slabs over-lapping one another, with the centre stone crowning the whole, according to the

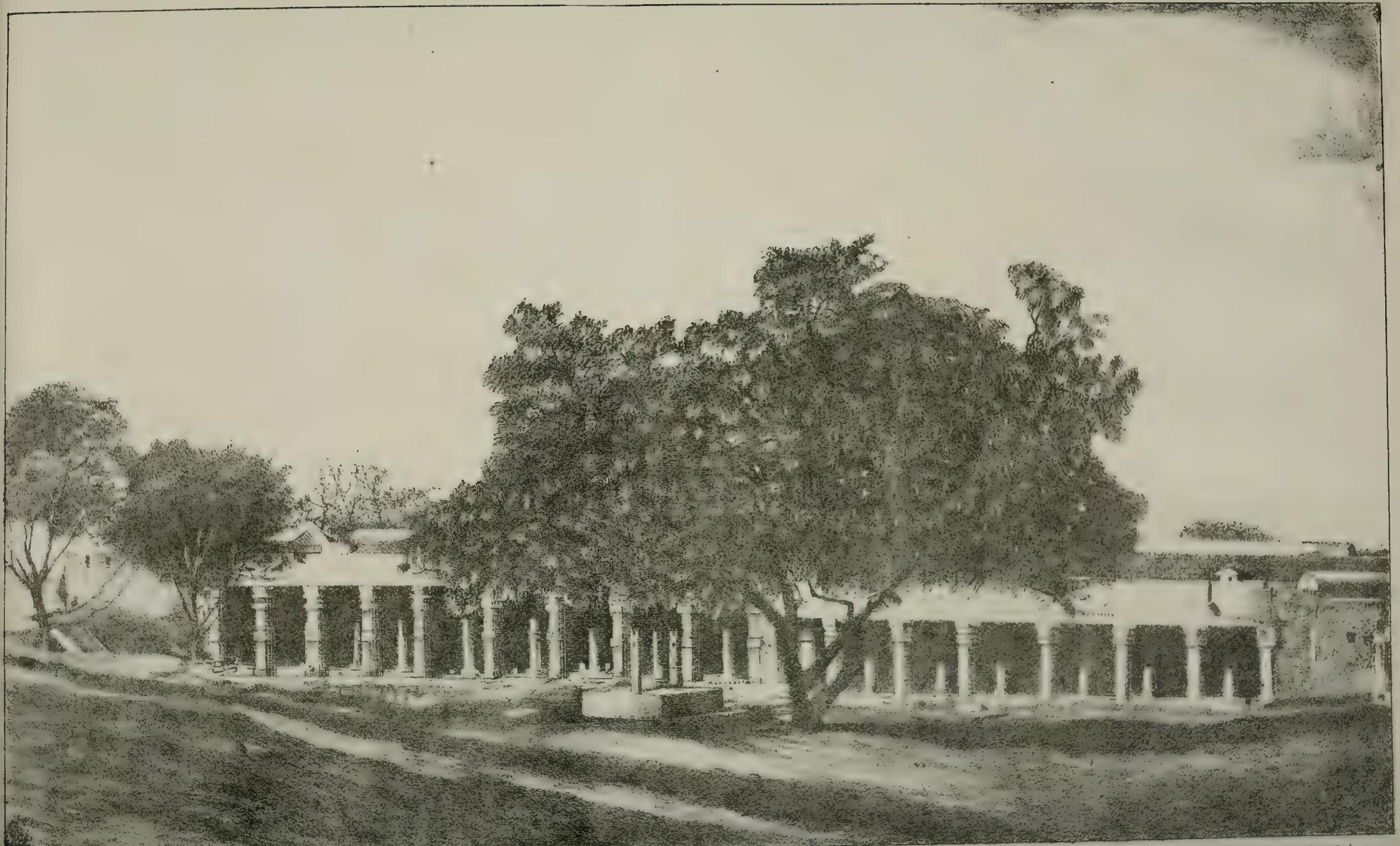
primitive mode of Indian roof-building. This latter stone exhibits the out-spread petals of a lotus blossom, while eight out of the twelve triangular spaces formed by the intersection of the slabs, are freely carved with the scroll-pattern. A few sculptured stones lie about the mound; amongst them is an erect figure of Buddha with garland and armlet, much mutilated. There are also three stone beams or architraves bearing the chess-board and spear-head patterns. In the small terrace likewise on which the chaitya stands, are inserted four carved stones, taken doubtless from some ancient building formerly in the neighbourhood. The occurrence of three or four plain cloister pillars of the usual form, adapted by the Mussulmans as head-stones for graves, together with the carved architraves already alluded to, would seem to indicate that a small cloister for monastic purposes must originally have stood upon this mound, which was then terraced, the stones of which have been by degrees removed both for building Mohammedan graves, and also for repairs in the Fort.

*Small Mosque in the Budaon Mahalla.*

In the Budaon Mahalla near the Raj Ghaut Fort, a short distance south of the high road, there is a small mosque in an enclosure, made up to a great extent of ancient remains. The building seems to have been curtailed from its original dimensions, leaving a ruined portion still standing on its southern side. The entire structure contains seventeen stone pillars, eight of which exhibit ornamental carvings and probably belonged to a Buddhist chaitya. There are also eight capitals inserted in the walls without shafts and bases, and in addition there are fragments of other capitals in various places. None of these old remains are in situ. They were brought, most probably, from some temple in the neighbourhood, perhaps indeed from the mound occupied by the ruins of the Buddhist Chaitya No. I., which is not far off.

*Ancient Mound or Ridge running from the Burna, near its confluence, into the Adampura Mahalla.*

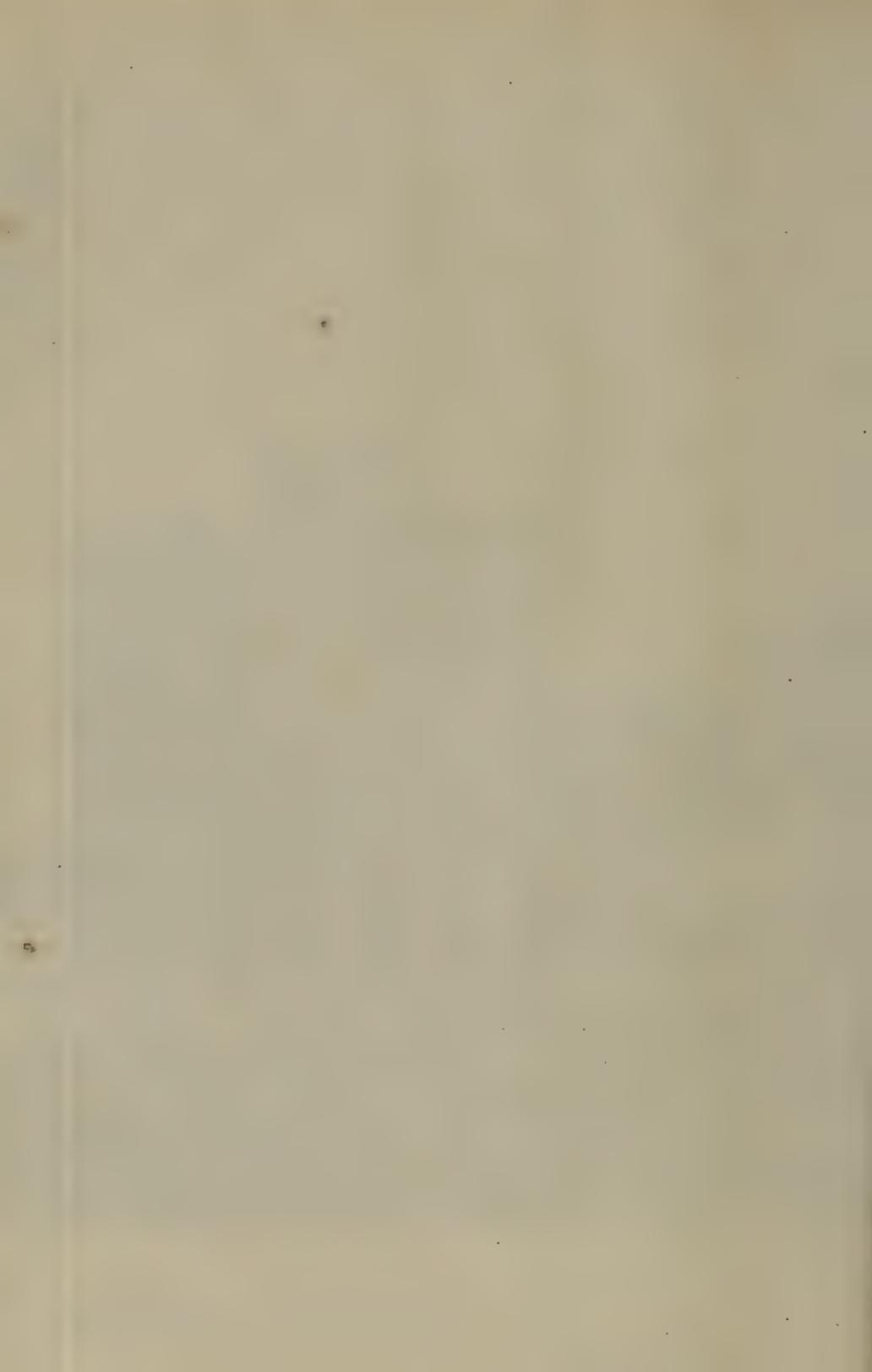
This very remarkable ridge extends for a long distance, and commences at the river Burna when at its flood. In the dry season therefore there is a stretch of low land lying between its extremity.



*T. Black & Co. Lithrs. Calcutta*

*Photographed by W. Grant Esq.*

**VIEW OF BUDDHIST VIHAR—RAJ GHAUT FORT.**



in that direction and the bed of the stream itself. The ridge is manifestly an artificial work, and was originally intended either as a wall to the ancient city, or as a rampart thrown up against it and the neighbouring fort of Raj Ghaut. The latter supposition was that held by Mr. James Prinsep, who imagined that it was cast up by the Mohammedans in their attack upon Benares, and was specially directed against the fort. This supposition may be true, although it is difficult to perceive how it could have been of much service either in an attack on the fort or on the city, especially in a period when artillery was not in use. Had it reached as far as the river Ganges, we could understand how, by severing the fort from the city, it might have been a source of damage to both, but the south-western extremity is not near the Ganges by a third of a mile or perhaps more. We are inclined to think, however, that this extremity was once connected with that river, but at a time far more ancient than the Mohammedan conquest of India. On the whole, it appears not unlikely that this long embankment was the old boundary of the city in the early periods of its history, which was possibly employed for offensive purposes by the Mohammedans on the extension of the city to the south and south-west, and the consequent abandonment of this means of defence by the inhabitants. The embankment may have been originally carried on to the Ganges in a straight line with its present direction; or, making a short circuit, may have entered it by Tilia Nálá, on the banks of which are the remains of a Buddhist temple, which will be hereafter described. In this case, a portion of it must have been thrown down and swept away to make room for the growth of the city, and there is good ground for supposing that the city extended in a narrow band on the banks of the Ganges, about as far as the Man-mandil observatory, even before the Christian era. Should this idea be correct, it would follow that the most ancient site of the city of Benares was situated within the limits of this wall, stretching across from the Burna to the Ganges, cutting off a tongue of land as far as the confluence of the two rivers, and including the high land of the Raj Ghaut Fort, which was, in all probability, once well populated. The city must have been then of small extent, as compared with its existing dimensions, unless, as we

believe, and as it is almost indisputably certain, it crossed over to the right bank of the Burna.

That both sides of the river Burna were in former days better inhabited than at present, is somewhat corroborated by an examination of the ground on both sides. Brick debris is scattered about among the fields on the right bank of this stream, and old coins and broken stone images are occasionally found by the people, or are dug up by the plough; while on the other, or Benares side, not only are old remains found in the fort, but also below it on the lowland already referred to, blocks of stone, some of which are carved and exhibit ancient mason marks engraved upon them, are still to be seen. Moreover, it is stated in the Ceylon Annals that formerly the city surrounding Sarnath, (about three miles from the right bank of the Burna,) coalesced with or was a part of Benares, which, if true, must have been at a period of remote antiquity. Indeed, the allusion in these records is to an epoch long anterior to that of the historical Buddha or Sakya Muni, and therefore prior to the sixth century before Christ. This account must of course be received with much caution, and not as absolutely authentic history. At the same time, it is manifest that there was a tradition amongst the Buddhists of India, conveyed thence by their missionaries to Ceylon, that in remote ages the city of Benares extended to Sarnath.

In visiting this ridge or embankment, it will be observed that the high road leading to Raj Ghaut cuts right through it, the earth of the cutting being used to raise the road above the level of the country. It is well to remark too that where the road passes under the fort to the ghaut, the soil has been cut away to make room for it, so that formerly we may suppose that instead of a steep and almost precipitous wall which the elevated land to the east of the road now exhibits, the mound of the fort in this direction diminished in a gradual slope, terminating perhaps not far from Tilia Nálá.

The ridge is in one part formed of three terraces, the uppermost being perhaps thirty feet above the land, upon which elevated spot is the tomb of Mira Sahib. In the mutiny a large portion of the mound opposite the Fort was cut away for strategical reasons, although what is left is sufficient to prove of great service to an enemy attacking the fort.

On the south side of the ridge, in sight of Míra Sáhib's tomb, is an Imambara, a modern edifice, built altogether of new materials; and a few paces distant from it are two small structures, one in front of the other, which, although of recent erection, are partly composed of old materials. Each building possesses four ancient pillars of the Buddhist type, and lying about in various places are four pillars more, five *kulsees*, two architraves, and seven bases, one of the latter being richly carved. All these are the spoils of some ancient temple or monastery.

*Remains of Buddhist Chaitya, No. II., and Buddhist Monastery,  
No. II., at Tilia Nálá and Maqbum Sahib.*

We have chosen to unite these remains, and to speak of them under one head, because, although separated and standing in different Mahallas, yet they are near enough together to give rise to the supposition, that they may have been at one time connected. There is no question in our minds that at least one monastery stood in this neighbourhood, which is very rich in old carved fragments of stone scattered about amongst the walls and foundations of dwelling-houses and in divers other places. Perhaps it may be questioned whether the ruins at Tilia Nálá, now forming part of a deserted mosque, were originally a portion of a monastery or a portion of a temple, but our own opinion is in favour of the latter; yet even though this conjecture were true, it would still be probable that the temple was within the precincts of a large monastery and was considered to be a portion of it.

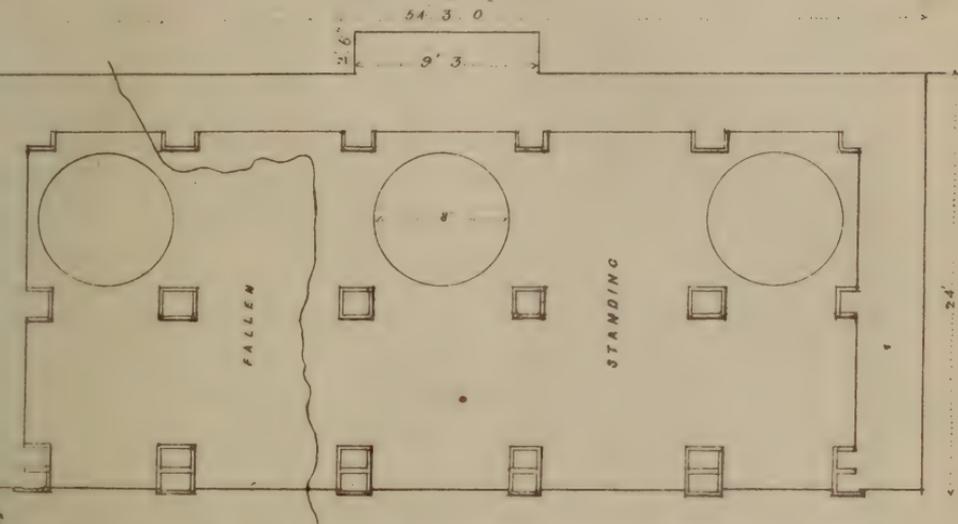
The remains at Tilia Nálá are immediately above the Nálá on the high ground of its left bank, a very short distance only from the point where it runs into the Ganges, and close to the main street under which the stream flows. The ruins not only overhang the brook, but there is no doubt that at one time they must have extended nearly, if not entirely, across its present bed. They consist of seventeen massive square columns in three rows, namely four double columns in the front row, four single ones in the second, and five in the third or innermost row. Between the third and fourth pillars of the last row is the Singhasan of Buddha, an immense slab of stone, nine feet three inches in length and five and a half in breadth, retreating beyond the boundary wall behind, into which all the pillars of

this row are inserted. There can be no dispute that the Singhasan was in the centre of the building, that is to say, that as there are three pillars to the right of it, there were as many to the left, in each of the three rows, the front row being of double pillars throughout. Re-constructing the edifice as it originally stood, therefore, there were one row of six double pillars, and two rows of six single pillars, or twenty-four pillars in all. Each capital is ornamented with the bell pendant, of which the Buddhists were so passionately fond, and which was after them much used by the Brahmins. The double columns are surmounted by one huge capital, five feet and a half in breadth, each of which possesses a long arm for the eaves stone. Over the two inner rows are two domes, one of which is above the Singhasan, and is more ornamented than the other. There must have been originally a third dome to the left of the central dome, corresponding to that on the right. Outside the building there is a fine basement moulding which doubtless belonged to the primitive structure. Estimating the building as it once stood, it was fully fifty-four feet in length and about twenty-four in breadth. The Mussulmans may have altered it considerably in transforming it into a mosque, but we apprehend that not a little of the old temple still remains. Some of the large stones have fallen into the Nálá or upon its banks, and others have not unlikely been made use of in the repairs of the bridge, and of its adjoining stone wall, so that we believe it would not be a difficult task to find nearly all the missing pillars and capitals.

The Maqdum Sahib is a square enclosure in the Gulzar Mahalla near to Tilia Nálá, used by the Mohammedans as a cemetery. On its northern and western sides are cloistered pillars, partially in situ, with portions of ancient stone eaves overhanging their capitals, presenting on their upper surface imitations of wood-carving. There are twenty-five pillars on the western side, and twenty-eight, or, if all could be seen, probably thirty-two, on the northern side. Several of the pillars are carved; while some of the capitals are ornamented, and some are double. There may be seen also handsomely carved stone brackets for the support of the eaves above alluded to. The eastern wall bounding the enclosure is evidently composed, to some extent, of cut stones of an ancient date. The entire court is one hundred feet long from east to west, and sixty feet broad from north to south.

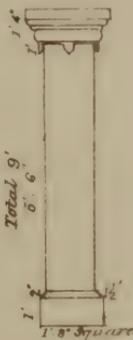
ROUGH PLAN  
OF  
TILIA NALA VIHAR CHAITYA

Scale 12 feet = 1 inch.

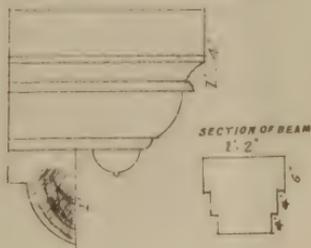


Enclosing wall 3<sup>ft</sup> thick - with 9 inches of each pillar built into it.  
 Outside measurements 54' 3" 0" by 24' 6". Between shafts of columns 8<sup>ft</sup>  
 Double columns - capitals with long arm for eaves stone 5' 6" in one  
 piece, size of all shafts 15 inches square.

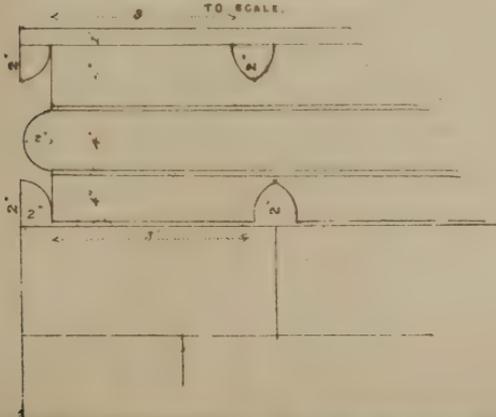
SCROLL ON CAPITAL.



PORTION OF CAPITAL  
LONG ARM OF DOUBLE CAPITAL.



SECTION OF BASEMENT MOULDING.





## SITE OF BUDDHIST VIHAR—No. III.

*Lát Bhairo.*

At the junction of the old Ghazepore road with the Raj Ghaut road, to the north of the latter, and about a short mile from the fort, is a large square tank, on the left bank of which, as on a terrace, stands the *lát* or pillar, which gives the name to the spot. It is probably not more than three or four feet high inside, and is covered with copper sheeting. We endeavoured to prevail on the faqir residing here to permit us to lift up the copper cap, by removing the plaister which connects it with the flooring below, in order to gain a view of the stone pillar which it now conceals; but so great is the reputed sanctity of this object, that our united efforts were entirely fruitless, and had we persisted in them, a disturbance might have been occasioned. The original stone column, of which the concealed pillar is doubtless a small fragment, was about forty feet high, and, it is reported, was covered with ancient carvings, which were most probably inscriptions. This was thrown down by the Mahomedans during a terrible conflict with the Hindu population in the early part of the present century, when Mr. Bird was magistrate of the city. The natives say, that the pillar was thrown into the Ganges, but as that stream is half a mile off or more, this must have been done piecemeal. In all likelihood it was destroyed by fire, the action of which on sandstone soon causes it to crumble to pieces. As there is strong reason for believing that this was one of Asoka's pillars, it would be exceedingly interesting to inspect the remaining fragment, which we may fairly suppose to belong to the original column, and in that case to possess a portion of an inscription sufficient to verify its connexion with Asoka, or with the Guptas, or with the monarchs of any other era by whom the column was erected.

It is important in our present investigations to know that the pillar once stood in the midst of a temple, that is, in its courtyard, which temple was destroyed by Aurungzebe, and on its site a mosque was erected, the courtyard of which enclosed the pillar. On examining the terrace where the Lat stands, it is exceedingly manifest that the upper portion has been thrown up in modern times, and that the ancient level of the ground was some six or eight feet lower than

what it now is, and indeed was even with the soil of the Mahomedan cemetery close by, in the midst of which are a few Buddhist remains in the shape of pillars and architraves made up into a Mahomedan sepulchre. What this so-called temple was, admits of very little question, inasmuch as the boundary walls of the terrace and of the neighbouring cemetery and garden exhibit a considerable variety of isolated carved remains, sufficient to afford abundant attestation to the supposition that formerly a large Buddhist structure, most probably a monastery with a temple connected with it, stood on this site, covering the whole extent of the ground elevated above the tank on its northern side. Some of the carvings are in excellent preservation, and are worthy of being removed to the archæological collection in the Government college grounds in Benares. There are several pillars embedded in the brickwork, and also a stone seven feet in length and one and a half in depth, which is deserving of special remark, as on its face are projected four magnificent bosses, each ten inches in diameter, with a projection of two inches from the surface of the stone. These bosses must have formed part of the decoration over the main entrance to the monastery.

Below the upper terrace on which the Lat stands, is, as already observed, a Mohammedan cemetery with a *Rauza* or tomb in the middle. This building rests upon sixteen pillars, each being eight feet two inches in height, and the architraves between their capitals being one foot two inches in thickness. In addition, there are five pillars in the verandah to the south. Some of the pillars are ornamented with scroll-work and the lotus plant, while their four corners are deeply cut with representations of the lotus seed-pod. One pillar has eight sides in its lowest division and sixteen in its upper, and has also a band of four grinning faces connected together, and under them a row of beaded garlands. The pillar is crowned with a round stone projecting two inches, on the face of which is a curious assemblage of thirty-two grotesque faces all round the edge of the stone, with beaded garlands and tassels depending, issuing from their mouths.

It should be mentioned, that if our conjecture, that the upper terrace has been only recently thrown up, be correct, then on the supposition that the fragmentary pillar on its summit is part of the original pillar which in ancient times stood here, it would follow that the

length of the existing fragment is equal to the depth of the terrace above the foundations of the neighbouring cemetery, in addition to its present elevation above the terrace, and to the extent of insertion of its lower extremity in the primitive but now subjacent soil. In this case, it would be not less than from fourteen to sixteen feet in length.

### BUDDHIST CHAITYA—No. III.

#### *Battis Khambha.*

About a third of a mile to the east of the Bakarya Kund Remains, is a beautiful little structure called by the natives Battis Khambha or thirty-two pillars. It is a very picturesque object as seen from the Raj Ghat road, from which it is some four hundred yards distant. It consists of a dome sustained by twenty-four square pillars, standing in pairs at intervals all round. Formerly each corner had four pillars, thus increasing the present number by eight, and then, of course, the entire number was thirty-two; but two from each corner have been removed, leaving the spaces occupied by them empty. All the upper part of the building is Mohammedan, while all the lower part is indisputably Buddhist in its style of architecture. On the western side is an abutment for the Singhasan of Buddha, similar to that which exists in the Chaitya at Bakarya Kund, and indeed, so far as our knowledge extends, in all *bonâ fide* Buddhist temples. The pillars stand upon a platform raised above the ground, and in the interior of the building is a Mohammedan tomb.

It is remarkable that there should be so many ancient remains lying almost in a straight line from Bakarya Kund to the Raj Ghat fort, yet most of the remains hitherto referred to, lie in this line. We have no doubt that formerly a large number of Buddhist buildings existed between these two extremes, and that the foundations of some of them might be discovered, if a keen search were instituted, in addition to the more prominent remains already brought to notice. It seems evident therefore that there was a road here during the Buddhist period, not far removed from the track of the present one. This road was at right angles to another proceeding from Bakarya Kund in the direction of Sarnath, which still exists. Search might be made along this road for the foundations of ancient buildings and

for Buddhist relics, as there can be no doubt that constant communication was kept up by the monks of Sarnath with Bakarya Kund, in both which places there were vast monastic edifices and numerous temples.

Near this Chaitya and between it and Bakarya Kund is a small building standing by the road side, in which are several pillars of the most ancient type inserted into the containing walls. They have been very probably brought from Bakarya Kund. The building has an unpretending appearance, and is kept whitewashed by the Mohammedans, its proprietors.

#### BUDDHIST VIHAR—No. IV.

##### *Arhai Kangura Mosque.*

It is not our purpose thoroughly to describe this handsome structure, which is one of the finest mosques in the whole city, and is situated in the Mahalla bearing its own name. Its magnificent and lofty dome, as well as various parts of the mosque itself, unquestionably exhibit a Mohammedan style of architecture, but we have no hesitation in saying that by far the greater portion of the building, and certainly five-sixths of its materials, belong to an epoch far more distant than the Mahomedan invasion. The numerous square columns with their cruciform capitals, and also the screens between some of them in the upper story, are of Buddhist workmanship; but we are inclined to think that both Buddhists and Hindus have made use of the same materials in different eras, and that in fact the mosque is a mixture of three styles, namely Buddhist, Hindu, and Mohammedan. The first edifice was, we believe, a monastery, with (most probably) one or more temples attached; but it is hard to say whether any portion of the original building exists in situ, and we have not sufficiently examined it to be able to pronounce a decided opinion on the point. Our conviction, however, is that certain leading characteristics of the first structure were perpetuated by the Hindus in that which they raised on the departure, or rather expulsion, of the Buddhists from Benares. It is not easy to determine accurately what this Hindu building was, but perhaps it is more likely to have been a math or a sort of monastery or religious house for Hindu ascetics, such as exist in the land at the present day, than a temple. In the

roof of the second story of the mosque a slab was discovered bearing a long Sanscrit inscription, towards the end of which is the date 1248, which, regarded as Sambat, is equivalent to A. D. 1190. The inscription itself is of no particular importance, except that it abounds with references to the Hindu religion, showing that it belonged to a building erected by a Hindu, and therefore subsequent to the Buddhist period. It alludes also to certain tanks, temples, and math's, erected and embellished in and about Benares, which of course were all in honour of Hinduism. It is not unlikely indeed that these structures were erected and this inscription was written with somewhat of a religio-political object, to testify to the triumph which Hinduism had then recently gained over Buddhism; for there is good ground for believing that the buildings at Sarnath were not burnt, and the monks were not expelled therefrom, till about the twelfth century of our era. We have obtained a copy of the inscription in Sanscrit, with a translation into Hindí, through the kindness of Babu Shio Parshad, Joint Inspector of Schools, whose intelligence, enterprise, and extensive knowledge place him in the front rank of native gentlemen in these provinces.

We would direct especial attention to the small side door or postern with its massive wall, to the right of the building, which has a great appearance of originality, and also to two noble capitals of gigantic dimensions, lying in the court-yard in front of the mosque and turned into small cisterns. They are the largest carved capitals we have found anywhere.

#### HINDU TEMPLE OF KIRT BISHESHWAR.

##### *Alamgírí Mosque.*

Near the temple of Briddhkál, one of the very few Hindu temples of the earlier Mohammedan period still standing in Benares not appropriated by the Mussalmans, and a few paces from the well-known shrine of Rattaneshwar, is a mosque spoken of in the neighbourhood as the Alamgírí Masjid, which was erected during the reign of Aurungzebe or Alamgír, and was designated after that emperor. Upon it may be read the following inscription in Arabic:—

قول وجهك شطر المسجد الحرام  
سنة ١٠٧٧ هـ چري

The translation of which is, "Turn your face towards the sacred mosque. 1077 Higira," or A. D. 1659.

The mosque is built, tradition states, from the materials of the Hindu temple of Kirt Bisheshwar, and has three rows of lofty stone pillars, eight in each row; but the pillars at both extremities are not single, but three-fold. The capitals are large and massive, and are cruciform in shape. In the centre of each shaft, upon all the four sides, is the boss ornamentation, each boss being fully a foot in diameter. The pillars have a double base, a false and a true, the one consisting of the lower end of the shaft, the other, the true base, of a separate stone. Both are covered with carvings. Some of the architraves also bear upon them the boss pattern; but it is possible that these were formerly shafts of pillars. The inner wall of the mosque is likewise of stone. Viewed from behind, many of the blocks display various mason marks inscribed upon them.

From an examination of the marks or symbols, and of the architecture represented by the remains now briefly described, there is no reason for supposing that the temple which once stood here, and which was levelled to the ground by Aurungzebe, was of great antiquity. The style of architecture has a Buddhist basis, yet is not purely Buddhist, and the symbols are not necessarily Buddhist at all. We should be inclined to fix the date of the Hindu temple at some five or six centuries ago. It must have been a place of great sanctity, as many Hindus still visit the spot on pilgrimage, and instead of an image (which we suppose the Mohammedans would not allow them to put up) worship the spout of a fountain rising up in the centre of a small tank in the court-yard of the mosque. It is not improbable that the tank is the site of the old temple; but if the temple was a large one, as is likely, it must have occupied not only a considerable portion of the present courtyard but also some ground in addition on either side. A few persons perform their devotions in the tank daily, but the grand festival is at the *Shio rát mela*, for one day in March, when crowds throng reverently around the sacred spout, and present *it* (or perhaps regarding it as a god, they would say *him*, or *her*,) with abundant offerings, all of which, down to the last rupee, are received by the Mullah of the mosque, who thinks, we suppose, that if he winks at the idolatry, which in fact he cannot put down, he may as well be paid handsomely for it.

Attached to the mosque is a corridor, built a few years later, on the inner wall of which is the following inscription:—

ز حکم شاه سلطان شریعت \* شهاب آسمان سرفرازی  
 دلیل زهد برهان طریقت \* محمد شاه عالمگیر غازی  
 سر اصنام بت خانه شکسته \* ظهور مسجد دلخواه گشته  
 باستصواب نورالله صفتی \* بناء خانقاه همت پیدا  
 غلام درگهه پیران چشتی \* زدولتخانه تاریخش هویدا  
 سنه ۱۰۹۶ هجری

In noticing the remains of the Kirt Bisheshwar temple, we are aware that they do not come under the designation of “old” or “ancient,” as applied to other remains described in this paper, and yet, as they are not without interest, we have given them a place in it.

#### BUDDHIST CHAITYA—No. IV.

##### *Chaukhambha Mosque.*

The long Chaukhambha street in the city of Benares, in or about which most of the great bankers have their houses of business, takes its name from four low massive pillars of modern erection, standing in the lowermost story of a lofty building, the weight of which they entirely sustain, situated towards its north-eastern extremity. There is a narrow court running out of this street, which terminates in a small enclosure, on the further side of which is a mosque. The entire enclosure has a very remarkable appearance, and, for the archaeologist, is a place of considerable interest. The entrance is by a doorway let into a huge breastwork or wall formed of blocks of stone, which is twenty feet long, thirteen feet high, and four feet thick, and is constructed for the most part systematically, as is evident from the ornamentation on one stone answering to that on the stone contiguous to it. Over the doorway is an inscription in Arabic. But with the exception of this doorway and the castellated appearance crowning the wall, there is nothing Mohammedan in its architecture.

The mosque and corridor adjoining it are supported by twenty-four pillars, of which six are double. The capitals are of the simple cruciform pattern, and their outer limbs are decorated with the dwarf bell ornamentation. To the south of this building is a staircase

leading up to the roof, built of heavy stones; and along the south side of the enclosure, for the space of about twenty-five feet, is a low stone wall six feet in height, and, attached to it, a peculiar ledge three feet from the ground. It is known that a similar wall exists on the north side also, but hidden from view.

In our judgment most of the pillars are in situ, and originally formed part of a Buddhist structure, but whether of a temple or of a monastery, it is difficult to say. Our opinions are divided on the subject, and the former has been assigned to the building by way of a heading to this chapter. The wall with the projecting bench is very curious. The latter may have been used by the priests or monks for reclining upon.

#### BUDDHIST VIHÁR—No. V.

##### *Aurungzebe's Mosque near Bisheshwar Temple.*

The mosque built by the emperor Aurungzebe on the foundations of what is commonly regarded, though erroneously, as the old or original Bisheshwar temple, is of interest not for its own sake—for notwithstanding its lofty appearance, it is a structure without any striking beauty in its own right—but for the sake of the ancient buildings with which it is associated, and with the materials of which it has been largely constructed. The courtyard consists of a terrace raised some five feet above the level of the temple quadrangle, in the centre of which it is situated, and occupying a large portion of the area. On walking round the quadrangle and examining the retaining wall of the terrace, one's attention is arrested by peculiar openings or niches in the wall, in which architraves, and capitals, and parts of pillars on which they rest, are visible, but in some places the openings are filled with earth almost up to the level of the capitals. Proceeding from west to east, the ground gradually declines, until, after descending four steps and arriving opposite a large stone bull or Nándi, the opening in the terrace becomes clear, and a cloister, such as surrounds a Buddhist vihár, comes into view, and reveals the character of the entire series. It consists of a small chamber sustained by genuine Buddhist pillars, severely simple in their type, and without doubt of great antiquity. Formerly a succession of such cloisters encompassed not less than three sides of the existing terrace, which

must consequently date from the same epoch. It would be desirable, if the consent of the Mohammedans could be obtained, to remove the external wall by which these cloisters have become almost completely hidden, in order to ascertain what is their extent and condition.

This series of cloisters formed the lowermost story of a large Buddhist monastery, which once enclosed the entire space occupied by the terrace, and rose to the height of probably two or three stories above it. On the southern side stood the chief chaitya or temple, which, on the suppression of Buddhism, passed into the hands of the advocates of another religion, who transformed it according to their own tastes. The mosque on this side is altogether composed of the remains of an ancient temple of large dimensions, and of very elaborate workmanship. The high pillars, moreover, on its northern face have been abstracted from the same spacious building. These remains are partly Hindu, and it is unquestionable that the edifice which was destroyed in order to make way for the mosque, was an old temple of Bisheshwar. An excellent ground plan of this temple, prepared from a minute examination of the existing remains, was drawn by Mr. James Prinsep, and published by him in his "Views of Benares." These remains, however, are only partially Hindu. Some portions, judging from the elaborate ornamentation of certain details which it was the custom of the Buddhist architects to leave plain, seem to be of Jain origin, and to have been appropriated by the builders of the Hindu temple. If this supposition be correct, the mosque with its terrace exhibits a singular architectural anomaly, and presents us with no less than four styles, namely Buddhist, Jain, Hindu and Mohammedan. Indeed it would not be wrong to add a fifth style, for the square terrace pillars with their cruciform capitals are so simple in structure, that, compared with the highly carved and decorated pillars of mediæval and later Buddhist history, they belong to another style, which may be called early Buddhist or Hindu, according to which of these two ancient religious communities is supposed to have invented it. It is not our object to discuss the interesting and also important topic, who were the first Indian sculptors and builders of permanent works, yet it is one which must one day, when materials have been sufficiently accumulated, which they have not been at present, be thoroughly investigated.

When this is settled, the antiquity and origin of these terrace pillars will be settled likewise.

### BUDDHIST VIHÁR—No. VI.

#### *Ad-Bisheshwar Temple and neighbouring Mosque.*

Ad-Bisheshwar is the name of a lofty temple situated a short distance from Aurungzebe's mosque just referred to, and in sight of it, and is held to be, by some persons, the original or most ancient temple of this deity. The derivation of its name only bears out this supposition, for the temple itself, from the pinnacle to the base, has nothing really ancient about it. On the eastern side of the enclosure the ground takes a sudden rise of eighteen feet, forming a terrace manifestly of artificial construction. On this side there is a retaining wall of stone masonry, which is wanting on the southern side of the terrace, where there is only an earthen bank. The other two sides of the terrace are covered with buildings, which prevent the exact ascertainment of its boundary in these directions. On that flank which is contiguous to the Ad-Bisheshwar enclosures, stands a mosque erected some eighty years ago or less, but not finished then, for want of money. It was built of stones found on the spot, with new Chunar slabs added. The terrace existed before with the buttress, and is evidently of ancient construction.

The building is in two divisions, each of which is  $23\frac{1}{2}$  feet in length, connected together by a massive wall  $5\frac{1}{2}$  feet thick, composed of large blocks of stone. This wall projects considerably beyond the building into the courtyard to the east, and has the appearance of a huge buttress; but what its object is, seeing that the mosque, which is entirely of stone, is amply sustained by its columns and walls, and requires no such additional support, it is hard to say. Possibly the buttress is pierced with a staircase, leading formerly to an upper story which the buttress supported, and the Mohammedan architects, not caring to remove the massive prop, have retained it in the mosque. They appear, moreover, to have confined themselves chiefly to materials lying upon the spot, as in three places carved pillars, similar to those sustaining the centre aisle, have been adopted as architraves. There are fourteen columns in the interior of the mosque, which are peculiarly but not extensively carved, and are crowned with orna-

mented capitals. The western wall is strengthened externally by three rounded buttresses, which are of the Pathan dynasty, like those found at Jaunpore, and were built at the same time. They did not exist in the Buddhist period, and were added as much for ornament as strength. All the mosques about old Delhi have them.

There is no doubt in our minds that the *Ad-Bisheshwar* temple stood on this site, and was destroyed by the Mohammedans, who, as usual, transferred its stones to their own mosque. The neighbouring temple bearing this name, the Hindus built, with the kind permission of their friends, the Mohammedans, of course, for the purpose of perpetuating the worship and the honour of their old idol, *Ad-Bisheshwar*. Yet, while allowing that the edifice standing on the site of the present mosque when the Mohammedans took possession of it, was the temple of *Ad-Bisheshwar*, we are nevertheless equally certain that the primitive building was of a Buddhist character. We were inclined at one time to imagine that, from its proximity to the Buddhist Vihár No. V., it must have been a part of that monastery, but two reasons have led us to abandon that idea. One is, that a separate terrace of extensive dimensions was appropriated to this structure, whatever it was, and that between this terrace and that of No. V., the ground is depressed corresponding to the depression of all the neighbouring soil; and the second is, that the style of architecture of the ancient buildings upon or around the two terraces, differs exceedingly. We are led to conjecture, therefore, that the original structure was a Buddhist monastery, but later in date by several hundred years than the first monastery erected on the terrace No. V. It was of course a quadrangle, encompassing the four sides of the terrace. Nothing remains of it except the massive transverse wall with the buttress, and the lower portion of the retaining wall. The mosque has been erected perhaps on the site of the principal cloister of the monastery, its second division occupying the position of a smaller cloister. The amount of stone material expended on the present comparatively small building is preposterously great, and in itself is a proof that an edifice of much larger dimensions formerly stood here.

## STONE PILLAR.

*Soná-ká-Talao.*

Before closing this paper, we would direct attention to a stone pillar standing in the midst of a tank between the city of Benares and the Buddhist remains at Sarnath. The tank is called Soná-ká-Talao, or the Golden Tank, and is situated on the opposite side of the river Burna, near the road which branches off from the high road leading to Ghazeepore, and almost close to the point of its junction with several other roads. The road is a portion of the Panch-kosi or sacred boundary of Benares. Proceeding along it for somewhat less than a mile, you arrive at the tank, which is to the right of it, and is approached by a strong and well built ghaut, on which are several Buddhist figures, brought most probably from Sarnath. It is three hundred yards in length, and one hundred and forty in breadth. In the midst of it is a round pillar, eighteen feet high and upwards of nine in circumference, composed of great blocks of stone cut in quadrants and put together without cement or mortar. There is no inscription on the pillar, and no mason marks, so that we have been totally unable to assign any date, even approximately, to its erection. Its base is always, we believe, surrounded by water; yet it would be worth while to ascertain whether any inscription exists below. We probed it to its foundations, but found no face for an inscription. It is likely that both the pillar has somewhat sunk, and that formerly the tank was less choked with mud than it is now. In appearance therefore the pillar was once higher than at the present time. It was probably surmounted formerly by a lion or some other figure, and on close examination bears marks of extreme old age.

Besides allusions to a few other ancient structures, we have in this paper traced out remains, more or less abundant, of six Buddhist vihárs or monasteries and four Buddhist chaityas or temples, still existing in Benares, and have pointed out the sites on which they stood or are still standing. Add to these the remains at Bakarya Kund already described in a former paper, and we have the remains of seven monasteries and at the least seven chaityas. The monasteries are doubtless a portion of the thirty monasteries and upwards which Hwan Thsang, the Chinese traveller

of the seventh century, said existed in Benares in his day. In conclusion, we may remark that we are much inclined to believe that many of the ancient Buddhist monasteries, and of the temples also, were on a line of road leading from Bakarya Kund to Raj Ghaut Fort in one direction ; on a second line, at right angles to this, running from Bakarya Kund to Sarnath ; and on a third, proceeding from the site of Aurungzebe's mosque and joining one or both the others, possibly, at Bakarya Kund, and that hereabouts most of other remains of such buildings, if found at all, will be discovered.

*Note by the Rev. M. A. Sherring.*

Since the above was written, I have visited and examined the country lying on the banks of the Ganges to the north of the river Burna. To my utter astonishment, though I must confess, not contrary to my anticipation, I found brick and stone debris scattered over the fields for, as far as I could conjecture, five miles or thereabouts. In many places the rubbish lies thick upon the ground, choking up the soil, and to a large extent the deposit can be traced continuously. Here and there small bits of sculptured stone are visible, and occasionally, where the broken bricks and stones are in very great abundance, they have been collected into ridges or small mounds. This is especially manifest at the termination of the deposit at a spot called Patharaká Siwáu, where, in ancient times, doubtless stood a large fort, of which the foundations may even now be partially traced. Although the fields beyond this point seem to be clear of rubbish, yet further on, at Muskábád, at the distance of a mile, it recommences and becomes as thick as in any other place. Perhaps this latter was the site of an outlying town.

But what are we to say of these remains? They lie immediately on the great river's bank, and never retreat from it more than three quarters of a mile. It is, I think, very evident that all the way from the mouth of the Burna this bank has been, with the lapse of centuries, considerably cut away. Indeed, I believe, that as much as a quarter of a mile may have gone into the river. In all probability therefore the space covered by debris was much broader than it is at present. There can be no question, however, that here a great city once stood. I have no hesitation in expressing my belief that in the

entire absence of any *bonâ fide Hindu* remains in the present city of Benares, dating from even the Buddhist period, not to speak of the pre-Buddhist epoch, when we know from historical records that Benares was in existence, the ancient city of the pre-Buddhist and early Buddhist eras must have occupied this site. Beyond the northern extremity of the remains of the ancient city is a series of mounds also covered with debris, tending in a north-westerly direction, where formerly forts or towns existed. I think it not unlikely that in a far distant age the connexion of the ancient city of Benares with Sarnath was along the course of these mounds. Sarnath is spoken of in the Ceylon records as though it may have been a city of itself; and there is no doubt that it is referred to in ancient documents as a part of Benares. Now, modern Benares is at least one-third of a mile to the south of the Burna, whereas Sarnath is out in the country about three miles to the north of that stream. If we suppose, however, that Benares, in its most ancient period, was mainly on the north side of the Burna likewise, and if such supposition is corroborated by extensive remains of ancient buildings in the shape of brick and stone debris stretching over several miles of country, as already shown, and terminating in mounds lying in the direction of Sarnath, the proof approaches to demonstration that in that early epoch a union, more or less intimate, existed between Sarnath and Benares, as stated by historical records. I had no opportunity to examine thoroughly the country lying between these remains and Sarnath, but I feel satisfied that at some point in these remains a line of debris would be found connecting the two spots, with only a few breaks in its course, the debris indicating the former existence of solid buildings and being the broken remains of the same. This point must not be searched for at the southern extremity of the ancient city, but at the northern extremity; and perhaps the line of junction may be the line of the mounds just now referred to; but of this I am not able to speak positively.

If these observations respecting the site of the early city be correct, it would follow that the derivation of the word Benares, as the city lying between the Burna and the Assi, is utterly absurd, as applied to the most ancient city. That it is a correct derivation of the word, as denoting the city of modern times even as far back as the Gupta dynasty, and perhaps somewhat further, I have not the smallest

doubt. But Banár-assi has nothing whatever to do with ancient Benares, and as applied to it would be a ludicrous misnomer. It seems, indeed, probable that the Buddhists were the first people to occupy to any extent the southern side of the Burna, and such a notion is remarkably substantiated by the existence of various Buddhist remains there, as described in this paper; but none of them, so far I know, date from earlier than the Gupta period. The Panchkosi road or sacred boundary of modern Benares, nearly fifty miles in extent, and regarded by many natives as of immense antiquity, is no older than the city which it encompasses, and must also be assigned to a comparatively recent date. Many pleasant and perhaps hallowed associations connected with Benares, as it now stands, will in the minds of multitudes be in danger of being snapped asunder, when they discover that the Benares of to-day was not the Benares which their forefathers knew.



*Assyro-Pseudo-Sesostris.*—By HYDE CLARKE, Esq. Member of the German Oriental Society, of the Society of Northern Antiquaries of Copenhagen, of the Academy of Anatolia, of the Institution of Engineers of Vienna, Local Secretary of the Anthropological Society.

[Received 13th July, 1865. Read 2nd August, 1865.]

As the monument near Ninfi (the ancient Nymphæum), and twenty miles from Smyrna, has of late years become a subject of some controversy, I have been very desirous of getting it photographed, and at length this has been effected (Plate XXI.) by the zeal and ability of Mr. Alexander Svoboda, an artist doubtless remembered by many members of the Society for his paintings of Indian scenes, and his having first photographed the caves of Elephanta and the monument of Ctesiphon, as he has latterly those of Ephesus.

Herodotus, in his second book, as is well known, speaks of the foreign wars and expeditions of Sesostris, and says that he erected various monuments of his victories, of which Herodotus had seen one in Syria, and there were two others in Ionia, one on the road from Sardis to Smyrna, and the other on the road from Ephesus to Phocæa, and that

the figures, four cubits and a spathamus high, held a bow in one hand and a lance in the other.

The words of Herodotus are :—

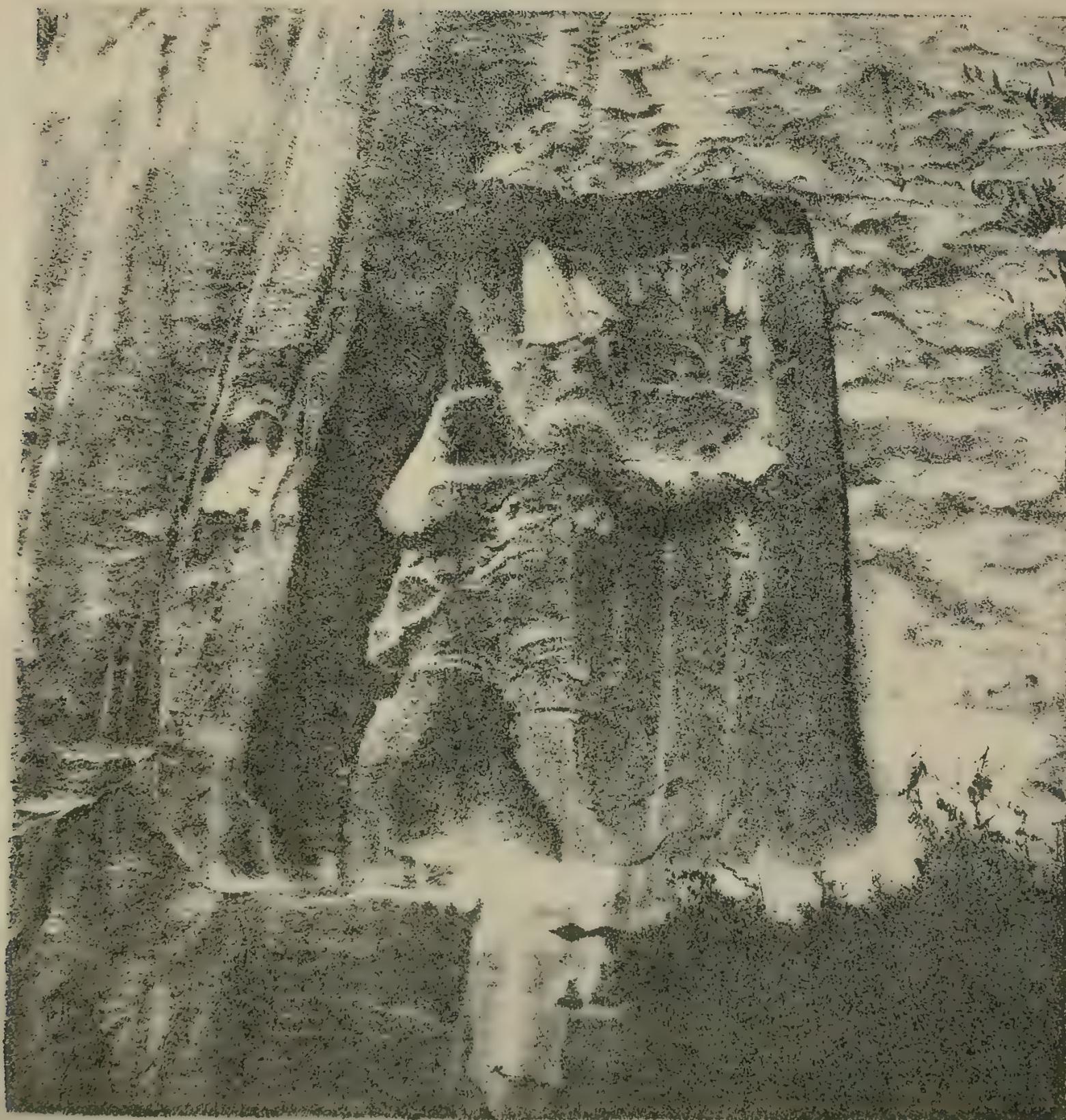
“The pillars which Sesostris erected in the conquered countries, have for the most part disappeared, but in the part of Syria called Palestine, I myself saw them still standing, with the writing above-mentioned, and the emblem distinctly visible. In Ionia also, there are two representations of this prince engraved upon rocks, one on the road from Ephesus to Phocæa, the other between Sardis and Smyrna. In each case the figure is that of a man, four cubits and a span high, with a spear in his right hand and a bow in his left, the rest of his costume being likewise half Egyptian, half Ethiopian. There is an inscription across the breast from shoulder to shoulder, in the sacred character of Egypt, which says, “With my own shoulders I conquered this land.” The conqueror does not tell who he is, or whence he comes, though elsewhere Sesostris records these facts. Hence it has been imagined by some of those who have seen these forms, that they are figures of Memnon, but such, as I think so, err very widely from the truth.”

Diodorus Siculus repeats the like, and says there was an inscription in hieroglyphics on the monument, of which he gives the translation.

As the monument near Ninfi agrees with the description of Herodotus, it is generally believed to be Egyptian, to bear a hieroglyphic inscription, and to be the Sesostris. As will be seen, there are traces of characters on the right hand corner, though what, cannot be made out. They are exceedingly unlike any hieroglyphic inscription, which will carry the meaning of Diodorus, and the rock is too soft for the minute characters of the hieroglyphic ever to have been carved upon it. It would not bear even the ring of the cartouche.

Who first doubted its Egyptian character, we have not the means here of knowing, but at any rate the geographers Kiepert and Carl Ritter have done so, and in their works the monument is figured as “Pseudo-Sesostris,” and is placed with the Assyrian class.

Unaware of this, some years ago, I visited the monument and arrived at the same conclusions, and I have since endeavoured to obtain the opinions of competent authorities in Europe. This corre-



Drawn on Stone at the Govt School of Art, Calcutta by Kamakha Churn Ghose, Student.

FIGURE OF SESOSTRIS AT NINPI

LITH. BY M. N. VEN SURVIVOR GENERAL'S OFFICE CALCUTTA AUGUST, 1866



spondence made me more urgent to get it correctly reproduced, and it is satisfactory that at length it can be examined by all interested in the subject, instead of the very few who could reach Ninfi.

It is reasonably to be doubted whether Herodotus ever saw this monument, because he has not described it with absolute accuracy.

The monument is quite off the road or any high road, and is a very unlikely place for a public monument of Sesostris. It is on a friable rock, and it is a miracle it has been preserved so many centuries. It was perhaps attached to the country palace of some king or satrap, or it may commemorate a battle fought in the glen. It does not bear the appearance of having been an object of adoration.

Its class is not distinctly Assyrian, for it wants the sharp touch of those workmen, and it must always have been of rude appearance.

It is allied to the Assyrian, and is the production of some people of Assyrian character.

The question arises, whether this monument and the neighbouring Niobe, and the other rock-cut pictures, are the works of settled inhabitants, or of an invading or conquering race. The latter seems to be the preferable hypothesis, because in this district, even in the time of Herodotus, there cannot have been more than three, and there are few scattered over the country. Those in this district most probably belonged to some petty kingdom.

With regard to their epoch, they are certainly as old as the Egyptian cities in their neighbourhood. These cities there form a close group, Smyrna, Tantalus, Sipylus and Nymphæum, attesting at one time a population of large and strong cities and a relative civilization.

These cities, as well from identity of remains with those in the South of Europe, as well from the identity of names with those of the Iberian nations, as well as from the fact of their population having endured beyond the Hellenic invasion, I place as anterior to that epoch, and as Iberian in character. This subject I have treated at length in a detailed memoir read before the Academy of Anatolia, the Ethnological Society, and the British Association.

The rock-cut monuments must, to some extent, have preceded the Iberian occupation, or may have been the result of an invasion during that period, proceeding from Cilicia and the south east, that is, from the Semitic district.

As yet the elements for the determination of these pre-historical questions are very few. They are indeed hardly known, and we are not yet in a situation to judge of the ethnology, the monuments, or the mythology either of an earlier or a later age.

There are two elements in particular that exercised a great influence over this region, that have not been adequately studied, the Iberian and the Caucaso-Tibetan. The remarkable discovery of Mr. B. H. Hodgson, communicated to your Society, of a connection between the tribes of the Caucasus and those of the Himalaya and its valleys, opens up new views as to the history of Central and Western Asia, and will in time afford one of the keys for unlocking their secrets, not less valuable perhaps than those applied to hieroglyphics or cuneiform.

I was led by a like train of investigations with Mr. Hodgson to the like results, and I am glad to find that what I have done, has been in confirmation of such an authority. I lately communicated a paper on this subject to the Asiatic Society of London, with the hope of inviting other inquiries.

It is perhaps by means of the Caucaso-Tibetan, that we shall obtain a knowledge of the early history of Iranistan, of the influences which have affected so peculiarly the early Indo-Europeans, the Armenians, the Ossetes and the Koords, of the third arrow-headed, and the Lycian.

It is here we shall perhaps find another element in the determination of mythology, though so far as the mythology of these regions is concerned, and particularly its local character, Iberian sources must be searched. It is there we must seek for the explanation of much of the mythology, and not in Sanskrit sources, however plausible such explanations may appear.

The Hellenes found a mythology ready made for them in the Iberian countries, in which they settled, and they adopted Iberian terms. To a certain extent, they brought with them Indo-European dogmas, and here Sanskrit philology will help us; but the local colony is Iberian. This western country of Asia Minor was, in fact, the seat of mythology and the land of the gods, before the Hellenes appeared. In some cases an Indo-European legend may have been attached to a local site, but the Hellenes borrowed more than they gave,

The Sesostris I propose to designate Assyro-Pseudo-Sesostris.

*Notes on some of the temples of Kashmir, especially those not described by General A. CUNNINGHAM, in his Essay published in the Journal of the Asiatic Society of Bengal for September, 1848.—By W. G. COWIE, M. A., Chaplain on duty in Kashmir, during the summer of 1865.*

[Received 1st December, 1865.]

In these notes I have followed as nearly as possible the wording of General Cunningham, in his description of the different temples, which he visited in Kashmir.

The temples of Bhaniyar, Waugat, Manusbal, Narayan Thal, Futtchghur, Dyamun, and Lidar do not seem to have been described before. What I have said about those of Pandrethan, the Takht, Pathan, Avantismami, and Marttand, is meant to be supplementary to General Cunningham's accounts of those temples.

#### BHANIYAR.

The buildings at Bhaniyar consist of a lofty central edifice, standing in a large quadrangle, surrounded by a colonnade of fluted pillars with intervening trefoil-headed recesses.\* The ground plan of the temple is a square of  $26\frac{1}{2}$  feet with pilasters at the corners, 4 feet in thickness. The interior is a square of  $13\frac{1}{2}$  feet, and the walls are therefore  $6\frac{1}{2}$  feet thick, which proportion may be considered a strong proof, according to General Cunningham's† theory, of the antiquity of the building.

The roof was pyramidal, and the total height of the temple, estimated at twice its breadth, would be 53 feet. The lowest stones of the pyramid remain in some places, and their external slope is parallel to that of the sides of the pediments over the doorways. The only entrance to the temple is gained by a broad and lofty flight of steps to the N. N. W. On each of the other sides there is a porch containing a closed doorway.

These porches are just the same as that of the entrance, each being  $16\frac{5}{8}$  feet wide, with a projection of one foot in advance of the corner pilasters.

\* See Photograph, No. I.\*

† See Cunningham, p. 249, para. 6.

\* The photographs referred to in this paper are by Messrs. Sheppard and Bourne of Simlah.—Ed.

The doorways are surmounted by trefoiled arches, 23 feet high; and the latter are covered by pyramidal pediments, resting on independent pilasters. Within the large trefoiled arches, there are smaller pyramidal pediments, of which the tympanum is occupied with the trefoiled decoration, like that at Bhaumajo,\* resting on the architrave covering the pilasters of the doorway.

The pilasters at the corners of the building sustain the entablature, and give a look of strength and solidity to the walls, which was absolutely required for the vast and massive roof.

In the interior the walls are plain, except that (as at Narayan Thalt†) a sort of string-course projects all round, about  $12\frac{5}{8}$  feet from the floor. It is about a foot high, flat above, and rounded below.

Over the string-course and resting on it, there is, on each side, a semicircular headed recess, about 3 feet high, 2 feet wide, and  $1\frac{1}{2}$  feet deep. Only the one at the back of the building, that is, towards the S. S. E., is pierced for a window, the opening being rectangular, and about 2 feet high by 1 foot in width. The roof is hollowed out into a hemispherical dome, of which the centre is decorated with an expanded lotus flower, as in the Payach‡ temple. The spandrels of the dome are too much injured to show any trace of figures, if any ever existed; but the dome looks as if it were a modern restoration, and the whole is overlaid with thick whitewash, concealing the material of which it is constructed. There were, however, no figures in any other part of the building, except the tympanum of each smaller pediment over the architraves of the doorways; and *there* the remains of heads (for such I took one of them to be) are now so much worn away, that it is impossible to say exactly what they represented. The colonnade had *no* such ornaments.§ (Plate XX.)

The basement of the temple is very fine. It is divided into two portions, each having the same style of moulding as that of the Bhaumajo|| basement; but they differ from it in being further projected beyond the face of the wall.

The lower portion is 47 feet square and  $5\frac{5}{8}$  feet high; and the upper portion  $34\frac{1}{2}$  feet square and 6 feet high, with a projection of 4 feet. Each division of the basement has a massive filleted torus as

\* See Cunningham, plate X.

† See below.

§ See photograph, No. II.

‡ See Cunningham, plate XI.

|| See Cunningham, plate VIII.

the crowning member, with a straight fillet above and below. Under this is a dado, or plain straight face, which is a little higher than the torus itself. Beneath the dado, is a quirked ovolo of bold projection surmounted by a straight fillet, and under this is the plinth, of which (as at Bhaumajo) the lower stone projects beyond the upper one. As at Payach too, there is a stone drain or water-spout, open at the top, for carrying off the water used for the service of the temple. It emerges from the building on the W. S. W. side, and projects slightly beyond the upper basement; the termination of the drain or spout being made to represent the open mouth of a large snake or some other animal.

The temple is approached by a flight of twelve steps,\* the lower six being 11 feet in width, and the upper six 10 feet, enclosed between sloping walls one foot in thickness. Besides the sloping walls, the lower 6 steps are further supported by flanking walls† (as at Avantiswara,) nearly 6 feet high and  $3\frac{5}{8}$  feet thick.

The temple is enclosed by a pillared quadrangle (Plate IX.) measuring inside 145 feet by  $119\frac{5}{8}$  feet, the longer sides being to the W. S. W. and E. N. E., containing 54 fluted columns. In the middle of the longer sides of the colonnade, and of that in rear of the temple, there is a pair of large fluted pillars, 12 feet in height and 15 inches in diameter, and 10 feet apart, advanced beyond the line of the peristyle a little more than the corresponding pillars at Marttand. On all these columns the transverse architraves, connecting them with the walls of the peristyle, are still standing. The central porticoes, to which these large pillars belong, are not gateways, but lead only to small chambered recesses, similar to, but a little deeper than, those between the other pairs of pillars. There is, however, one flank entrance to the quadrangle, viz., between the third pair of pillars on the E. N. E. side, to the south of the central porch. This has always been, as it is now, closed with a wooden door.

The quadrangle itself originally contained 48 round fluted pillars (of which all but three are still in their places) and six square parallel pillars (disposed in the corners, and on each flank of the gateway); which, together with the six pillars of the central porches and the two of the gateway, made up 56 in all. None of the pillars now

\* See Photograph, No. I.

† See Photograph, No. I.

standing seem to have been injured otherwise than by the wear of time and the elements; but from these causes, many of them have now lost all trace of fluting. Each pillar of the peristyle is 10 feet in height and 13 inches in diameter, with an intercolumniation of  $7\frac{3}{4}$  feet. Immediately behind each pillar there is a square pilaster  $\frac{1}{2}$  engaged, of the same height as, and with mouldings similar to those of, the square corner pillars. The pilasters are  $9\frac{1}{2}$  inches distant from the pillars. Between every pair of pillars there is a chambered recess  $7\frac{5}{12}$  feet by 4 feet, with a trefoil-headed arch covered by a pediment, (which pediment) is supported on small pilasters, or rather upon half\* engaged pillars, as at Avantiswámi. The general style of the pillars is similar to that of the Marttand colonnade; but it is impossible to say whether the pedimental pilasters of the intervening recesses were ornamented or not. The trefoiled heads of the recesses are joined to the side mouldings of the openings by short horizontal returns† (as at Avantiswámi). Each pillar is connected with its pilaster and with the main wall by a transverse stone beam, which, being broader at top than at bottom, bears the appearance of an upper capital to the pillar.‡ “The greatest and most characteristic distinction,” therefore, as General Cunningham says, “between the Arian and Classic orders, lies in the disposition of the architrave. In the latter it lies immediately over the line of pillars, whilst in the former it is placed over the transverse beams.” Nearly all of this entablature still exists, but the building has been so much injured by the weather, that its character can only be conjectured. It seems to have been much the same as the upper part of that given in No. 2, plate VIII. of General Cunningham’s Essay. The upper part of the roof of the quadrangle has entirely disappeared, but there can be little doubt that it was triangular in section.

The outer walls of the quadrangle are ornamented by fine deep horizontal bands,§ the intervals being occupied by rectangular figures 18 inches high, 13 inches wide, and  $4\frac{7}{12}$  feet apart, the whole being surmounted by an entablature of the same design as that of the peristyle. The base of the wall is buried deep in accumulated earth

\* See Cunningham, plate XVIII.

† See Cunningham, plate XVIII, and ante Plate IX. p. 92.

‡ See Photograph, (of Marttand colonnade), No. XXIV.

§ See Photograph, No. III

and rubbish; but to the S. W. of the gateway, and on a level with the bottom of the fluted torus which crowns its basement, is part of a similar torus,\* or string-course, projecting from, and running horizontally along, the face of the wall. This torus no doubt ran along the exterior face of the whole quadrangle, and is probably still in good preservation below the ground. Lastly, the front wall is ornamented at each extremity with a trefoil-headed† recess covered by a pediment, the latter resting on half engaged pillars, which are flanked by square pilasters  $\frac{1}{8}$  (one-eighth) engaged, in every way like those of the interior. The quadrangle has had two large wells in the W. S. W. and E. N. E. corners, probably to supply water for flooding the enclosure; and half way between the steps of the gateway inside and the steps of the temple there is a square structure of stone, cut away in the centre as if to receive the end of a prop to a raised pathway,‡ such as that suggested by General Cunningham as the probable connection between the gateway and the temple at Marttand. The object of erecting temples in the midst of water appears to him to have been “to place them more immediately under the protection of the Nágas, or human-bodied and snake-tailed gods, who were zealously worshipped for ages throughout Kashmir.”

The entrance or gateway§ stands in the middle of the N. N. W. side of the quadrangle, and is  $25\frac{1}{2}$  feet in width, nearly that of the temple itself. Outwardly the gateway somewhat resembles the temple, in the disposition of its parts and in the decorations of its pediments and pilasters. It is open to the N. N. W. and S. S. E., and is divided into two distinct portions by a cross wall  $3\frac{3}{4}$  feet thick, with a doorway in the centre closed by a wooden door. These inner and outer porticoes of the doorway are each  $16\frac{1}{2}$  feet wide and  $6\frac{1}{4}$  feet deep. Their side walls are decorated each with a miniature temple having a square-headed doorway, surmounted by a pyramidal pediment representing a double roof. The tympanum of each compartment of these roofs is occupied with the trefoiled decoration, common to the Kashmirian buildings, resting on the architrave, as in the doorway pediments of the temple itself. The pediment of the gateway,

\* See Photograph, No. III.

† See Cunningham, p. 270, para. 25 and Photograph, No. III.

‡ See Cunningham, page 273, para. 31, and page 287, para. 8.

§ See Photograph, No. III.

outside and in, is supported on half engaged fluted pillars,  $16\frac{5}{12}$  feet high, and 14 inches in diameter. As at Bhaumajo, the base of the tympanum\* is reduced to two short returns of the horizontal mouldings of the pediment, each of which serves as a sort of upper abacus to the pedimental pilasters. The doorway pilasters, supporting the architrave ( $2\frac{1}{4}$  feet high, and broken through as usual in the temples of Kashmir), are as high as the base of the main pilaster capitals, and  $4\frac{1}{8}$  feet higher than those of the quadrangle. Besides the doorway pilasters, there are two fluted columns of the same height (including a sort of second capital) and  $18\frac{1}{2}$  inches in diameter, one on each side of the entrance,  $7\frac{2}{3}$  feet apart, supporting the architrave. The second capital corresponds to the transverse beam of the peristyle connecting the pillar with its pilaster; but here it is detached on all sides. It is cruciform,† and so projects on each side of the capital proper. These columns are distant from the square doorway pilasters respectively about one diameter. The roof of the gateway, like that of the temple, has perished; but it was evidently pyramidal, for the corners of the base of the great pediments (outside and in) remain, and their angles are equal to those at the base of the doorway pediments.

The basement of the gateway is approached on either side by a flight of six steps‡  $7\frac{5}{8}$  feet wide, supported by flank walls  $7\frac{3}{4}$  feet in length, and terminating in upright stones,§ each separated by an interval from the main wall, and ornamented with a standing figure, said by the pundits to represent a servant of Siva.

The material of which the buildings are constructed, is a pale, coarse granite, of which there seems to be no quarry within reach on the left bank of the Jhelum. This circumstance is remarkable, considering the enormous size and weight of some of the stones employed. Mr. Drew, a geologist in the service of H. H. the Maharajah, thinks that the blocks of granite must have been carried down some of the valleys on the opposite side into the river bed, whence they were brought for the construction of the temple. Mortar has been used in all parts of the buildings. Opposite the gateway,

\* See Photograph, No. III.

† See Photograph, No. III. and Cunningham, pp. 269-70, para. 24.

‡ See Photograph, No. III.

§ See Photograph, No. III.

across the road, there is a large cistern, (like that attached to the central temple of the second group of buildings beyond Wangat\*), cut out of a single block of granite. It is  $6\frac{7}{12}$  feet long, 5 feet wide, and  $2\frac{1}{3}$  feet high. There is another cistern† of the same kind, but of smaller dimensions, close by.

The Hindoos residing on the spot say that the temple was built by one Bonadutt (hence the name Boonyar), whose brother built or began a temple at Venapoora beyond Sopur. The situation is very fine, in a deodar forest on the left bank of the Jhelum, which roars below as it descends in foaming cataracts. Immediately behind, the pine-clad hills rise precipitously to a great height. About one-third up, there is a strange formation of rock, resembling a human figure, which is said by the pundits to be the petrefaction of an evil spirit, who formerly devoured men and women passing that way. A very holy fakir, they say, fixed the man-eater for ever where the figure is now seen.

After carefully examining every part of the Bhaniyar buildings, I am inclined to think that they are older than the quadrangle at Marttand‡, and of about the same age as the temples beyond Wangat.

They probably owe their escape from the hand of the destroyer to their secluded situation, which is quite off all the old thoroughfares leading from the Punjab to Kashmir, about three miles lower down the Jhelum than Nowshera, on its left bank.

I found no trace of an inscription on any of the buildings.

#### TEMPLES AT LIDAR.

About half a mile beyond Ladoo, and two miles to the left of the road leading from Pampur to Awantipore, there are two temples, one surrounded by water, (Plate XIV.) and a smaller one, close by, a little higher up the hill side.

The ground plan of the former is a square of 24 feet, with corner pilasters  $3\frac{1}{4}$  feet thick and 6 inches projected. There is only one doorway, to the W. S. W. Its head is semicircular, with a pyramidal pediment slightly projected and divided into two portions, of which the upper one is plain, and the other is occupied by a semicircular

\* See below, p. 106.

† See Photograph, No. III.

‡ See Cunningham, p. 263, para. 10.

ornament. The apex of the pediment reaches to the top of the cornice, which runs round the top of the walls on the outside. The roof is entirely gone.

The interior is a circle, the diameter of which diminishes from the ground upwards. Four feet from the floor it is  $17\frac{5}{12}$  feet. There is a cornice 20 inches high,  $9\frac{5}{12}$  feet above the floor. Its mouldings are the same as those of the lowest course of the ceiling of the small temple,\* viz. three fillets, like those of the Payach dome,† but that the edge of the middle one is round instead of square.

The diameter of the circle formed by the projecting edge of the cornice is 15 feet. The thickness of the wall at the doorway is  $3\frac{2}{3}$  feet. The wall on the inside shows signs of fire having been used, perhaps to destroy the roof, which may have been of wood. The top of the doorway inside is formed by the underside of the course from which the cornice of the interior is projected.

There is a drain on the south side, as at Payach, for carrying off the water used in the services of the temple. The height of the wall outside from the top of the cornice is  $10\frac{1}{3}$  feet. The corner pilasters stand on a basement  $2\frac{5}{12}$  feet high, and are  $6\frac{1}{2}$  inches projected beyond the face of the wall (See Plate XIV.) This basement is carried all round the building, except where it is broken by the doorway; the bottom of the basement being on a level with that of the doorway.

The uppermost course of the basement is nearly flush with the corner pilasters, but the next two courses project  $5\frac{1}{2}$  inches beyond the uppermost one.

The basement of the temple stands on a platform 48 feet square, faced with stone walls, forming a sort of lower basement, as at Bhaniyar.‡

The whole stands in the middle of a tank of very clear water, which issues from two springs in the N. E. corner. The tank is now 3 feet deep, but I could not ascertain whether there was a stone bottom below the accumulated mud. The tank has been a square of about 70 feet, with stone walls supporting the bank, now 2 feet above

\* See below, p. 100.

† See Cunningham, Plate XI. and page 258, para. 10.

‡ See Photograph, No. I. and ante, p. 92.



Drawn by R. T. Burney Esq<sup>r</sup> C.S.

On stone by Kristo Hari Das Student Govt. School of Art Calcutta

TEMPLE AT LIDAR (IN WATER)

LITH: BY H. NIVEN SURVEYOR GENERAL'S OFFICE CALCUTTA JULY 1866.



the water line, but much injured. Round the tank there are the foundations of walls,\* which seem to have formed a square of 100 feet.

There is an ancient looking *lingam*  $4\frac{1}{8}$  feet high,  $1\frac{1}{4}$  feet in diameter, with 8 flat faces, of dark limestone, standing in the water near the springs which supply the tank. It probably once stood in the centre of the temple, like that at the Takht.

The round head of the doorway outside has a sort of keystone (Plate XIV.), being a projection from the lower face of a stone of the course next above, as in the entrance to the temple at Marttand,† and other Kashmirian arches.

The smaller of the Lidar temples stands a little above and behind (*i. e.* to the north of) the first. Its ground plan is a square of  $10\frac{1}{8}$  feet. It has only one doorway, *viz.*, to the west. All the walls have corner pilasters 15 inches thick.

The doorway has a square top covered by a pediment, which rests upon the jambs of the door, the tympanum being occupied by the trefoiled ornament. The trefoil contains a niche which once held a figure. This pediment is covered by another, having a trefoiled tympanum. The trefoiled arch rests, as usual, upon small pilasters on each side of the door, but the pediment is supported upon bold square pillars, which are attached to the building by walls of less breadth and 8 inches long. The temple in front is a plain copy of that at Pandrethan,‡ or perhaps the original from which *it* was taken. The capitals of the corner pilasters are ornamented with two animals (I think Bulls) standing back to back; and those of the square pillars, supporting the principal pediment, are decorated with a bold flowered ornament. The roof of the building is pyramidal, but its outer facing of stone has disappeared. The walls are  $2\frac{1}{2}$  feet thick. The basement is buried. The interior forms a square of 6 feet, the walls being 7 feet high and plain.

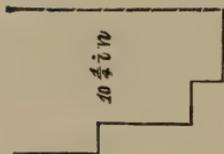
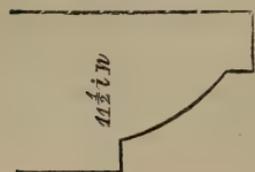
The ceiling is formed of 9 blocks, four of which rest over the angles of the walls. The same process is again repeated with an upper course of four stones, by which the opening is still further narrowed to a square of  $2\frac{7}{8}$  feet; and lastly, the opening is closed by

\* See Cunningham, p. 288, para. 11.

† See Photograph, No. XXIII.

‡ See Photograph, No. V.

a single stone without ornament. The edges of the lowest course have a plain moulding of three straight edged fillets, (Vide woodcuts) and the upper course a similar one, except that the central fillet is rounded.



To the east and west of the temple are rectangular foundations, of the same width as, and continuous with, that of the temple itself; but there is no trace of surrounding walls. There are, however, numberless hewn stones lying about in all directions. From the position of the building, the ground being high on three sides

it may once have stood in water, like the other temple. The pedestal of a *lingam* remains in the centre of the interior.

#### BHAUMAJO.\*

At Bhaumajo (pronounced Bhoomzoo by the natives) there are two temples, besides that described by General Cunningham. The larger of the two has been appropriated by the Mahomedans for a tomb, and disguised as much as possible; so much so, indeed, that when first I visited the *cave* temple, I did not think it worth while examining this other close by, on account of its new and plastered appearance. It is, however, in a very perfect state of preservation, but its details cannot, at present, be seen on account of the thick plaster with which the building is in most parts overlaid. The pyramidal roof is probably uninjured, but it is buried in a mound of earth surmounting the square Mahomedan roof, which now disguises the nature of the building. With some difficulty, I obtained admission to the interior, which I found to be a square of 8 feet. The ceiling is like that of the smaller temple at Lidar.† There is a door on the north side, but the other walls are covered with plaster, rendering it impossible to see whether they once had doors or not. The third temple, however, on the west of the tomb, has only one door, viz., to the north.

The exterior is a square of  $16\frac{1}{2}$  feet, with corner pilasters 2 feet  $1\frac{1}{2}$  inches thick. There are porches with high trefoiled arches on

\* See Cunningham, page 251, and the Bishop's letter to the Asiatic Society, 1865.

† See ante, p. 99.

all the sides. I could not find out how far the porches project beyond the walls, owing to the plaster; but the one on the river side (where the door is) projects 3 feet beyond the small pilasters which support the doorway pediment.

The intervening spaces between the sides of the porches and the corner pilasters are filled in with mortar.

The small pediment of the doorway within the trefoiled arch is like that of the cave temple,\* but is supported on independent pilasters of its own. The porches are 11 feet one inch wide.

To the west of the temple above described, also on the bank of the river, are the remains of a smaller temple of the same kind. Its interior is a square of 7 feet, with a roof like that of the smaller temple at Lidar.† Below the roof is a cornice of three square edged fillets, like those of *both* courses of the ceiling.

The building has, I think, had no corner pilasters. It has porches on all four sides, 5 inches projected. The only opening is on the north side: the other porches containing closed doorways, which, like the porch pediments, are an exact copy of those of the cave temple.‡ The exterior of the roof has been destroyed.

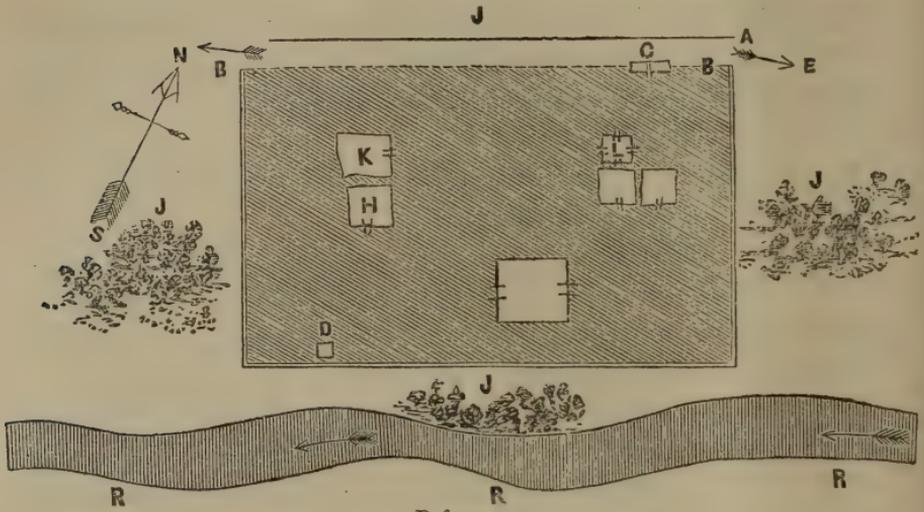
#### TEMPLES NEAR WANGAT.

About 3 miles above Wangat, on the right bank of the river Kanknai, are two groups of temples of all sizes, more or less in a state of ruin.

The first group, viz., that nearest to Wangat, consists of six temples,§ with a gateway and an enclosing wall. (See woodcut, p. 102.) The ground plan of the principal building is a square of 25 feet, with pilasters at the corners  $3\frac{2}{3}$  feet in thickness, and having a projection of two inches beyond the temple walls. There are four porches  $14\frac{1}{2}$  feet wide, with a projection of  $2\frac{5}{8}$  feet beyond the corner pilasters. On two sides they contain closed doorways, the recesses of which (like those at Pathan||) once held *linga*, whose pedestals are still in their places.

The porches were all surmounted by pediments of high pitch, covering trefoiled arches, which rest on  $\frac{1}{4}$  engaged square pilasters. Over each

\* See Cunningham, plate X. † See *ante*, page 99. ‡ See Cunningham, plate X. § See Cunningham, p. 273, para. 31. || See Cunningham, p. 283, para. 1.



## References.

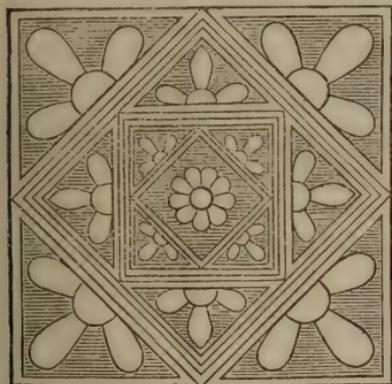
- |                                                                                                                                                                                                             |                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A. Massive wall forming facing to hill.</p> <p>B.B. Foundation of original wall of enclosure.</p> <p>C. Gateway.</p> <p>D. Base of lingam.</p> <p>E. Road to second group.</p> <p>H. Temple to west.</p> | <p>J. (On top). Steep mountain side covered with jungle.</p> <p>J.J. (On sides). Dense jungle.</p> <p>K. Temple to west.</p> <p>L. Temple to east.</p> <p>N. Road to Wangat.</p> <p>R.R.R. Kanknai river.</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

doorway, within the large trefoil arch, is a pyramidal pediment, of which the tympanum is occupied with the trefoil ornament, resting on the architrave which covers the pilasters of the doorways. The base of the great pediment of the porches is on a level with that of the capital of the corner pilasters, but the upper portions of these pediments have disappeared. There were two entrances, to the E. N. E. and W. S. W. respectively. The former has the remains of short flanking walls (afterwards added, it would seem) projecting  $2\frac{5}{12}$  feet beyond the porch. They do not appear to have risen higher than the base of the capitals of the porch pilasters. The roof is still standing, and is pyramidal, but its outer facing of stone has fallen, forced out, probably, by the expansion of the roots of a tall fir and other trees, which grew out of the pyramid. The interior, which has been much injured by fire, is a square of 17 feet, the walls below the cornice being  $13\frac{1}{3}$  feet high, and plain; but the roof forms a hemispherical dome, 17 feet in diameter, of which the centre has been decorated by a large expanded lotus flower. The cornice is one foot high, with a moulding of three bands; the upper two projecting each beyond the one below it.

The stones of the interior of the dome diminish in size, from about  $1\frac{1}{2}$  feet long and 6 inches wide in the lower courses, to squares of about six inches near the centre. The foundation of the dome is formed of large blocks of stone, about 2 feet high, decorated with three straight edged fillets as at Payach,\* the two upper ones broad and projecting each beyond that immediately below it, and the lowest narrowest. The spandrels of the dome are plain and horizontal.

Within a few yards of the principal temple, to the north, there are the remains, more or less ruined, of five small temples, three to the east (L), and two to the west (H and K). All but one of them are built on the same general plan as the temple already described, but have only one door each. The two to the west have their doors to the east and south respectively. The doorway of the latter (H) is like that of the temple A of the second group, described below. The other three sides of H are decorated each with a miniature double-roofed temple, but without an enclosing porch like those of A. It has a water-spout on the north-west side. The other temple on the west (K) has been a copy of the principal building, without the second doorway.

Of the other three small temples, *that* corresponding in position to the one nearest the central building on the west, has its door to the south east, and is built on the same plan as H. So has the next one to it (almost touching it) on its north-east side. Its walls have been plain on three sides, and there is a waterspout on the west. The third of these temples, almost touching the first (on its north side), has four doorways; that on the east being larger than the others, with



(I think) a flight of steps to the east. (L). It has a stone water-spout projecting on the N. W. W. side. In the interior the walls are plain. The ceiling (as in the Pandrethan temple,† Plate XVIII.) is formed of 9 blocks, four of which rest over the angles of the walls and reduce the opening to a square. The same process is again repeated with an

upper course of four stones, by which the opening is still further nar-

\* See Cunningham, p. 258, para. 10. † See Cunningham, p. 288, para. 10.

rowed to a square of  $2\frac{1}{4}$  feet; and lastly this opening is covered by a single stone, decorated with a large expanded lotus surrounded by a narrow square moulding, whose angles bisect the sides of the upper opening of the ceiling. All the angles are occupied by a flowered ornament of three leaves, something like that of the upper part of the tympanum in the niche of the upper roof at Payach.\*

The gateway, about  $22\frac{1}{4}$  feet wide, is to the N. N. E. of the principal temple, almost in the N. E. corner of the enclosing wall, and about 30 feet from the nearest of the smaller temples. It was divided into two chambers, and had two columns on each front; one on either side of the entrance and supporting the architrave, as in the Bhaniyar gateway.† The surrounding wall formed on two sides a facing and support to the platform, on which the temples stand. On one of these sides, viz. that to the east, the wall is over 20 feet high in some places, and is built of small thin dark-coloured stone without mortar. On another side, viz. that on which the gateway is, and the furthest from the river, only the foundation remains; but 14 feet beyond it there is a second wall, very massive, built of rough blocks of stone, and forming a facing to the hill. It has evidently been erected at a later date, to protect the temples and the gateway from a landslip (probably), which threatened to bury them all in its descent towards the river.

There is built up in this wall a fragment of the pediment of one of the smaller temples. At the S. W. corner of the enclosure there is the base of an enormous *lingam*,  $5\frac{1}{8}$  feet in diameter.

From the N. E. corner of the first group of temples there was a road-way flanked with large stones, leading down to the second group, a few hundred yards distant. Half way down, a little to the right of the road, are the ruins of a small solitary temple, but so much injured that it is impossible to make out the original form of the building. Close to it is a block of granite (measuring 10 feet in length, 16 inches in height, and 26 inches in thickness) which seems to have formed part of the facing wall of a resting-place just above it, where the base of a small column is still in its place, at one corner of a rectangular platform. A little further down the road, on the same side, is another rectangular platform, which seems to have been the

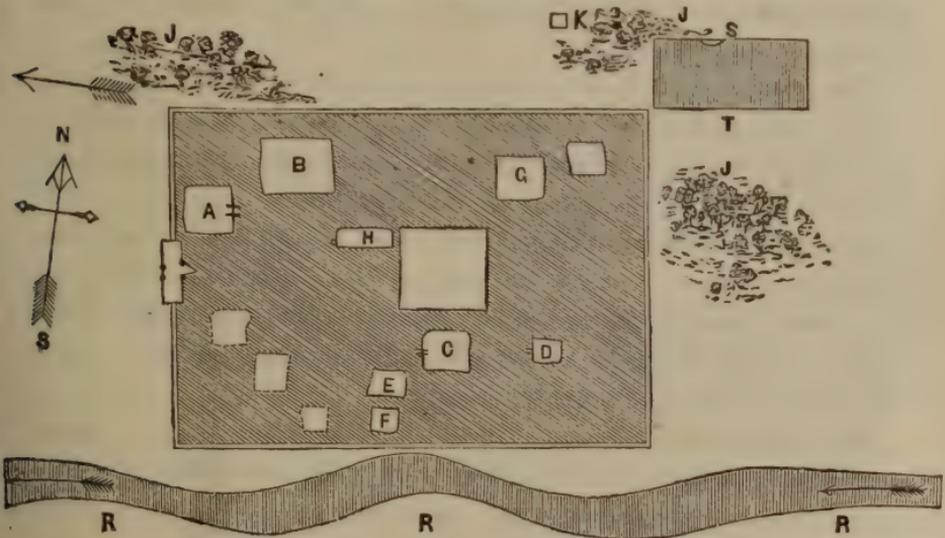
\* See Cunningham, plate No. XII.

† See *ante*, p. 96, and Photograph, No. III.

basement of a *bara durree*, or some such structure, 100 feet long and 67 feet wide. It must have had a broad open verandah all round. The bases of the pillars on one of the longer sides (*viz.* that to the east), eight in number, are all but one still in their places. The pillars were fluted and two feet in diameter, with an intercolumniation of nearly  $12\frac{1}{8}$  feet. Numerous fragments of them are lying about in all directions.

The uppermost course of the basement stones (on which the pillars stood) are 15 inches high, and project about 5 inches over those of the second course (which is almost entirely buried in the ground). In the centre of the platform there are the remains of what appear to have been the walls of an apartment.

About 20 yards to the N. E. of the platform there are the ruins of the enclosing wall of the second group of temples eleven in number, (see woodcut below), with the remains of a gateway in the centre, about  $22\frac{7}{12}$  feet wide, similar to that belonging to the first group.\* Like



## References.

A. to G. Temples.

H. Cistern.

I. Road to first group of temples.

J.J.J. Jungle.

K. Small temple on hill side.

R.R.R. Kanknai river.

S. Spring.

T. Tank.

the latter, it was divided into two chambers, and had flanking pillars to the front and rear, like those at Bhaniyar.† Their

\* See *ante*, p. 104.

† See Photograph, No. III.

bases on the river side are still in their places. Immediately inside the gateway, to the left, are the ruins of a small temple A, like those of the first group. Its only entrance, a trefoiled arch covered by a pediment resting on independent pilasters, looks to the N. E. *i. e.* in the direction of the central building. Over the doorway pediment, and resting on square pilasters, is another trefoiled arch, occupying the tympanum of the porch pediment. The square pilasters project 15 inches, and are attached to the building by short walls, as at Pandrethan.\* The other three walls are ornamented with similar porches, projecting about 6 inches, and containing each the front of a miniature temple with two roofs. The recesses once held *linga*.† The interior is blocked up with the debris of the roof.

Between A and the principal temple, and a little to the north of them, are the ruins of another temple (B), of which the basement alone remains, amid a heap of huge stones, earth, and jungle. The ground plan of this building was a square of about 18 feet with corner pilasters  $2\frac{3}{4}$  feet thick, and four porches projecting about 14 inches beyond the pilasters.

Close to the central and principal temple, at its N. W. corner, is a huge cistern (like those at Bhaniyar‡), cut out of a single block of granite, 15 feet long,  $7\frac{1}{3}$  feet wide, and 3 feet high, with a projecting spout on the W. S. W., one of the shorter sides.

The central building here is much more injured than that of the former group, and is buried half way up the porches on two sides. It appears, however, to have been very much like the corresponding temple of the first group, but it had only one entrance, *viz.* towards the W. S. W. facing the gateway.

The interior is a square of 17 feet. The lowest course of the dome, consisting of 8 stones, each 22 inches high, has not the mouldings which the other dome has in this place, but seems to have had one narrow plain moulding at the edge, and above it there is a concave course, about 18 inches high, with a moulding resembling the frieze of entablature No. 2, (of Marttand), given by General Cunningham on plate VIII accompanying his Essay. The entrance has the remains of projecting walls§, like those of the large temple in the first group.

\* See Cunningham, plate XXI. † See Cunningham, p. 283, and plate No. XX.

‡ See *ante*, p. 97.

§ See *ante*, p. 102.

The corner pilasters of this temple are 4 feet thick, the ground plan being a square of 25 feet, as in the other case. A few yards to the S. S. E. of the central temple is a small one (C), seven feet square, with one round-headed doorway  $3\frac{5}{8}$  feet wide, having mouldings the same as those of G, and looking in the same direction as that of the principal building. On the other three sides, there are similar porches with closed square headed doorways. The basement (of which part only is above the ground) seems to have been like that of Bhaumajo.\* The entablature over the doorways, beneath the base of the pyramidal pediment, like the entablature over the corners of the building (on each side of the pediment) is decorated like frieze No. 2, of the Marttand entablature, shewn by General Cunningham. The porches project  $4\frac{1}{2}$  inches. The interior is a square of  $4\frac{2}{3}$  feet. The roof is constructed of horizontal courses, like these of L. (Woodcut on p. 102.) The uppermost stone is decorated with an expanded lotus flower. The two lower courses are ornamented each with a moulding of three square-edged fillets, like those of the Payach dome.†

To the N. N. E. and S. S. W. of this small temple are the ruins of two others. That in the former direction (D), a mere heap of ruins, had its only entrance on the same side as that of the central temple. The other (E) is a heap of huge stones, scarcely one of which is in its original place. Eight feet behind the S. S. W. temple is a fourth small one (F), with a square headed doorway which has plain perpendicular and horizontal mouldings. There are similar doorways on the other sides, but only that on the N. N. W. has an opening. The interior is a square of  $5\frac{1}{2}$  feet. The roof has been formed of horizontal courses, of which the lowest alone remains, forming a square opening of about 4 feet. The walls are 20 inches thick.

There has been another small temple to the S. S. W. of that last described, but it is now only a heap of stones; and on its N. W. side I think there are the foundations of one, if not two, more temples.

To the N. N. E. of the central building are the ruins of a very elegant temple (G), the interior of which formed a square of about 9 feet. The walls were plain, with a cornice of 3 horizontal bands, the centre one having a rounded edge. The walls are  $2\frac{7}{8}$  feet thick.

\* See Cunningham, plate No. X.

† See Cunningham, plate No. XI.

The only entrance is to the S. S. W. The head of the doorway is round, and has a few parallel and perfectly plain mouldings, which are joined to the similar mouldings of the sides by short horizontal returns. To the N. E. of the last, and a few feet only distant, are the ruins of another small temple, the ground plan of which was a square of  $6\frac{1}{4}$  feet.

The wall enclosing all of these buildings, has been plain and very massive. Many of the stones are still in their places on the N. N. W. side, some of them being 7 feet long, 22 inches high, and 22 inches thick. The wall measures 161 feet by 118 feet, the longer sides being towards the river and the hill respectively. On the former side the wall forms a support to the platform on which the temples stand; and on the latter, a facing to the hill side, which has either been cut away to form the quadrangle, or has subsequently come down in a landslip, threatening to bury all the buildings in its descent towards the river. Wherever the lower part of the wall remains and is visible on the outside (as it is near the gateway), there is a string course, like that at Bhaniyar.\*

Immediately beyond the enclosing wall, at its N. N. W. corner, is a tank (T) of most delicious water, very cold and clear. The bottom of the tank is considerably above the level of the quadrangle, which might therefore have been kept flooded from the tank. The water issues from the hill on the N. W. W. side of the tank, through the stones of the wall, and was probably the cause of this site being selected for all these buildings. Not only the temples, but the neighbourhood is now forsaken by all human beings, and there is not a *resident* Hindu for many miles. But the spring (S) still runs on the same as ever, affording another instance of the temporary nature of man's greatest devices compared with that of things not human.

To the west of the tank, and the north of the second group of temples, on the hill side, and almost buried in the ground, are the ruins of a small solitary temple. The roof is broken into two portions (like that of the Payach temple†), of which the upper one, a pyramid formed of a single stone  $2\frac{5}{8}$  feet square, is still in its place.

The situation of the two groups of buildings is very wild and secluded, but not grand like that of the Bhaniyar temple.

\* See *ante*, p. 94, and Photograph, No. III.

† See Cunningham, plate No. XII.

They are on the right bank of the Kanknai river, about 3 miles above Wangat, and not on the Brahimsur stream, where the latter place is incorrectly marked in the trigonometrical survey map. The Kanknai is nearer to the temples than the Jhelum is to that of Bhaniyar, and is quite as noisy as the latter river, but its dimensions are much less. The mountains on both sides of the stream above the temples rise to a great height and are very steep. They are covered with forests of pine and fir; and, not far distant to the N. N. E., the head of the valley is closed by a bare, dark green hill, with the snow still remaining in its clefts on the 27th of July. The temples are built of a coarse, pale granite, like that used at Bhaniyar, and mortar is found in most of the buildings. There are tall firs growing out of the roof of the principal temple of each group, and many of the smaller temples have been much injured by other trees forcing their way through the walls.

The best way to the temples from Srinagar is by Gundurbul, Kuchnungul, and Wangat.

#### DYAMUN, BETWEEN NOWSHERA AND URI.

On the left bank of the Jhelum, between Nowshera and Uri, and about  $3\frac{1}{2}$  miles from the latter place, are the ruins of a fine temple and gateway, similar to those of Bhaniyar.\* There has been also a surrounding quadrangle, but very little of it remains.

The ground plan of the temple is a square of 23 feet, with corner pilasters  $2\frac{5}{6}$  feet thick and six inches projected beyond the walls of the building. The porches, of which three contain closed doorways, are each 16 feet wide, with a projection of  $1\frac{3}{4}$  feet. The doorways have square heads with plain straight mouldings, and are surmounted by pediments containing the trefoil ornament. The pediments are supported on half engaged fluted pillars. The only entrance, viz. to the W. N. W., is approached by a flight of steps like that of Bhaniyar.†

The interior is a square of 12 feet, but is nearly filled up with the debris of the pyramidal roof. The interior walls had a cornice of three plain mouldings, like those of one of the larger temples at Wangat.‡ Part of the pyramidal roof is still standing. It has been

\* See *ante*, p. 91, and Photographs, Nos. I. II. III. and XIII.

† See Photograph, No. I.

‡ See *ante*, p. 102.

very massive, but hollow. The basement of the temple is like that of Bhaniyar,\* but a good deal of it is concealed by earth and jungle.

The steps of the temple are about  $19\frac{1}{2}$  feet from those of the gateway, but the latter are covered with earth and fragments of stone.

The exterior face of the surrounding wall has been ornamented like that at Bhaniyar,† and there were two recesses in the corners of the front wall, like those at Marttand and Bhaniyar. The colonnade of the interior has entirely disappeared, if any ever existed. I found no fragments of small columns, like those of the Bhaniyar peristyle; but the quadrangle is so filled up with earth, fragments of stone, trees and jungle, that whole pillars may be concealed from view. I think there was a peristyle; because behind the temple I found part of a basement, like that on which the columns of the peristyle stand at Bhaniyar.‡

The gateway is built on the same plan as that at Bhaniyar,§ and is  $23\frac{1}{2}$  feet wide. It is divided into two compartments, each 17 feet by  $5\frac{1}{8}$  feet. The short side walls of each compartment are decorated with two trefoil headed niches, one above the other, with pyramidal pediments. The upper part of the gateway has disappeared, but fragments of the four large fluted columns which supported the architrave, are lying about in the neighbourhood, and also the capital of one of these columns, elaborately carved with small figures and flowered ornaments. Nearly the whole of the outer wall of the quadrangle is still standing, but its character is concealed, in most parts, by the earth which on three sides is up to the top of the wall. The whole of the ruins are so buried in jungle that I passed along the road, on my way to Kashmir, without noticing them at all. The material is black stone (I think limestone), streaked with veins of white marble.

The situation is wild, like that of the Bhaniyar temple, the hill rising to a great height immediately behind the ruin.

#### MANUS BAL.

At the S. E. corner of the lake of Manus Bal, there is a small temple, of which the roof only was above the water on the 9th of

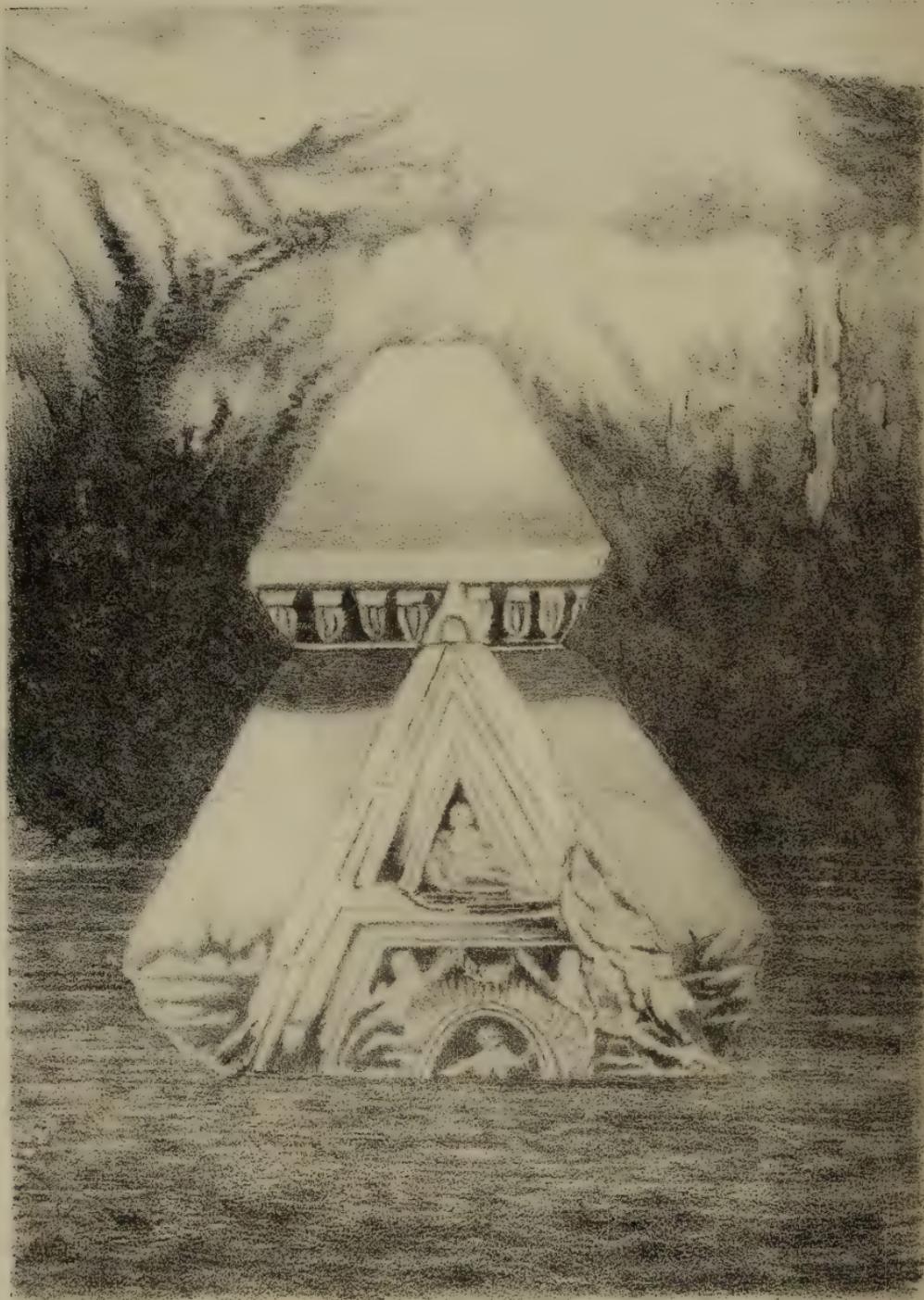
\* See Photograph, No. I.

‡ See Photograph, No. II.

† See Photograph, No. III.

§ See Photograph, No. III.





On stone by Kristo Hari Das Student Govt. School of Art Calcutta.

TEMPLE IN LAKE AT MONUSBAL

LITH: BY H. NIVEN, SURVEYOR GENL<sup>o</sup> OFFICE CALCUTTA JULY, 1866

August. (Plate XIX.) In the winter, I was told, the building stands on dry ground. At other seasons the whole is sometimes below the surface of the lake.

The roof is very like that of the Payach temple,\* being broken into two distinct portions by an ornamental band; each portion being formed of a single stone. The upper stone is 5 feet square at its base, and is plain on all sides. The ornamental band† is like that of Payach, divided into spaces alternately projecting and retiring. The latter are square and occupied by the lotus; but the projecting ends are carved into upright mouldings, slightly rounded at top and bottom, and surmounted by a straight and horizontal band. The north, south, and east sides of the lower portion of the roof are plain. The top seems to have been crowned by a melon-like ornament, of which the base only remains.

The temple appears to be a square of about 6 feet, and has only one doorway, to the west, covered by a pyramidal pediment, which is divided into two portions by a horizontal return of the side mouldings, as in the case of the Martand colonnade.‡ The upper portion is occupied by the head and shoulders of a figure holding a sort of staff in the left hand, and with something, which I could not make out, under the left arm. (See Plate XIX.) In the niche (like those at Payach§) formed by the trefoil over the doorway, there is a sitting figure, holding a sort of club in the left hand. The angles of the lower portion of the doorway pediment, below the horizontal moulding and above the trefoil, are occupied each with a naked figure leaning against the head of the trefoil, and holding up over the arch a sort of waving scarf, which is passed on through their other hands.

#### LANKA.

On Lanka island there are the ruins of a very fine temple. Its ground plan appears to have been a square of  $34\frac{1}{2}$  feet, with a sort of antechamber to the S. E. E., which is 11 feet wide, including the walls. The latter are  $2\frac{5}{12}$  feet thick. This *antechamber* projects  $5\frac{3}{4}$  feet beyond the walls of the *Naos*. The exterior walls of the temple are ornamented with two rows of deep niches with cinq-foiled

\* See Cunningham, plate No. XII.

‡ See Cunningham, plate No. XVI.

† See Cunningham, plate No. XII.

§ See Cunningham, plate No. XII.

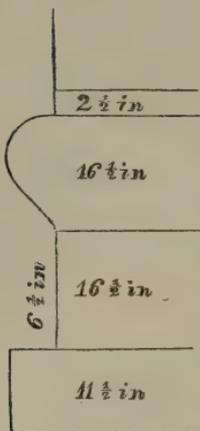
heads, flanked by half engaged fluted columns. The wall on each side of the antechamber has three of these niches in each row, *i. e.* 12 niches in all.

There are many small pillars lying about, almost uninjured, and more fragments of similar pillars. The columns measure 8 feet  $6\frac{1}{2}$  inches, including base and capital, the latter being like that of the small pillars of the Marttand\* peristyle, but with beading between the egg-shaped ornaments. The capital of these pillars is  $14\frac{1}{2}$  inches in height. They have 6 flutes, and their diameter is  $16\frac{1}{2}$  inches. The exterior face of the walls of the antechamber have only one of the niches in each row.

The doorway is to the S. S. E., but I did not feel sure that there had not been doors on the other sides also.

On the S. S. E. side of the island there is a flight of steps with flanking walls; and close by, in the water, a large *lingam*. There are heaps of hewn stone on all sides of the island at the water's edge, including fragments of square headed doorways, pyramidal pediments, &c., and I think the island must all have been surrounded by a quadrangular wall, with a peristyle and recesses on the interior, as at Marttand.

Near the steps are the remains of a cistern like the smaller one† at Bhaniyar. The building stands on a basement, of which a woodcut is given in the margin.



#### NARAYAN THAL.

This temple stands in a small tank‡ on the right hand side of the road, going from Baramula to Mozufferabad, and about  $2\frac{1}{2}$  miles to the S. W. of the former place. It is situated in a hollow at the foot of the hills, and is buried in trees; and it may, therefore, easily escape the notice of travellers who are not looking out for it. The temple is a square of  $13\frac{1}{4}$  feet, with plain walls. There is only one doorway  $3\frac{5}{12}$  feet high, and 3 feet wide, on the east side, its top being formed

\* See Cunningham, plate No. XV, and plate No. VII, fig. 6.

† See *ante*, p. 97.

‡ See photograph, No. XVII.

by the ends of two stones, whose lower corners are rounded off, forming an arch one foot high. The walls are formed of eight courses, of which two are below the surface of the water.

The roof of the temple is a low pyramid, also formed of eight courses, of which the lowest projects a few inches beyond the face of the walls. The second course from the top of the roof is formed of one stone,  $4\frac{3}{4}$  feet square at the bottom, and  $1\frac{1}{4}$  feet high. Over it are three small stones, forming the uppermost course, of which the centre is pierced with a hole, 6 inches in diameter, apparently made to receive the end of a finial that is wanted to complete the pyramid.

The interior is a square of  $7\frac{1}{4}$  feet, and is  $9\frac{5}{2}$  feet high. The floor was in July more than a foot below the surface of the water. The inside walls are formed of horizontal courses, each consisting of four stones only, one on each side of the building. The course over the doorway is slightly projected and rounded, forming a sort of string course along the walls. Above it are eight courses; the sides of the building diminishing in length as they near the top, and the slope of the walls being straight.

The uppermost course of the interior walls, forming a small square opening, is crowned by a single flat stone.

There are a great many stones lying about the tank, but I could not find the foundation of an enclosing wall,\* and, owing to the rushes and other weeds which abound in the water, I could not ascertain whether the bottom of the tank had been flagged or not. I did not find any part of the pedestal of a *lingam* in the temple.

The tank is fed by a running stream, which comes from a spring in the side of the hill immediately behind.

Some of the stones of the temple walls are  $9\frac{1}{2}$  feet long and 13 inches high.

#### FUTTEHGUR, KASHMIR.

After crossing the hill at the end of the valley, about two miles from Baramula, on the way to Nowshera, a short distance off the road, to the left, towards Gul-murg, there are the ruins of a grand temple, in a village called (since Runjeet Sing's conquest of the country) Futtehghur. Runjeet had a fort built round the temple,

\* See Cunningham, p. 288, para. 11.

using the stone of its pyramidal roof, and probably of its enclosing quadrangle, for the construction of his walls of defence. The ground plan of the temple is a square of  $46\frac{2}{3}$  feet. There were four porches, each  $27\frac{1}{3}$  feet wide, with a projection  $3\frac{1}{2}$  feet beyond the temple walls. The only door was on the W. N. W. side, the other three porches containing closed doorways, like those at Bhaniyar.\* The doorways had pyramidal pediments, the tympanum being occupied by the trefoil ornament, and were supported on half engaged fluted columns, with capitals decorated with the egg-shaped ornament.† The doorway pediments were surmounted by those of the porches, with noble trefoiled arches occupying the tympanum; the principal pediments being supported on fine square pilasters, and the arches resting, as usual, on half engaged square pillars of their own. The corner pilasters are  $7\frac{1}{3}$  feet thick, and  $4\frac{1}{2}$  inches projected. The capitals of the square pilasters, like the entablature of the exterior walls, were ornamented with small trefoil-headed niches, containing naked human figures standing; and over them was a row of lotus flowers in small square panels. The interior measures 29 feet across, and seems to have been octagonal, the four principal sides measuring each  $18\frac{1}{2}$  feet, and the other four each 9 feet; but the whole building is buried in earth and the debris of the roof nearly up to the top of the doorways, and it is consequently not possible to take all the measurements accurately. Some of the stones (black limestone?) are very large, measuring  $10\frac{7}{8}$  feet in length  $3\frac{5}{8}$  feet in height, and  $3\frac{1}{8}$  feet in thickness. From the exterior face of the porch to the back of the recess formed by the closed doorway is  $8\frac{1}{2}$  feet.

#### Tewan.

About a mile to the left of the road beyond Bimbaga, at a village called Tewan, near the foot of the hills, there are the ruins of a temple built after the plan of the principal temples beyond Wangat, but of smaller dimensions. It has only one door, viz. to the south; but there are porches, similar to that on the south, on the other three sides, containing closed doorways. The roof is entirely gone, and the walls look as if they would very soon topple over. The basement is buried. The

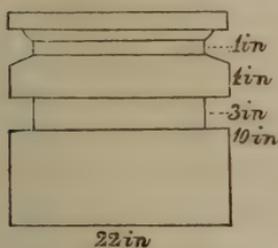
\* See photograph, No. I.

† See Cunningham, plate VIII. fig. 6.

interior is a square of about 11 feet. The temple seems to have stood in a tank, and to have had an enclosing wall. Immediately behind is the steep hill side, covered with fine spreading cedars.

#### TEMPLES AT PATHAN SUGANDHESWARA.\*

The inner chamber of this, the smaller of the two Pathan temples, is, as Cunningham says, "quite plain," except that in the west wall there are four small niches in a line,  $5\frac{1}{2}$  feet from the floor, two with trefoiled heads and two square-headed. To the right of the gateway ruins there is a fragment of a fluted column, one foot in diameter, like those of the Avantismami peristyle, and, a little further to the front, a fragment of a larger fluted column (having 20 flutes)  $1\frac{2}{3}$  feet in diameter.



Down each flute there is a flat band, one inch wide, slightly projected. Near the latter fragment there are pieces of two trefoil-headed arches, and the capitals (with parts of the shafts) of two of the colonnade pilasters. There is also, on the same spot, the base (22 inches square) of a small column, cut on three

sides only.

#### SANKARA GAURESWARA.

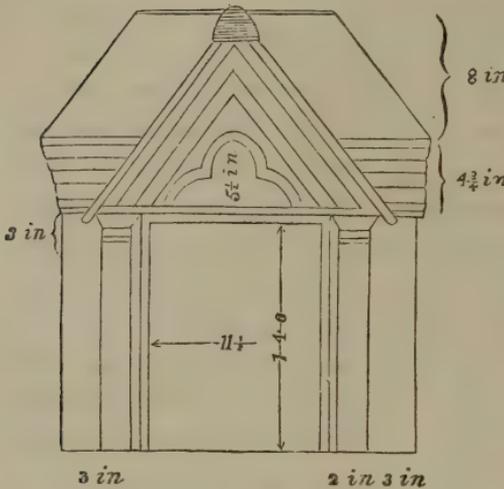
Nearly opposite this, the larger of the two Pathan temples, on the left hand side of the road in a bagh of cherry trees, there is a fragment of a small fluted column† (having 16 flutes), one foot in diameter, similar to that of the Pampur peristyle. The fragment measures about 3 feet in length, and is standing up out of the ground, marking the site of a Mahomedan grave. And in a field to the east of the temple, there is another fragment of the same or a similar pillar. In the village of Pathan, I found the base of a small column like that described near Sugandheswara, and another of a larger column. In and about the village, there are numberless huge stones, squared and otherwise carved, which probably belonged to the enclosure of one or both of the temples. To the east of the entrance porch of the larger temple, at 90 feet distance, there is the foundation of a wall of squared stones, and I thought I could trace the foundation of a gateway.

\* See Cunningham, page 281.

† See Cunningham, page 283.

## KOHIL.

At Kohil, between Awantipore and Payach, there is a miniature



temple, cut out of one stone, standing near a Mahomedan tomb, within an enclosing wall of recent construction. (See woodcut.) The interior of the temple is a cube of 15 inches, with the centre of the roof hollowed out into a dome; and the walls are 5 inches thick.

The exterior walls are 2 feet long without corner pilasters, and there is only

one entrance. On three sides there are closed doorways, with pediments like that of the entrance. The apex of the doorway pediment is on a level with the top of the lower division of the roof, as at Payach,\* and projects 5 inches beyond the roof at the same level. As at Payach, also, the pediment is unbroken, and contains the trefoil ornament. The doorway pilasters project one inch beyond the face of the wall. The basement of the temple, and the upper division of the roof are missing.

At the same place there are the bases of 3 small columns, whose diameter has been 8 inches. Of their bases, the plinth is 7 inches high and  $11\frac{1}{4}$  inches wide. The upper member also is square, and somewhat like that of the Marttand peristyle columns,† 3 inches high.

## DRUBGAMA.

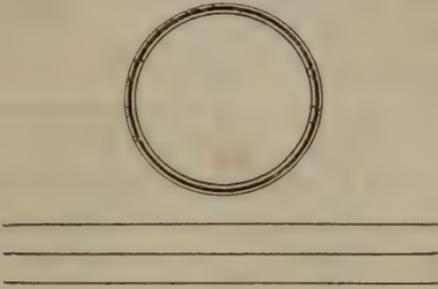
Between Ramoo and Shapuyon, a few yards from the road, on high ground, near Drubgama, is a miniature temple, like that at Kohil, cut out of a single block of stone 2 feet  $8\frac{1}{2}$  inches square, and 4 feet  $5\frac{1}{2}$  inches high.

It has one door to the south, with a horse shoe-shaped arch, covered by a pyramidal pediment, broken into two portions by a return of the

\* See Cunningham, plate XII.

† *Ibid.*, plate XV.

side mouldings. The upper portion is occupied by a small trefoil ornament, and the lower one contains a small round ornament, resting on the base, thus :



The width of the porch on the south side is 2 feet. On the north side there is a recess like those of the Pathan temples,\* with a cinquefoiled head, covered by a pyramidal pediment broken into two portions of which the lower one is occupied by a flowered ornament. A larger pediment supported on half engaged pillars surmounts the former one. The east and west walls have porches very slightly projected, with pyramidal pediments resting on the jambs of square-headed doorways. The tympanum of the pediment is occupied by a large trefoil ornament.

The roof of the temple has been formed of two stones, of which the upper one has disappeared, as is the case in the Kohil model.

The temple seems to have stood in a very small tank faced with stone walls. I could not find any trace of a basement. In front of the temple there are stones which I took for the foundation of a small rectangular building.

#### PANDRETHAN.†

The floor of this temple on the 7th of August was  $3\frac{5}{12}$  feet below the surface of the water, and above it there were  $5\frac{1}{12}$  feet of wall. The opening on the south‡ (differing from those on the other three sides) appears to have been made subsequently. Its sides are not splayed like those of the other doorways, and seem not to have been regularly cut, but rudely broken away. In fact, one stone on the west side of

\* See Cunningham, p. 283, para. 1.

† *Idem*, page 283.

‡ *Idem*, p. 287, para. 9.

the opening is not flush with the rest, but projects a couple of inches or so beyond the general level of the face of the wall. I think there had been originally a closed doorway outside on the south, like those at Bhaniyar\* and that the interior of the wall on that side was originally built up and plain.

General Cunningham's drawing of the ceiling of the temple is not quite complete. From the accompanying very accurate sketch made by Mr. R. T. Burney of the Civil Service, (Plate XVIII.), it will be seen that the angles of the square in which the beaded circle is, are occupied by naked human figures, as well as the angles of the other squares. These innermost figures have both arms outstretched, like those at Payach† seeming to hold up the circle. They have drapery about their shoulders, resembling light scarfs. The brackets supporting the cornice were once ornamented, and show marks of great violence having been used to destroy the carving. Each appears to have represented a human head; for on several of them there still remains on both sides what looks like plaited hair. The pediment pilasters project 5 inches beyond those supporting the trefoiled arches. The corner pilasters of the building are 1 foot 10½ inches thick. I found what I took for mortar in all parts of the building.

#### MARTTAND.‡

The middle chamber of the centre edifice is 14 feet by 6½ feet; and the innermost one, the naos of the Greeks, is 18 feet by 13½ feet, having the remains of a cornice, about 18 inches high, in the S. E. corner. I could find no trace of trefoil-headed panels or any other ornament on the outer walls of the quadrangle.

The large pillars at the extremities of the wall (in which the gateway is) outside, have, I think, supported the pediments of cells like those in the front wall at Bhaniyar.§

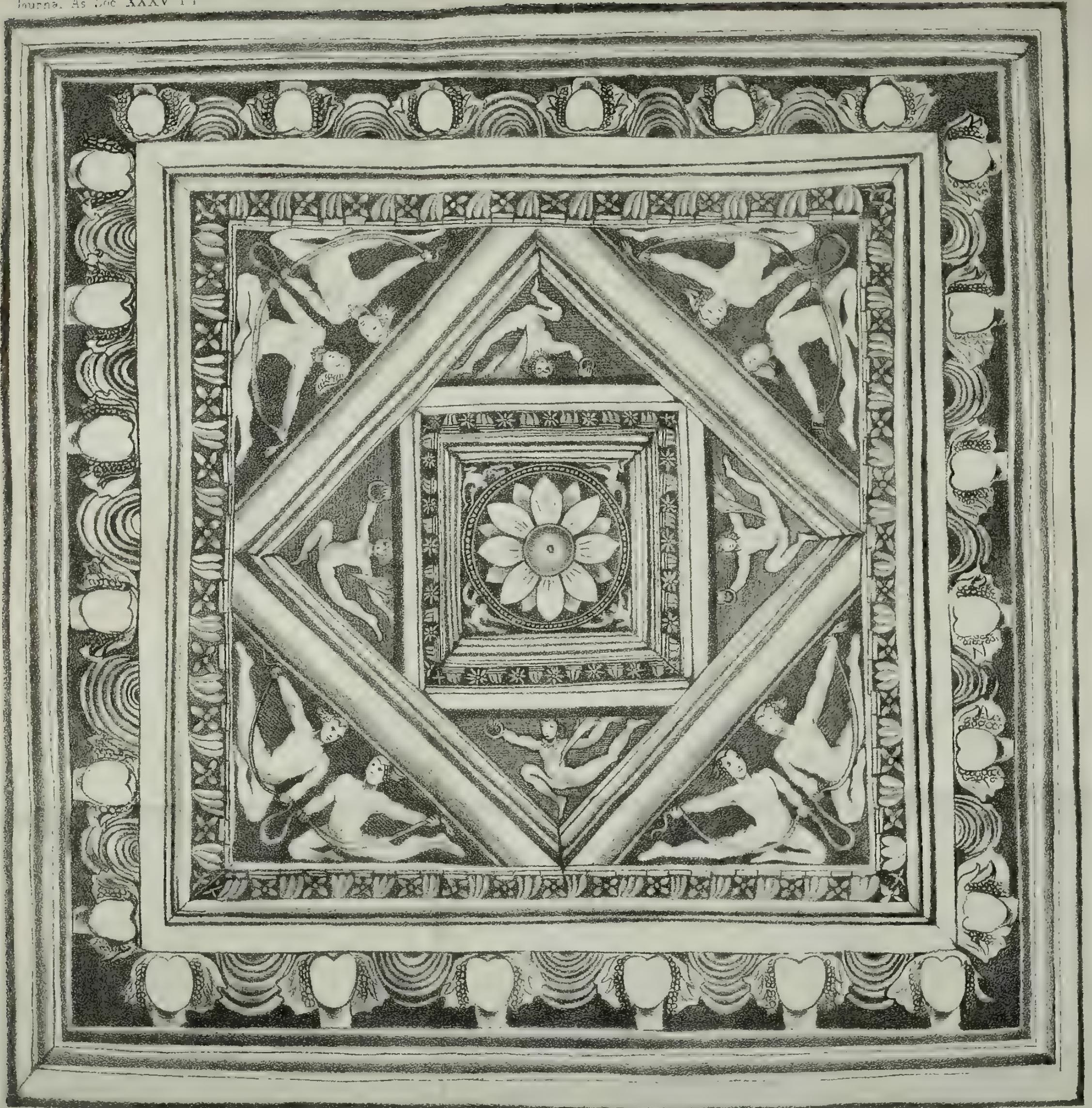
The leading feature of the entablature of the middle chamber is the cinqfoiled headed arch, resting upon small half engaged hexagonal pillars. See woodcut on next page.

\* See *ante*, p. 92.

† Cunningham, plate No. XII.

‡ Ibid, page 258.

§ Ibid, p. 270, para. 25, and Photograph, No. XXIII.



Drawn by R. T. Burney Esq<sup>r</sup> C. S.

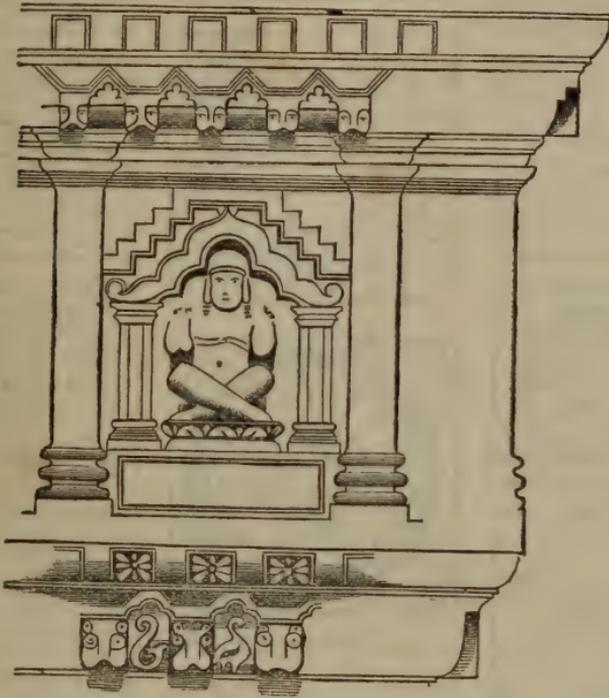
ROOF OF PANDRETHAN TEMPLE

LITH: BY H. NIVEN SURVEYOR GENERAL'S OFFICE CALCUTTA JUNE 1866

En stone by Kamakha Churn Ghose, Student Govt. School of Art, Calcutta.



The soffits of the arch, leading from the arddhamandapa or porch, to the antarala or mid-temple, is highly decorated. (See Cunningham, plate XVI. and woodcut overleaf.)



TAKHT-I-SULIMAN.\*

With all deference to General Cunningham, I should call the ground plan of this temple a *square*† of  $14\frac{2}{3}$  feet, with projections on each side.

The diameter of the interior of the temple is  $15\frac{1}{4}$ . The thickness of the wall on each side of the door is  $5\frac{5}{8}$  feet, and the doorway is projected 2 feet.

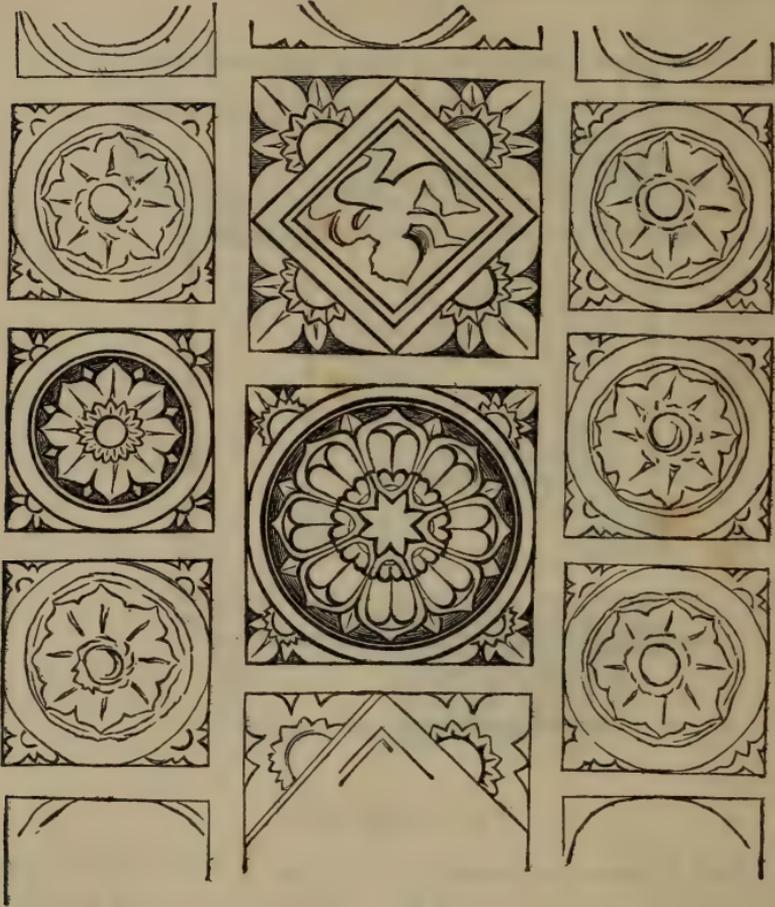
Only one side of the enclosing wall is perfect; and it contains 14 rectangular recesses. The wall on another side is partly standing, and seems to have contained 13 recesses. These walls each measure 22 feet in length on the inside. The outside of the wall is quite plain.‡

\* Cunningham, page 247.

† Ibid, p. 270, para. 25, and Photograph, No. XXI.

‡ Ibid, p. 250, para. 18.

The basement of the wall is  $2\frac{7}{12}$  feet thick, projecting on the inside one foot beyond the wall itself. The height of the basement is 10 inches.



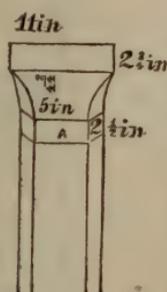
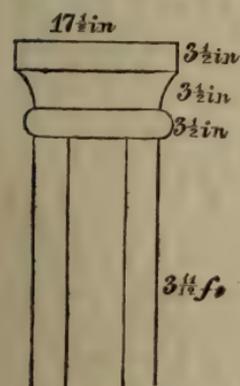
(Soffits of entrance arch of Temple. Marttand.)

The sloping walls, flanking the steps leading from the entrance, are  $2\frac{3}{4}$  feet thick. The surrounding walls and the entrance are in much better preservation than the temple itself. The entrance has a round top (like those of the arched recesses in the rectangular panels\*), whereas the doorway of the temple is narrow and pointed. For these and other reasons, I believe the surrounding wall and the steps to be much more recent in date than the temple.

\* See Cunningham, p. 250, para. 8.

I was assisted in taking the above measurement by W. Elmslie, Esq., M. D.

To the north of the temple, a few feet distant, there is a small rectangular building. Its interior is 11 feet by  $10\frac{5}{8}$  feet, and the walls are  $2\frac{7}{12}$  feet thick. The



roof is formed of large plain slabs, supported on four horizontal stone beams, 15 inches wide, and  $6\frac{1}{2}$  inches high. Each of these beams is formed of two stones. These beams again rest, in the centre, on another stone beam (formed of 2 pieces)  $10\frac{5}{8}$  feet long, 11 inches high and 16 inches wide,

and supported on two stone pillars (of 8 flat faces each) without bases. Including the capitals, the pillars are 4 feet  $10\frac{1}{2}$  inches high and  $23\frac{1}{2}$  inches thick. (See woodcut.) The capitals are not alike.

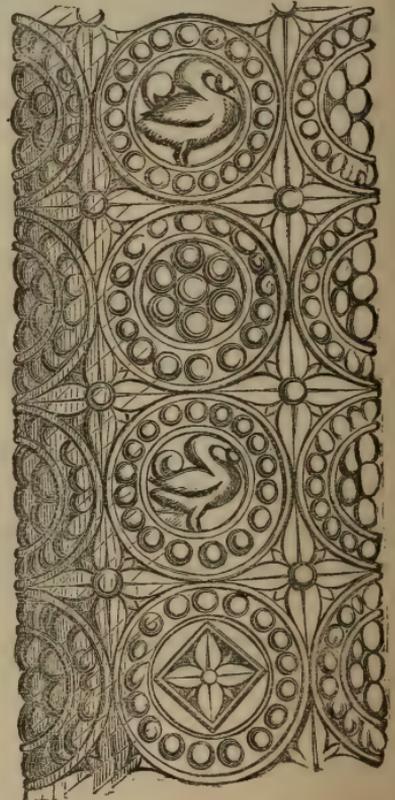
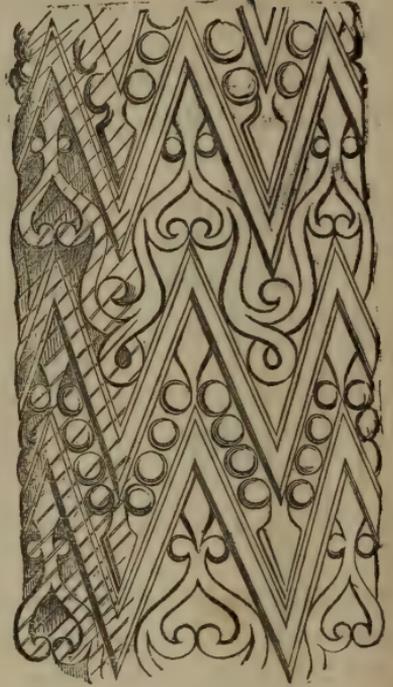
There is one entrance to the east, as in the temple close by. It is round headed, with plain mouldings parallel to the sides and top. The walls outside and inside are plain. The exterior of the roof is gone.

#### AVANTISWAMI.\*

Though the Dewan at Srinagar readily consented to my opening up the ruins of Avantiswami, I experienced great difficulty in obtaining bildars and coolies for the work. For some weeks I could not get any at all, and most of the work was done by very old men and children.

I excavated the whole of the peristyle on the south side of the quadrangle and the part of it between the S. W. corner and the gateway. At first I hoped that the displacement of the entablature over the colonnade was only local; but, on continuing the excavation,

\* See General Cunningham's Essay, p. 276, and the Bishop's letter to the Asiatic Society, 1865.



I found that the whole of the entablature on the south side had been thrown down before the silting up of the quadrangle. Notwithstanding this circumstance, the pedimental pilasters of the recesses have scarcely been injured at all. This is specially remarkable in the case of one pair of pilasters, which are ornamented with figures representing Siva or some other divinity. The woodcuts on page 122, from a drawing by Mr. H. Wilson of the Civil Service, give a very faithful representation of four of these pilasters.

#### KUNAMOH, &c.

At Kunamoh and Kroo, beyond Pampur, to the left of the Islamabad road, there have been temples in the middle of small tanks, which (latter) still remain. At Tapur also, between Pathan and Baramula, there are the foundations, if not the entire basements, of two fine temples; and near Woossun, on the right bank of the Sind, there are likewise extensive ruins of similar buildings.

About one mile from Baramula, on the left bank of the Jhelum, are the foundations of a wall 90 yards square, enclosing a small *tope*. This is probably the ancient Jayendra Vihar. Near the wall there are the foundations of a large village or city. Stones of all shapes are strewn over the ground to the extent of some acres. In one place there is a heap of huge blocks, which are evidently the debris of a temple long ago overturned. There is also a small mound resembling a Buddhist *tope*, also covered with loose stones. Near its top is a very large *lingam*. A few hundred yards from this mound, in an orchard, there is another and larger *lingam*, measuring 17 feet in circumference near the base, and 9 feet in height.

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*Remarks on Barbier de Meynard's edition of Ibn Khordádbeh and on the Land-tax of the empire of the Khalyfs.*—By Dr. A. SPRENGER.

[Received 23rd February, 1866.]

*Le livre des routes et des provinces d' Ibn Khordádbeh, texte arabe publié, traduit, et annoté par C. Barbier de Meynard.* Paris, 1865.

Monsieur Barbier de Meynard is known to us as the author of the *Dictionnaire Géographique de la Perse*, and as the editor and translator of the *Travels of Ibn Baṭūṭá* and of the *Golden Meadows* (or more correctly, as Gildemeister explains this book title, "the gold washings) of Masúdy. To these important publications he has lately added that of *Ibn Khordádbeh*, and at present he is engaged with *Moqaddasy*. As soon as he has completed this work, we may say that he has done more for oriental geography, than all Arabists past and living together. Barbier de Meynard has visited the East, and he is an 'Alamdyda and a man of vast erudition. His way of working differs essentially from that of his confrères of the old rotten school. He gives us good texts and close yet elegant translations, and does not waste his time in puerile notes, replete with philological subtleties and nonsensical explanations, in which men whose ideas do not extend beyond the narrow limits of the school, delight so much.

The most ancient MS. of the geography of *Ibn Khordádbeh* is that of Oxford, which has hitherto been considered as unique. To the zeal of Monsieur Barbier de Meynard and to his knowledge of the East we owe the discovery of another copy, which was found at Constantinople. Notwithstanding this important discovery, it was an extremely difficult task to establish a good text of *Ibn Khordádbeh*. I do not maintain Barbier de Meynard has succeeded in every instance to fix the correct reading, but I assert, without fear of contradiction, that no Orientalist could have done more for amending the text than he, for no man has a better knowledge of Eastern geography. The editor suffered under one great disadvantage: he could not consult the MS. of Oxford, whilst the work went through the press, and the transcript which he made use of was not taken by himself. The Oxonians are as jealous of their literary treasures as an eastern prince of the hundreds of ladies in his harem, and as they have no particular

predelection for Eastern lore (they have in fact better things to do), they derive about as much advantage from them. I copied the Oxford MS. for my own use, and in some instances I prefer my own reading. Baron de Slane published in the "Journal Asiatique" an account of Qodáma's work on the Kharáj, a book which I shall frequently quote in this paper. I might probably have avoided many mistakes arising from the incorrectness of my extracts from Qodáma, if I had had the good fortune to consult the Baron's remarks, but unfortunately I do not possess the Journal.

Ibn Khordádbeh wrote about A. H. 250 (A. D. 864.) His geography is small, and fills only 127 pages octavo, but it is of immense importance, inasmuch as it consists almost exclusively of official documents, and contains the caravan and dawk stations of the whole empire of the Khalyfs, and the amount of revenue of every district. I have inserted his itineraries in my "Post-und Reiserouten des Orients," and some of them will be taken from that compilation and embodied, as Mr. Hyde Clark writes to me, in Murray's Guide for the East. I therefore give here a short account of the revenue of the Khalyfs, extracted from Ibn Khordádbeh.

I must premise a few remarks on the weights and measures of the Arabs, making use of the researches which I made on the weights in my *Leben und Lehre des Mohammad*, Vol. III. p. 141, and in an essay on the *Wegmasse und Gradmessung der Aegypter, Griechen und Araber*, which is not yet published.

The standard of the Musulman weights is the Aureus of Constantine: 72 Aurei = 1 Roman pound = 5256 English grains Troy according to Gibbon, = 6165 grains de Paris according to Böckh. The Aureus, considered as the unit of weight, is called Mithqál, and may be taken = 4.6 Grammes or somewhat more. This weight of pure gold is according to the present value of the precious metals = 15.97 Francs. The Musulman Dirham is in weight =  $\frac{7}{10}$  Mithqál, and if consisting of pure silver, its value is = 72 Centimes. 1 Baghdádian rofl pound (the one mentioned in law-books) = 128 $\frac{4}{7}$  Dirhams = 90 Mithqáls = 11 $\frac{1}{4}$  Roman pounds = 409.536 Grammes = 1.1 pound Troy (nearly).

All other Musulman weights we must reduce, if possible, to the Mithqál (= Dynár = Aureus); for there existed various systems:

the grain and the weights, calculated by the number of grains which they contain, had, in some parts of the empire, and at one time, a greater or lesser value than in other parts and at other periods. There is a grain of which 72 make a Mithqál, there is a grain (شعيرة) of which 100 make a Mithqál, one of which 96 make a Mithqál, one of which  $68\frac{4}{7}$  make a Mithqál, and one of which 60 make a Mithqál, but this grain is called *Habba* and not *Sháyra*. The fact seems to be that the Persians, and after them the Mohommedans, found that the Roman Aurei are more equal in weight than any other coin, and for this reason they used it as standard, calculating the value of their own weight by Aurei. In some cases, slight alterations in the value of their own weights seem to have been made in order to adapt them better to this foreign standard. The apothecaries' weight, as we learn from Avicenna, was Greek, but not without some alteration.

According to the Dictionary of Techn. Terms, p. 176, there existed in the early ages of the Islam the same system as was in later times preserved at Samarqand. It may be expressed as follows :

| Mithqál. | Daneq. | Tassúj. | Habba. | Grain (Sháyra.) |
|----------|--------|---------|--------|-----------------|
| 1        | 6      | 24      | 48     | 96              |
|          | 1      | 4       | 8      | 16              |
|          |        | 1       | 2      | 4               |
|          |        |         | 1      | 2               |
|          |        |         |        | 1               |

Another system or *Çanja* we find in the *Qámús* under *Makkúk*, it may be expressed as follows :

| Mithqál. | Dirhem.        | Dáneq.         | Qyrát.          | Tassúj.         | Habba<br>(grain.) |
|----------|----------------|----------------|-----------------|-----------------|-------------------|
| 1        | $1\frac{3}{7}$ | $8\frac{4}{7}$ | $17\frac{1}{7}$ | $34\frac{2}{7}$ | $68\frac{4}{7}$   |
|          | 1              | 6              | 12              | 24              | 48                |
|          |                | 1              | 2               | 4               | 8                 |
|          |                |                | 1               | 2               | 4                 |
|          |                |                |                 | 1               | 2                 |
|          |                |                |                 |                 | 1                 |

This system is in the *Qámús* continued beyond the Mithqál, as follows :

| Makkúk. | Kaylaja. | Maná.           | Ro'l<br>(pound.) | Ounce. | Istár.          | Mithqál.           |
|---------|----------|-----------------|------------------|--------|-----------------|--------------------|
| 1       | 3        | 5 $\frac{5}{8}$ | 11 $\frac{1}{4}$ | 135    | 225             | 1012 $\frac{1}{2}$ |
|         | 1        | 1 $\frac{7}{8}$ | 3 $\frac{3}{4}$  | 45     | 75              | 337 $\frac{1}{2}$  |
|         |          | 1               | 2                | 24     | 40              | 180                |
|         |          |                 | 1                | 12     | 20              | 90                 |
|         |          |                 |                  | 1      | 1 $\frac{3}{8}$ | 7 $\frac{1}{2}$    |
|         |          |                 |                  |        | 1               | 4 $\frac{1}{2}$    |
|         |          |                 |                  |        |                 | 1                  |

In this table three systems of weight are brought together: the Roman monetary, the Greek apothecary, and the Persian heavy weights. I ought to observe that the grain of شَعِيرَة in Herat was, even in later times, so small, that 100 such grains were required to make up a Mithqál. In some places 3 *Habba* made a *Tassúj*.

I now insert an abstract of the calculations of 'Alyy *Hasany*, who wrote at *Murshidábád* in A. H. 1164, transcribed from his autograph.

1 grain of barley = 2 grains of riye = 4 grains of mustard.

1 *Másha* = 8 *Raty* = 36 grains of barley = 72 grains of riye.

1 *Tola* = 12 *Mashas* = 96 *Raties* = 9 *Dirhams* of the law-books = 6 $\frac{3}{10}$  *Mithqáls*.

A *Paysa* (copper coin) of 'Alamgyr has exactly the weight of one *Tola*, but the *Paysa* of Bengal, current in 1164, weighs 10 $\frac{1}{2}$  *Raties*.

1 *Sér* of 'Alamgyr = 60 *Tolas*.

1 *Man* of 'Alamgyr = 40 *Sérs*.

1 *Bengal Rupee* = 10 *Mashas* and 2 *Raties*.

1 *Delhi Rupee* = 10 *Mashas*.

1 *Ashrafy* = 9 *Mashas* and 6 *Raties*.

1 *Qyrát* =  $\frac{1}{20}$  of a *Mithqál* of the traditions = 3 $\frac{3}{7}$  grains of barley =  $\frac{2}{3}$  *Raty* and  $\frac{3}{7}$  grain.

1 *Dáneq* =  $\frac{1}{6}$  *Dirhem* = 8 grains = 1 *Raty* and 3 $\frac{1}{2}$  grains.

1 *Dirhem* = 6 *Dáneq* = 48 grains =  $\frac{7}{10}$  *Mithqál* = 10 $\frac{2}{3}$  *Raties*.

1 *Mithqál* = 68 $\frac{4}{7}$  grains = 20 *Qyrát* = 1 $\frac{3}{7}$  *Dirhams* = 14 *Raties* and 1 $\frac{1}{4}$  grains.

1 *Ro'l* of 'Iráq = 130 *Dirhems* = 91 *Mithqáls* = 6240 grains =  $\frac{3}{8}$  *Ro'l* of *Madya* = 1380 $\frac{2}{3}$  *Raties*.

1 *Ro'l* of *Makka* = 2 *Iráqy Róls* = 182 *Mithqáls* = 260 *Dirhems* = 12480 grains = 2773 $\frac{1}{2}$  *Raties*.

1 Modd =  $292\frac{1}{2}$  Dirhems =  $204\frac{3}{4}$  Mithqáls = 14040 grains =  $2\frac{1}{4}$  Iráqy or Baghdadian Rotls =  $1\frac{1}{2}$  Rotl of Madyna = 3120 Ráties.

According to some, one Modd =  $257\frac{1}{7}$  Dirhems.

1 Çá' = 4 Modd = 1170 Dirhems = 819 Mithqáls = 56108 grains = 12480 Ráties.

1 Korr = 1200 'Iráqy Rotls =  $533\frac{1}{3}$  Modd =  $133\frac{1}{3}$  Çá' = 156000 Dirhems = 109201 Mithqáls = 7488000 grains =  $2070\frac{1}{16}$  Sérs.

1 Wisq = 60 Çá'.

The values of Arabic weights reduced to Indian weights in this table, is certainly wrong. It is incomprehensible, how a man in his senses could believe that one Paysa is as heavy as  $6\frac{3}{10}$  Dynárs or 9 Dirhems. This error seems to arise from the supposition that an Indian grain is exactly equal to the largest Arabic grain, of which  $68\frac{4}{7}$  are sufficient to make a Mithqál, and  $4937\frac{1}{7}$  one Roman pound. Some other data of this table are probably equally incorrect, yet it contains some information which may be useful.

The value of cubic measures for grain is expressed by the Arabs in the weight of the quantity of barley which they contain. At this moment I have no book in which they are explained, and I must refer to dictionaries. Their explanations unfortunately do not square, because the Çá' and the Maná have different values in different authors. According to Abú Hanyfa 1 Çá' of Barley = 8 Rotls; according to Sháfí'y =  $5\frac{1}{2}$  Rotl; according to the Shy'ites = 9 Rotls; and according to Kolyug = 1170 Dirhams =  $9\frac{1}{10}$  Rotls. On the Maná Meninsky says: apud Arabes Hispanos duas libras, apud Asiatas 260 Drachmas appendebat. Maná ægyptiaca, pondus sedecim unciarum; mana græca, pondus 20 unciarum; maná alexandrina pondus 30 unciarum. (Casiri Bib. ar-hisp.)

The measures of importânce for our present purpose are the Qafyz, the Korr and the Jaryb.

1 Qafyz = 8 Makkúk (which is not the name of a weight, but of a cubic measure). Consequently 1 Qafyz = 8100 Mithqáls = 90 Rotls. According to Golius, 1 Qafyz = 12 Çá's; or if we take the Çá', with Abú Hanyfa, to 8 Rotls = 96 Rotls.

We find in the Qámús also the following explanation of the Qafyz, نیم ویده ویدیه بیست و دو یا بیست و چهار مد بود النبى باشد

"1 Makkúk =  $\frac{1}{2}$  Wayba; and 1 Wayba = 22 or 24 Modds, that is to say Modds of the prophet." And under Modd he says: "According to the people of 'Iráq, the Modd is equal to two Rotls, and according to the people of Hijáz to  $1\frac{1}{3}$  Rotl;" and lower down he states the value of the Modd of the prophet at one-fourth of a Çá'. Now if we take the Çá', with Abú Hanyfa, at 8 Rotls, the Modd has as in 'Iráq 2 Rotls, and if we take the Çá', with Sháfíy, at  $5\frac{1}{3}$  Rotls, the Modd holds as in Hijáz  $5\frac{1}{3} : 4 = 1\frac{1}{3}$  Rotls; and I therefore suspect that in one place two Rotls, in another place  $1\frac{1}{3}$  Rotls, were called Modd of the prophet. If we take the Modd at two Rotls, we have for the value of the Qafyz  $\frac{2}{3} \times 2 = 24$  Rotls." It is impossible to reconcile this statement with the preceding one.

There are in the Qámús two other definitions of the Makkúk, eight of which make one Qafyz. According to the one, a Makkúk weighs from six to eight ounces, that is to say, half a Rotl or  $\frac{2}{3}$  Rotls. It is impossible that this be the value of the Makkúk in question. According to the other statement, 1 Makkúk =  $1\frac{1}{2}$  Çá' or 12 Rotls, if we give to the Çá' the value of 8 Rotls.

From a passage of Qodáma, it appears that any small measure of corn was called Makkúk-bushel, and that the Makkúk was different in different countries. In the definition of the value of the Qafyz, I think the large Makkúk is meant, and I therefore assume 1 Qafyz = 96 Rotls or Arabian pounds.

The Korr. At this moment I have no access to the Arabic text of the Qámús, but to judge from the Persian translation and from the extracts found in Golius and Freytag, it seems that the Qámús contradicts itself. Freytag, without stating the authority, says, 1 Korr = 12 Wasq (camel-loads) and every Wasq = 60 Çá'. The value of the Wasq or Camel load depends upon the value of the Çá'; it may therefore be 320 or 480 or 540 Rotls. A camel may carry rather more than two hundred weights on either side, and I therefore take 480 to be nearest to truth. A Korr would therefore be equal to 5760 Rotls.

According to the Persian translation of the Qámús, 1 Korr = 6 ass-loads, and one ass-load = 60 Qafyz. Now a donkey carries about half as much as a camel or less, but according to the above statement, 6 ass-loads are = 12 camel-loads. Moreover 60 Qafyz

weigh 5760 *Rotls*, a burden which no beast is able to carry. It is therefore clear that one *Korr* contains 60 *Qafyz* or 12 camel loads of 480 *Rotls* each. Another statement of the *Qámús* says, 1 *Korr* = 40 *Irdabb*. The *Korr* is an 'Iráqian (Babylonian), and the *Irdabb* an Egyptian measure. One *Irdabb* = 24 *Çá'* or 6 *Wayba*. If the *Wayba* is taken at 24 *Modd*, and the *Modd* at  $1\frac{1}{3}$  *Rotls*, these two valuations agree; for  $24 \times 8 = 24 \times 6 \times 1\frac{1}{3} = 192$  *Rotls* = 1 *Irdabb*. Consequently the weight of a *Korr* = 7680 *Rotls*. We must bear in mind that this is a reduction of the largest Iráqian measure of grain to Egyptian measure, and it is very likely that the value of the *Irdabb* is stated in Egyptian *Rotls*, the weight of which I do not know; we can therefore make no use of this definition of the *Korr*. *Golius* gives the value of the *Korr*, on the authority of the *Destúr alloghat*, at 7100 *Rotls*. This approaches to the result which we have just found; the question is only, what kind of *Rotl* is meant, and by what means did the author arrive at this result.

The *Jaryb* is defined in the *Qámús* as follows: 1 *Jaryb* = 4 *Qafyz*; 1 *Qafyz* = 8 *Makkúk*; 1 *Makkúk* = 3 *Kaylaja*; and 1 *Kaylaja* =  $1\frac{1}{3}$  *Maná*. We see that this statement is a continuation of the one given above in a tabular form; and it seems to be an abstract of a systematical comparison of 'Iráqian weights and measures; and we therefore keep to it. Consequently 15 *Jaryb* = 1 *Korr*. I now continue the above table taken from the *Qámús*.

| Korr. | Jaryb. | Qafyz. | Makkúk. |
|-------|--------|--------|---------|
| 1     | 15     | 60     | 480     |
|       | 1      | 4      | 32      |
|       |        | 1      | 8       |
|       |        |        | 1       |

Consequently one *Korr* is equal in weight to 486080 *Mithqáls* or 6750 Roman pounds. I ought to observe that *Abú Yúsus* mentions a *Jaryb* of 7 *Qafyz*, and that he as well as *Ibn Sád* say that a man may live on a *Jaryb* of grain one month. I should think that fifty or sixty Roman pounds would be sufficient for the support of a man; and as the *Jaryb* of 7 *Qafyz* contains  $787\frac{1}{2}$  Roman pounds, I am at a loss, how to explain this statement.

The linear measures of the Arabs are probably not essentially different from those of the Greeks. 1 *Háschimite* or Royal cubit =

2 Greek feet = 32 Arabic inches = 273.32 lignes de Paris. The Arabs have besides a cubit of 24 inches (the ذراع اليد), and one (the black cubit) of 27 inches; the proportion of the former to the Háschimite cubit is as 3 : 4.

Regarding the square measures I am in the dark. According to an extract from the Akhwánalçafá, inserted by Dieterici in the Zeitsch. d. D.M.G., 1 Jaryb of 10 Qafyz = 3600 Háschimite square cubits. I suspect that there must have existed a Jaryb of  $\frac{7}{4}$  of this value or = 6300 Háschimite square cubits = 22700  $\square$  Pieds de Paris. This is, however, a question which ought to be further investigated by those who have better sources.

The history of the finances of the East, as handed down by the Arabs, begins with the Súsánians, but the two accounts which we have of their revenue, are extremely difficult to be reconciled with each other. Ibn Khordádbeh, p. 42, says :   
 وكان جيبى الكسرى البروز من خراج : مملكته في سنة ثمان عشرة من ملكه اربعة آلاف الف مثقال وعشرون الف الف مثقال يكون ذلك بوزن الدرهم سبع مائة الف الف وخمسة وتسعين الف الف ثم بلغت جباية مملكته ستمائة الف الف مثقال

Qodáma, in my incorrect extracts from the corrupted text, says :   
 يقال ان كسرى البروز احصي ناحية المملكة في سنة ثمان عشرة من ملكه و انما كان في يده ما ذكرناه و سمينا اعماله من السواد و ساير النواحي دون اعمال المغرب لان حده كان الي هيت و كان ما سمينا من المغرب في ايدي الروم من العين سبعمائة الف و عشرين الف مثقال يكون من الورق ستمائة الف الف درهم

There is no doubt that both accounts refer to the same fact, yet there is only one figure "600 millions of Dirhams" in both identical. This figure appears to me to express the amount of revenue in Musulman Dirhams. Ten Musulman Dirhams are *in weight* equal to 7 Mithqáls, consequently 600 millions Dirhams = 420 millions Mithqáls or 5,833,333 $\frac{1}{3}$  Roman pounds. The first figure of Ibn Khordádbeh is consequently to be read 420 millions instead of 24 millions. At the time of Qodáma 15 Dirhams (silver) had the value of one Dynár or Mithqál (of gold); consequently gold was only 9 $\frac{1}{2}$  times more valuable than silver. It seems, however, that gold had at times a higher rate, and that a pound of gold was equal in value to 10 pounds of silver. 420 Mithqáls of silver were therefore equal to 42 Mithqáls or Dynárs of gold in value. I consequently propose to read in Qodáma 42 mil-

lions instead of 720,000 Dynárs. The only difficulty is caused by the figure of Ibn Khordádbeh, 795 millions Mithqáls (of silver). It is clear that the author wants to say, that after the eighteenth year of Perwyz the revenue increased, and as 795 is a higher sum than 600, I take that this is the highest figure to which the revenue rose during his reign. After these observations I change the figures, and translate the passage of Ibn Khordádbeh as follows: "The Kheráj of the whole kingdom which was gathered for the Chosroes Parwyz in the year 18 of his reign amounts to 420 millions Mithqáls (of silver, read *اربعمائة الف* *الف وعشرون الف*). This makes, reduced to the weight of Musulman Dirhems, 600 millions of Dirhems. Subsequently the revenue of his kingdom rose to 795 Mithqáls."

The passage of Qodáma I translate: "It is asserted that Chosroes Parwyz counted in the year 18 of his reign the revenue (for *جباية* read *ناحية*) of his kingdom. He possessed all the provinces which I have enumerated, the Sawád and the other districts, with the exception of the western part of the Musulman empire; for the frontier of his kingdom was Hyt, and the country west of it belonged to the Greeks. He found that the revenue amounted to 42 millions Mithqáls (of gold), this makes 600 millions of Musulman Dirhams (of silver)."

The Musulman Dirham was not known to the Persians, they counted the revenue, as it seems, in Dirhams which had exactly the weight of a Mithqál or of an aureus of Constantine of which 72 made a Roman pound, and for this reason, in the original account which was used both by Ibn Khordádbeh and Qodáma, the sum was stated in Mithqáls. The money was weighed, and of course, if it contained alloy, deduction was made. We are therefore able to calculate the income with great accuracy, it is equal to 172,800,000 Rupees in value. If we reduce it to English money, we must bear in mind that the proportion of the value of gold to that of silver was not the same as in our days. In the Greek empire, it was fixed by law as  $14\frac{2}{3} : 1$ , and gold was the standard. In the Persian empire, the proportion was probably as  $10 : 1$ , and I am inclined to believe that in the document which Qodáma and Ibn Kordádbeh used, the amount of the revenue was stated both in gold and in silver. I have already observed that at Qodáma's time the proportion was  $9\frac{1}{2} : 1$ , and I have shown (das

Leben des Moh., Vol. 3, p. 136) that in Mahommedan law, it is as  $8\frac{2}{3}$  : 1 and even as 7 : 1.

In Persia silver was the standard, in the Byzantian empire gold. The Musulmans made no change : in the provinces which had belonged to the kingdom of the Sasanians, silver remained the standard, and in Syria, Egypt and other provinces which they took from the Greeks, gold continued as the standard. In Makka and Madyna, silver became the standard as early as Omar I., but in southern Arabia the revenue was calculated by Dynárs (Aurei.) The great difference of the value which gold had at Constantinople under Constantine, and which it had in the Sasanian and later in the Arabic empire, throws an unexpected light upon the relative prosperity of the two countries. The fact requires no comment for those who know the elements of Political Economy.

Ibn Khordádbeh begins his geography with a description of the Sawád—Babylonia. Immediately after the Musulmans had conquered that country, 'Omar I. sent 'Othmán b. Honayf to survey it for the sake of assessment. It appears that he measured the cultivated land of every district, and also for the sake of control the whole country *en bloc*. He found that it is from *Hadytha* in the north to 'Abbadán in the south 125 farsangs long, and from *Holwán* in the east to 'Odzoib in the west 85 farsangs wide. The whole surface of cultivated and waste land (عامرو غامو) amounts therefore to 10625 □ farsangs or 136607143 Jaryb. Ibn Khordádbeh (MS. of Oxford) and Qodáma calculate the surface in round figures at 136 millions of Jaryb.

Under the Sásánian king, Qobád b. Fyróz, the revenue of the Sávád amounted to 150 millions Mithqáls (of silver or Persian Dirhams) = more than 2 millions Roman pounds of silver = more than 214 millions of Musulman Dirhams. After the Musulman conquest, 'Omar I. derived a revenue of 120 millions Dirhams from it. This sum is named by Ibn Khordádbeh and Qodáma. Ibn Sád includes the revenue of *Jebel* and mentions a higher sum, but as two figures are wanting in his text, we cannot make out what he means, his words are مائة الف الف وعشرون الف الف و الف (الواق (آلاف) درهم ونصف

I shall speak on the assessment of 'Omar lower down. Here I will only observe that the 120 millions are made up by the land-tax and

capitation. The latter may have amounted to 7 millions: the male population of full age consisted of 500,000 souls, and the poorer classes had to pay 12, the middling classes 24, and the rich 48 Dirhams; supposing one in a thousand paid the highest, and one in a hundred the middling rate of capitation, this tax yielded 7,000,000 Dirhems and the land tax 113,000,000 Dirhems.

We see that the total income which 'Omar I. derived from the land of the Sawád is little more than half of that which it yielded under Qobád. It is not unlikely that 'Omar assessed it somewhat lighter, but the main cause of the diminution of revenue was the decay of the country. Babylonia has some resemblance with Holland, and the Sunderbunds, being the Delta of the Euphrates and Tigris; and it appears that great efforts have been made in former times to drain it and to protect it from inundation by dykes, and in measure as they were neglected, the land was converted into swamps. We find *paludes* in the map of Ptolemy, but they seem to have been of no great extent. The Tigris carries much silt, which is partly deposited in its bed, where it slackens its course, and consequently in the progress of time the bed became higher and threatened to inundate the country. To prevent this calamity, it was dammed in below Baçra, and the course was regulated: it was made straight, so that the water might carry off the deposit. During the reign of Qobád (probably after the time at which he derived so high a revenue from the Sawád) the dyke was broken through below Kaskar, and the neighbouring country was inundated, but the government took no notice. Anushyrwán had the dykes restored and much of the land was recovered. In the year 6 of the Hijra (A. D. 628) both the Euphrates and the Tigris swoll amazingly, and destroyed many of the dykes. King Parwyz showed great energy, and it is asserted that in one day no less than 40 gaps were filled up; yet though he granted great sums from the public treasury for the repairs, he was unable to remedy the evil. A few years later, the Arabs waged war against the Persians. The dykes were in consequence completely neglected, and the swamps gained in extent. The Musulmans, after they had conquered the country, seem not to have paid any attention to the matter, and the Dihqáns—heads of districts—were unable to repair the dykes. Mo'awiya I. sent his client 'Abd Allah b. Darráj to Babylonia as collector, and he seems

to have been the first Mahommedan who recovered some land. Much greater efforts were made by the Nabathean *Hassán*, who was collector under the reigns of *Walyd* and *Hischám b. Abd al-Malik*, and cut two canals to carry off the water. In A. H. 75, *Hajjáj* was appointed governor of *Babylonia*. He represented to *Walyd II.*, that the drainage of the country would cost three millions of *Dirhams*. The *Khalyf* thought he could spend the money more pleasantly on eunuchs and singers, and refused to grant so large a sum. *Moslíma b. 'Abd al-Málik*, a relation of the *Khalyf*, proposed to him to drain part of the swamps, under the condition that he should draw the revenue of the recovered land. The *Khalyf* accepted the offer, and *Moslíma* cut the two canals called *Saylaya*, and raised dykes. He succeeded in recovering a great extent of land, and the peasantry flocked to him to cultivate it. His family continued to derive the revenue from it up to the time of the overthrow of the *Omayide Dynasty*. The *'Abbáside Khalyf* granted it to one of his relations, *Dáwud b. 'Alyy b. 'Abd Allah b. 'Abbás*. His heirs remained for some time in possession of it, but eventually it was considered as one of the crown-lands الضياع السلطانية

In A. H. 75 *Hajjáj* was appointed governor of *Babylonia*, and he ruled 20 years over that country. *Ibn Khordádbeh* says of the financial condition of the country during his sway: "The revenue gathered by *Hajjáj* did not amount to more than 18 millions *Dirhams*, and there was consequently a diminution of one hundred (and two) millions. This was owing to his burning down villages, and to his oppression. Moreover he was obliged to give advances to the cultivators to the amount of two millions, so that only 16 millions reached the public treasury." It seems that the peasantry fled, for under the just *'Omar II.* who ruled in A.H. 99, the revenue of the *Sawád* suddenly rose to 124 millions.

It is a very unexpected fact that at the time of *Ibn Khordádbeh* not only the limits, but also the names of the districts were in the official language precisely the same which had been in use among the *Sásánians*, nay some of them seem to be even more ancient than the *Sásánians*; for we neither find a district called *Baghdád*, nor one called *Madáyin* (*Ctesiphon*). The province in which these two cities lie, is called *Shád-Hormuz* and the district *Kalwadzá*, from an ancient town half way between *Baghdád* and *Madáyin*.

The Sawád is divided into 12 Kúr, provinces, and originally it contained 60 *Tasásyj*, districts, but at the time of Ibn Khordádbeh only forty-eight. The whole province of *Holwán*, containing five districts, was added to *Jebel*. We have seen that Ibn Sád includes in reference to the time of 'Omar I. the revenue of *Jebel* in that of the *Sawád*. He probably means that of *Holwán* only, which at the time of 'Omar and of the Omayyids may have belonged to the *Sawád*. The province of the *Tigris*, containing 4 districts, was given to the Government of *Bağra*; and it is very likely that the crops which it had to supply to the State, were destined for the support of the troops stationed there. This, however, can only apply to the time of the 'Abbásides, for in former days they received their supply from *Máh-Bağra* in Persia, which under the Abbásides was placed under another Government. One whole district had become a swamp and disappeared altogether. Two districts (one of them is lower *Behqobád*) had been converted into crown lands after the system of *Khorásán*. In this manner, the *Sawád* was shortened by 12 districts and reduced to forty-eight.

I insert here a detailed account of the revenue of the *Sawád*, according to *Qodáma*, and also (distinguished by asterisks) one according to *Ibn Khordádbeh*. In a very few instances I deviate from *Barbier de Meynard's* text, and follow my own copy of the MS. of Oxford. *Qodáma* says of his account, it contains the income as it stands at present. I take the mean since the year 184, this being the first year of which documents are found in the public offices at *Baghdád*; for the earlier records were destroyed by fire during the disturbances which took place in 183 under *Amyr*, known under the name of *Ibn Zobayda*.

| <i>Western side of the Sawád watered</i> |     | <i>No. of</i>    | <i>No. of</i> |               |                |                 |
|------------------------------------------|-----|------------------|---------------|---------------|----------------|-----------------|
| <i>by the Tigris and Euphrates.</i>      |     | <i>Villages.</i> | <i>Barns.</i> | <i>Wheat.</i> | <i>Barley.</i> | <i>Dirhams.</i> |
| <i>Anbár and Nahr-Ma'rúf,</i>            | ... | —                | —             | 118,000(?)    | 6,400          | 4,000,000       |
| * <i>Anbár (alone),</i>                  | ... | 5                | 250           | 2,300         | 1,400          | 150,000         |
| <i>Qotrobbol,</i>                        | ... | —                | —             | 2,000         | 1,000          | 3,000,000       |
| * <i>Ditto,</i>                          | ... | 10               | 220           | 2,000         | 1,000          | 300 (sic!)      |
| <i>Maskan,</i>                           | ... | —                | —             | 3,000         | 1,000          | 150,000         |
| * <i>Ditto,</i>                          | ... | 6                | 105           | 3,000         | 1,000          | 300,000         |
| <i>Bádúryya,</i>                         | ... | —                | —             | 3,500         | 1,000          | 1,000,000       |

|                                                                                                                  |     |     | No. of Villages. | No. of Barns. | Wheat. | Barley. | Dirhams.   |
|------------------------------------------------------------------------------------------------------------------|-----|-----|------------------|---------------|--------|---------|------------|
| *Bádúryya,                                                                                                       | ... | ... | 14               | 420           | 3,500  | 1,000   | 1,000,000  |
| Nahr-Shyr,                                                                                                       | ... | ... | —                | —             | 1,700  | 1,700   | 150,000    |
| *Ditto,                                                                                                          | ... | ... | 10               | 240           | 1,700  | 1,700   | 5,000(sic) |
| Rúmayán,                                                                                                         | ... | ... | —                | —             | 3,300  | 3,300   | 150,000    |
| *Ditto,                                                                                                          | ... | ... | 10               | 220           | 3,300  | 3,050   | 350,000    |
| Kúthá,                                                                                                           | ... | ... | —                | —             | 3,000  | 2,000   | 350,000    |
| *Ditto,                                                                                                          | ... | ... | 9                | 220           | 3,000  | 2,000   | 350,000    |
| Darqyt,                                                                                                          | ... | ... | —                | —             | 2,000  | 2,000   | 200,000    |
| *Ditto,                                                                                                          | ... | ... | 9                | 125           | 2,000  | 2,000   | 200,000    |
| Jubara,                                                                                                          | ... | ... | —                | —             | 1,500  | 6,000   | 1,500,000  |
| *Ditto,                                                                                                          | ... | ... | 10               | 227           | 1,700  | 6,000   | 150,000    |
| The three Zábs,                                                                                                  | ... | ... | —                | —             | 1,400  | 7,200   | 250,000    |
| *Ditto,                                                                                                          | ... | ... | 12               | 244           | 1,400  | 7,200   | 250,000    |
| Bábel and Khaternyya,                                                                                            | ... | ... | —                | —             | 3,000  | 5,000   | 350,000    |
| *Ditto,                                                                                                          | ... | ... | 16               | 378           | —      | —       | 350,000    |
| Upper-Falúja,                                                                                                    | ... | ... | —                | —             | 500    | 500     | 70,000     |
| *Ditto,                                                                                                          | ... | ... | 15               | 240           | 1,500  | 500     | 70,000     |
| Lower-Falúja,                                                                                                    | ... | ... | —                | —             | 2,000  | 30,000  | 280,000    |
| *Ditto,                                                                                                          | ... | ... | 6                | 72            | 1,000  | 3,000   | 280,000    |
| The two Canals;                                                                                                  | ... | ... | —                | —             | 300    | 400     | 45,000     |
| *Ditto,                                                                                                          | ... | ... | 3                | 81            | 300    | 400     | 45,000     |
| 'Ayn-Tamr,                                                                                                       | ... | ... | —                | —             | 300    | 400     | 45,000     |
| *Ditto,                                                                                                          | ... | ... | 3                | 14            | 300    | 400     | 51,000     |
| Jenna and Bedát,                                                                                                 | ... | ... | —                | —             | 1,500  | 1,600   | 150,000    |
| *Ditto,                                                                                                          | ... | ... | 8                | 71            | 1,200  | 1,600   | 150,000    |
| Súrá and Barbysiya,                                                                                              | ... | ... | —                | —             | 1,500  | 4,500   | 250,000    |
| *Ditto,                                                                                                          | ... | ... | 10               | 265           | 700    | 2,400   | 100,000    |
|                                                                                                                  |     |     |                  |               |        | (rice)  |            |
| Banyama and King's Canal,                                                                                        | ... | ... | —                | —             | 3,500  | 4,000   | 112,000    |
| *Ditto,                                                                                                          | ... | ... | 10               | 664           | 1,500  | 4,500   | 250,000    |
| Upper and lower Bús,                                                                                             | ... | ... | —                | —             | 500    | 5,500   | 150,000    |
| *Tithes of lands belonging to the church or charities and from lands called Sanyn situated in various districts, | ... | ... | —                | —             | 500    | 5,500   | 250,000    |
| Forát-Badaqla,                                                                                                   | ... | ... | —                | —             | 2,000  | 2,500   | 62,000     |

|                          |     |     | No. of Villages. | No. of Barns. | Wheat. | Barley. | Dirhams. |
|--------------------------|-----|-----|------------------|---------------|--------|---------|----------|
| Forát-Badaqla,           | ... | ... | 10               | 271           | 2,000  | 2,500*  | 900,000  |
| Silhayn,                 | ... | ... | —                | —             | 1,000  | 1,500   | 140,000  |
| *Ditto,                  | ... | ... | —                | 34            | 1,000  | 1,500   | 140,000  |
| Rúmistán and Hormuzjerd, | ... | ... | —                | —             | 500    | 500     | 20,000   |
| *Ditto,                  | ... | ... | —                | —             | 500    | 500     | 10,000   |
| Nister,                  | ... | ... | —                | —             | 2,200  | 2,000   | 300,000  |
| *Ditto,                  | ... | ... | 7                | 163           | 1,250  | 2,000*  | 300,000  |
| Ighár of Yaqtyn,         | ... | ... | —                | —             | 2,200  | 2,000   | 204,800  |
| *Ditto,                  | ... | ... | —                | —             | —      | —       | 200,840  |

*At the junction of the two rivers.*

The provinces of Kesker : it is said the revenue formerly amounted to 90000 Dirhams, ... .. — — 30,000 20,000 270,000

\*Kesker and canal of Çillah, Riqqat and Reyán, the Kheráj and all other taxes yield, ... .. — — 3,000 20,000 70,000,000

(and rice)

Nahr Çilla, ... .. — — 1,000 3,121 59,000

*Eastern side of the Sawád.*

Buzurg-Sábúr, ... .. — — 2,500 2,200 300,000

\*Ditto, ... .. 9 260 2,500 2,200 300,000

The two Rádán, ... .. — — 4,800 4,800 120,000

\*Ditto, ... .. 19 362 4,800 1,800 120,000

Canal of Búq, ... .. — — 200 1,000 100,000

\*Ditto, ... .. — — 200 1,000 100,000

Kalwádzá and Canal of Byn, ... .. — — 1,600 1,500 330,000

\*Ditto, ... .. 3 34 1,600 1,500 330,000

Jádzér, old town المدينة العتيقة — — 1,000 1,500 240,000

\*Ditto, ... .. 9 116 1,000 1,400 250,000

Galúlá and Halúlá, ... .. — — 1,000 1,000 100,000

\*Ditto, ... .. 5 76 1,000 1,000 100,000

Desyn, ... .. — — 1,900 1,300 40,000

\*Ditto, ... .. 4 230 700 1,300 40,000

Deskere, ... .. — — 1,800 1,400 60,000

\*Ditto, ... .. 7 44(?) 1,000 1,000 70,000

\* Barley and rice.

|                           | No. of Villages. | No. of Barns. | Wheat. | Barley. | Dirhams. |
|---------------------------|------------------|---------------|--------|---------|----------|
| Beráz alrúd, ...          | —                | —             | 3,000  | 5,100   | 120,000  |
| *Ditto, ...               | 6                | 26(?)         | 3,000  | 2,000   | 120,000  |
| Bandanjayn, ...           | —                | —             | 600    | 500     | 35,000   |
| *Ditto, ...               | 5                | 54            | 600    | 500     | 100,000  |
| *The three Nahrawán, ...  | 21               | 380           | —      | —       | —        |
| Upper Nahrawán, ...       | —                | —             | 1,700  | 1,300   | 53,000   |
| *Ditto, ...               | —                | —             | 2,700  | 1,800   | 350,000  |
| Middle Nahrawán, ...      | —                | —             | 1,000  | 500     | 100,000  |
| *Ditto, ...               | —                | —             | 1,000  | 500     | 100,000  |
| Lower Nahrawán, ...       | —                | —             | 1,000  | 1,200   | 150,000  |
| Baduráyá and Baksáyá, ... | —                | —             | 4,700  | 5,000   | 33,000   |
| *Ditto ditto, ...         | 7                | —             | 4,700  | 5,000   | 330,000  |
| Rustuqbád, ...            | —                | —             | 1,000  | 1,400   | 246,000  |
| Silsyl and Mahrúd, ...    | —                | —             | 2,000  | 1,500   | 150,000  |

The Kúra (provinces) of the Tigris

yielded in A.H. 260 (266?), — — 9,000 4,000 430,000

Land-tax of the Kura (provinces)

of the Tigris, ... — — — — 8,500,000

In reference to the Ighár of Yaqtyn, mentioned in the preceding list, Qodáma says, no mention was made of it in the days of the Persians, nor was there such an Ighár existing in their times. Yaqtyn had claims on the government, and he received as payment lands in various districts, subsequently they lapsed to the government, and they were called Ighár of Yaqtyn. The canal of Çilla was dug by order of Mahdiy in the districts of Wásit, and thereby a good deal of waste land was reclaimed. The produce (of the Ighar and of the reclaimed land) was destined for prayers and defraying other expenses in the two holy places (Makka and Madyna). It is said the arrangement was made that two-fifths of the crops were to be given up by the cultivators for this purpose. This settlement was to last fifty years, after the lapse of which a new settlement was to be made.

Ighár (اِيغار) is correctly explained by Barbier de Meynard, dict. geogr. de la Perse, p. 65, "Il s'applique à une ville ou à une propriété qui, moyennant une certaine somme stipulée une fois pour toutes, et payée chaque année directement au soulthan, est exemptée de la visite et du contrôle des percepteurs du fisc." Qodamá defines it

الايغار هو ان تحمي الضيعة من ان يدخلها احد من العمال و اسباب بما يامر الامام به من وضع شي عليها يودي في السنة اما في بيت المال او غيره من الامصار

“Ighár (protection against danger) means, that a landed tenure is exempt from the visits of the collectors and from what is connected with them (rapacity and oppression), in consequence of an order of the head of the State which fixes a certain annual quit-rent to be paid either into the public treasury, or into the treasury for the support of a military cantonment.” The principal advantage of an Ighár consisted in being free from those harpies, the Omlas.

The provinces of the Tigris which form the last and largest item, may be those which were ceded to the Baçra government, and they seem to answer to those enumerated by Barbier de Meynard, p. 133, under Nos. V. and VI.

Some of the figures in the preceding table, taken from the very incorrect copy of Qodáma, are certainly erroneous, and may be corrected by comparing them with those of Ibn Khordádbeh. It must, however, be borne in mind that the data reported by the two authors are not in all instances the same. At the time of Ibn Khordádbeh, for instance, the whole of the revenue of the Tigris provinces seems to have been levied in cash, at the time of Qodáma partly in cash and partly in kind. For us the sum total alone is of some interest, and this is given by Qodáma, who says, *وذلك ارتفاع السواد سوى صدقات البصرة من الكنظة ١١٧٢٠٠ كرو ومن الشعير ٩٩٧٢١ كرو ومن الورق ٨٠٩٥٨٠٠ درهم يكون عن الغلات باواسط الأسعار وهو حساب الكرين المقرين من الكنظة والشعير ستين ديناراً وهو من العين ورقاعلي صرف خمسة عشر درهماً بدينار ١٠٠٣٦١٨٥ درهماً و مجموع ذلك الي الورق ١٠٨٤٥٧٦٥٠ وكانت صدقة البصرة ترتفع في السنة ٦٠٠٠٠٠٠ فجمع رتقاع لي ما بين من التسعين على العبر الهبئية ١١٤٤٥٧٦٥٠ درهم*

“The revenue of the Sawád, exclusive the poor rates of Baçra, consists of 117,600 Korrs of wheat, 99,721 Korrs of barley, and 8,095,800 Dirhams of silver. The grain at the mean market price, that is to say at the rate of two Korrs, one of wheat and one of barley at 60 Dynárs, taking one Dynár at the present rate of exchange equal to 15 Dirhams, is worth 100,361,850 Dirhams. Adding this sum to the cash payments, there results a total of 108,457,650 Dirhams. The poor rates of Baçra amount annually to six million Dirhams, the

average revenue is therefore (some words unintelligible) 114,457,650 Dirhams."

These data enable us to calculate the price of grain at the time of Qodáma. We convert the 100,361,850 Dirhams into Dynárs, by dividing the number by 15, and we obtain 6,690,790 Dynárs. With this money we purchase all the barley, and as many Korrs of wheat as there are Korrs of barley. Our expenditure amounts to  $99,721 \times 60 = 5,983,260$  Dynárs to spend and 17,879 Korrs of wheat to buy. If we divide the former number by the latter, we find that the Korr of wheat costs  $19\frac{1}{2}$  (*i. e.* 39 Dynárs and 10 Kiráts), and consequently the Korr of barley  $20\frac{1}{2}$  Dynárs. The result cannot be far from the truth; for at the time of Moḥammad wheat was at Madyna twice as dear as barley (comp. my *Leben des Moh.*, Vol. 3, p. 140), and consequently, if one Korr of wheat and one Korr of barley together cost 60 Dynárs, the price of wheat ought to be 40 and that of barley 20 Dynárs. But there remains much too great a cost in the division than that Qodáma should have neglected it. I therefore propose to read 117,691 Korrs of wheat instead of 117,600. If we adopt this reading, a Korr of wheat cost 39 Dynárs and  $7\frac{1}{2}$  Kiráts (20 Kiráts = 1 Dynár) and a Korr of barley 20 Dynárs  $12\frac{1}{2}$  Kiráts. A pound of bread (English weight) may have cost about 3 farthings.

In Qodáma occurs the following passage regarding the assessment of 'Omar I. قال القاسم بن سلام ان عمر بن الخطاب بعث عثمان بن حنيف الانصاري فمسخ السواد فوجدته ستة و ثلثين الف الف جريب فوضع على كل جريب عامر وغامر يبلغه الماء قفيزا ودرهما قال القاسم وبلغني ان ذلك القفيز كان مكوكا لهم يدعي الشابرقاني وقال يحيى بن ادم هو المختوم الحجاجي Qásim b. Sallám asserts that 'Omar, the son of Khaṭṭab, sent 'Óthmán b. Honayf of Madyna, and that this 'Othmán measured the Sawád, and found that it contained 36 (sic) millions Jarybs, and he imposed upon every Jaryb of land, cultivated or fallow, provided it could be irrigated, a tax of one Qafyz and one Dirham. Qásim says, I have heard that this Qafyz was a cubic measure then in use in the Sawád, and that it was called Shabirqány. Yahya b. Adam says it is identical with the Makhtúm of Hajjáj.

This account differs from that of other authors, who record that 'Omar I. assessed the Sawád as follows:—

|                               |            |
|-------------------------------|------------|
| Every Jaryb of Barley, .....  | 2 Dirhams. |
| „ „ „ Wheat, .....            | 4 „        |
| „ „ „ Vineyards and orchards, | 6 „        |
| „ „ „ Date plantations, ..... | 8 „        |

The assessment of Omar was according to a tradition of Jábir by himself called *Tasq* طشق Freytag considers this term cognate with the expression of the Arabic Christians *Taq* طقس, and it is perhaps also related with *qist*. No doubt it is derived from the same Greek word from which our tax comes. I believe, but am not sure, it was a *permanent* settlement, though owing to the disposition of the rulers and to circumstances, changes have taken place. The term *tasq* is applicable only to taxes levied from conquered land.

It is pretty certain that the land-tax amounted to about one-half of the value of the produce. Qodáma speaks of the tithes, and then he continues *وضع علي حسب المقاسمات فوضع* واما الطسوق فانها وضعت علي حسب ما يكون مشاكلا للمنافقة والدليل علي ذلك انه متي احتيج الي تعشيدو ارض اخذ من طسق الاستان الخمس لان خمس النصف عشر الاصل The taxes on conquered land have been fixed in accordance to the annual produce (of several years); consequently the tax of a district has been fixed agreeably to justice. In proof thereof we may mention that in case it be necessary to convert *tasq*-land into tithe-land, one-fifth of the original *tasq* of the district is taken, because  $\frac{x}{2} : 5 = \frac{x}{10}$  ( $x$ , in the original *الاصل* means in this case the value of the produce.)

I believe we may safely infer from this passage that in the assessment of conquered lands, the same rules prevailed as in fixing the amount of tithe, with the only difference that one-half instead of one-tenth was levied. The general rule was that land which was watered without the expense of labour, paid the whole tithe.

If labour was expended, one-half of the tithe or more was taken. Thus, if land was watered twice by a canal running through it, or if it was three times irrigated by means of a bucket by which water is raised from a canal, the tithe amounted not to ten, but to seven per cent., viz. 4 per cent. for the canal and 3 per cent. for the bucket.

The 'Abbásides changed the system of revenue in the Sawád. Qodáma says: Abú 'Obayd Allah Mo'áwiyya b. 'Abd Allah, the

secretary (Kátib) of the Khalyf Mahdiy reported on the inconveniences which arose, if the *tasq*-payers were obliged to pay a fixed sum of money, or to supply a certain quantity of grain, and he proposed that the taxes should be calculated (annually) by the Jaryb, as there was no telling whether the prices would sink or rise. In the one case the cultivator, in the other the government were in the disadvantage. The best thing, he thought, would be to introduce the same rule which the prophet adopted with regard to Khanghar: he left to the inhabitants the land under the condition that they were to give up to him one-half of the produce (as much the cultivators ought to give up from irrigated land); but if the labour of irrigation was very hard, they ought to give up only one-fourth; and if it was less hard, one-third. The choice was to be left to the farmers to give up as much straw\* to government as was due to it (*i. e.*  $\frac{1}{2}$  or  $\frac{1}{3}$  or  $\frac{1}{4}$  according to circumstances), or to sell it and pay the tax according to the market price of grain. In fixing the amount of revenue on vineyards, trees of every description, vegetables and every kind of produce, agreeably to the dictates of justice, the nett price which would be realized by the sale was to be calculated, taking into consideration what distance the land was from the market or harbour, and how great the expense and loss of time would be for bringing it there. After all these deductions one-half was to be charged as revenue.

This system of revenue, which was eventually introduced, and by which the above detailed statements of Ibn Khordádbeh and Qodáma are to be explained, is called *Moqásima*, a term which is used up to this day in India very nearly in the same signification as it was used at the time of our author: "partition of the actual crop between the cultivator and the State, either in kind or in value."

Certain it is that one-half of the produce was taken from the cultivators by the 'Abbásides; but it is not certain whether 'Omar made so high a settlement as to deprive the farmers of the value of one-half, and whether the above passage of Qodáma is applicable to the time previous to the Abbáside dynasty. But we may safely assume that even at the time of 'Omar I. the revenue amounted to two-fifths. Now if a Jaryb of wheat paid 4 Dirhams to Government, the value of the whole produce of a Jaryb could not be more than

\* In the original *نبن*

10 Dirhams. This does not square either with the prices of grain in those days, nor with the size of the Jaryb which I have found. There must be something wrong in my calculations, and I therefore would call the attention of men in India, who take an interest in such matters, to the subject. They have means of ascertaining facts connected with revenue and agriculture, which are wanting in Europe.

I now insert a statement of the revenue of the other provinces of the empire of the Khalyfs, according to Qodáma.\* He usually gives the numbers and names of the districts into which every province was divided for the sake of administration, and states the totals of the revenue. As the MS. is very incorrect, I omit the names of districts and confine myself to the provinces :

|                                                                                | Dirhams.   |
|--------------------------------------------------------------------------------|------------|
| Ahwáz, .....                                                                   | 18,000,000 |
| Fáris, .....                                                                   | 24,000,000 |
| Kermán, .....                                                                  | 6,000,000  |
| Mekrán, the Moqátea amounted, .....                                            | 1,000,000  |
| Ispahán, .....                                                                 | 10,500,000 |
| Sijistan, the Irtifá' revenue, according to agree-<br>ment, amounted to, ..... | 1,000,000  |
|                                                                                | <hr/>      |
|                                                                                | 60,500,000 |
|                                                                                | <hr/>      |

**Khorásán.** If I understand right, this immense province was leased to Abd Allah b. Táhir, that is to say, he received the whole revenue, defrayed the expenses of administration, and kept the surplus after having sent the tax to the treasury of the Khalyf in cash including the value of a certain number of horses and slaves furnished to him, 38,000,000

|                                         |           |
|-----------------------------------------|-----------|
| Máh-Kúfa, <i>i. e.</i> Daynawar, .....  | 1,000,000 |
| Máh-Baçra, <i>i. e.</i> Nohawand, ..... | 800,000   |
| Hamadán, ... ..                         | 1,700,000 |
| Masibzán, .....                         | 1,100,000 |
| Mahrján-Qazaq, .....                    | 1,200,000 |
| Qomm and Qóshán, .....                  | 3,000,000 |

\* Which may be compared with that of Ibn Khordádbeh.

|                                                 |                 |
|-------------------------------------------------|-----------------|
| Azerbyjan, Ardebyl, Marand, &c., .....          | 4,500,000       |
| Rayy,.....                                      | 20,000,000      |
| Qazwyn in A. H. 237, .....                      | 2,628,000       |
| Qúmís, .....                                    | 1,105,000       |
| Jorján, .....                                   | 4,000,000       |
| Táberistán and Ámol in A. H. 234, .....         | 200,163,070 (?) |
| Tikryt, Sonn and Bawázij (on the Tigris), ..... | 700,000         |
| Mosúl pays into the treasury of the Khalyf, ... | 2,750,000       |
| But the revenue of Mosul amounts to,.....       | 6,800,000       |
| Jazyra Ibn 'Omar (close by Mosul), .....        | 4,635,000       |
| Arzen, .....                                    | 4,100,000       |
| Tarún in Armenia, the Moqáte'a amounts to, ..   | 100,000         |
| Armenia, the Irtifá' revenue amounts to, .....  | 400,000         |
| Diyár Momiur (northern Mesopotadha), .....      | 6,000,000       |
| Taryq Forát (west bank of Euphrates), .....     | 2,700,000       |

---

17,935,000

---

Dynárs.

|                                                                    |           |
|--------------------------------------------------------------------|-----------|
| Aleppo and Qinnesryn, .....                                        | 360,000   |
| Homeç, .....                                                       | 118,000   |
| Damascus, .....                                                    | 110,000   |
| Jordan, .....                                                      | 195,000   |
| Egypt and the coast of the Mediterranean as<br>far as Barqa, ..... | 2,500,000 |
| Haramayn, <i>i. e.</i> Northern Arabia, .....                      | 100,000   |
| Southern Arabia (Yaman), .....                                     | 600,000   |
| Bahrayn in A. H. 237, .....                                        | 510,000   |
| 'Omán, .....                                                       | 300,000   |

The author concludes : " These are the provinces, as we have enumerated them, and this is the amount of revenue which they yield. We stated the average ; sometimes it is in some places larger, sometimes less. We pay no attention to these fluctuations, they are due to the want of good administration. The reader will find that the whole revenue which we have enumerated amounts to about 4,920,000 Dynárs, which make, at the present rate of exchange, the Dynár at 15 Dirhams, 73,800,000 Dirhams."

This sum represents 68,347 Roman pounds of gold, and does not amount to much more than two millions sterling, but this is only the revenue of the western provinces where the Dynár was the currency. It is true, if we cast up the above items, we obtain a sum which falls short by 127,000 Dynárs of the sum stated by Qodáma. This, however, is evidently owing to an omission or a mistake in the text.

If we omit in the item Tabaristan, the two hundred millions as being evidently too large, the revenue of the eastern provinces including the Sawád amounts to 223,487,320 Dirhams, or 2,171,404 Roman pounds of pure silver, or about 162 millions of francs. The income of the whole empire, as it was at the time of Qodáma, did not therefore amount quite to  $8\frac{1}{2}$  million pounds sterling. But we must recollect that a great proportion of it was the nett income, after all expenses of administration had been defrayed, and may be considered as the civil list of the Khalyf.

The study of the finances of the glorious Khalyfs would be edifying for discontented Musulmans in India. The Khalyfs, like Indian princes, squandered away the money in debauchery, ground down the people to the dust, surrounded themselves with Tartar mercenaries, who soon became a pretorian guard, full of insolence and insubordination. These deposed or put to death the Khalyf at pleasure, and no longer content with putting on the screw as tightly as possible, they plundered the provinces; and now those countries are so completely depopulated, that many a district, which at the time of Qodáma yielded a revenue of more than a million of Dirhams, cannot pay as many cowries.

There is much good in the Islám and in the Musulmans, but they have a great deal to learn, before they will be able to administer their own affairs.

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## LITERARY INTELLIGENCE.

The learned Professor Mahes'achandra Nyáyaratna, of the Calcutta Sanskrit College, has just brought out a new edition of the *Kávyá Prakás'a*, a treatise on Sanskrit Rhetoric by Mammaṭa Bhaṭṭa. It is illustrated by a number of explanatory notes by the editor, and has an excellent introductory essay. The last is a new feature in a Sanskrit book edited by a modern Pundit. It gives a summary of the principal works on Rhetoric in Sanskrit, their ages and characteristics, the relation which the work of Mammaṭa Bhaṭṭa bears to them, the number of manuscripts used in printing it, its contents and age, and a variety of other interesting literary and critical notices.

The Professors of the Benares Sanskrit College have started a monthly journal devoted to Sanskrit Literature. It is named THE PUNDIT, and is intended to serve as a vehicle for the "publication of rare Sanskrit works which appear worthy of careful editing hereafter; to offer a field for the discussion of controverted points in old Indian Philosophy, Philology, History and Literature; to communicate ideas between the Arian scholars of the East and the West; between the Pundits of Benares and Calcutta and the Sanskritists of the Universities of Europe." The first three numbers, already published, contain, among other articles, two cantos of the second half of the *Kumára Sambhava*, short notices of topics on Indian Astronomy and Logic, and a reprint of the late Dr. Ballantyne's essay on the Nyáya.

Pundit Rangáchári Swámí, of Brindábun, has published, for gratuitous distribution, a Sanskrit pamphlet entitled *Durjana-kari-panchánana*. Its object is to prove the authenticity of the present form of Vaishṇava worship, and to refute the opinion of the court pundits of Jaipur, who maintain that there is no ordinance in the shasters to justify the worship of Govindají, the great idol of that place, and accordingly recommend that it should be cast out of its temple. The author, in his little book, displays consummate polemical powers, and a thorough knowledge of the literature of the Vaishṇavas.



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“It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted: and it will die away, if they shall entirely cease.”

SIR WM. JONES.

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# CONTENTS.



## No. I.

(Published 15th June, 1866.)

|                                                                                                                                                                                                                  | Page |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Physical Characters of the Karens.—By the Rev. F. MASON, D. D.,                                                                                                                                                  | 1    |
| Contributions to Indian Malacology, No. VI. Descriptions of new land shells from the Nilgiri and Anamullay Hills, and other places in the Peninsula of India.—By W. T. BLANFORD, Esq. A. R. S. M., F. G. S.,     | 31   |
| Catalogue of the Specimens of Meteoric Stones and Meteoric Irons in the Museum of the Asiatic Society of Bengal, Calcutta, corrected up to January, 1866.—By Dr. F. STOLICZKA and H. F. BLANFORD, Esq. F. G. S., | 43   |
| Observations on the Astronomical points determined by the brothers Schlagintweit in Central Asia.—By Captain GOLUBIEF,                                                                                           | 46   |
| Comparative hypsometrical and physical Tableau of High Asia, the Andes, and the Alps.—By ROBERT DE SCHLAGINTWEIT, Professor at the University of Giessen,                                                        | 51   |
| Notes and Queries,                                                                                                                                                                                               | 73   |
| Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August, 1865,                                                                | lvii |
| Meteorological observations taken at Gangarooma near Kandy, Ceylon, in the month of May, 1864,                                                                                                                   | lxii |

---

## No. II.

(Published 14th November, 1866.)

|                                                                                                                                                                                                                                               |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Russian Geographical Operations in Asia.—Communicated by Lieut.-Col. J. T. WALKER, R. E.,                                                                                                                                                     | 77  |
| Kashmir, the Western Himalaya and the Afghan Mountains, a geological paper by ALBERT M. VERCHÈRE, Esq., M. D. Bengal Medical Service; with a note on the fossils by M. EDOUARD DE VERNEUIL, Membre de l'Académie des Sciences, Paris, Pt. I., | 89  |
| Contributions to Indian Malacology, No. VII. List of species of Unio and Anodonta described as occurring in India, Ceylon and Burma.—By WILLIAM T. BLANFORD, Esq. A. R. S. M., F. G. S.,                                                      | 134 |
| Scientific Intelligence,                                                                                                                                                                                                                      | 156 |
| Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the months of September, October, November and December, 1865,                                                         | i   |

## No. III.

(Published 22nd February, 1867.)

|                                                                                                                                                                                                                                                                                      |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Kashmir, the Western Himalaya and the Afghan Mountains, a geological paper by ALBERT M. VERCHÈRE, Esq., M.D. Bengal Medical Service; with a note on the fossils by M. EDOUARD DE VERNEUIL, Membre de l'Académie des Sciences, Paris, PART II. <i>continued from page 133,</i> ... .. | 159 |
| EXPERIMENTAL INVESTIGATIONS connected with the supply of WATER from the Hooghly to CALCUTTA, by DAVID WALDIE, Esq., F. C. S. &c. Pt. I., ... ..                                                                                                                                      | 203 |
| Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the months of January and February, 1866, ... ..                                                                                                              | i   |

## SPECIAL NUMBER.

## ETHNOLOGY.

(Published 22nd November, 1866.)

|                                                                                                                                                                                             |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| The Ethnology of India.—By Mr. Justice CAMPBELL, ... ..                                                                                                                                     | 1   |
| The "Kols" of Chota-Nagpore,—By Lt.-Col. E. T. DALTON, Commissioner of Chota-Nagpore, ... ..                                                                                                | 153 |
| APPENDIX A.—List of words and phrases to be noted and used as test words for the discovery of the radical affinities of languages, and for easy comparison, by Mr. JUSTICE CAMPBELL, ... .. | 201 |
| APPENDIX B.—Comparative Table of Aboriginal words, do., ... ..                                                                                                                              | 204 |
| APPENDIX C.—Comparative Table of Northern and Arian Words, do. ... ..                                                                                                                       | 207 |
| APPENDIX D.—Kashmíri Vocabulary and Grammatical Forms, by L. BOWRING, Esq., ... ..                                                                                                          | 225 |
| APPENDIX E.—Language of Dravidian Aborigines. Notes on the Oraon Language.—By the Rev. F. BATSCH, ... ..                                                                                    | 251 |
| APPENDIX F.—Brief Vocabulary of the Moondah and cognate Languages of the Kolarian type.—By Lieut.-Col. E. T. DALTON, ... ..                                                                 | 266 |
| APPENDIX G.—Grammar of the Ho Language. (Kolarian Aborigines.)—By Lieut.-Col. TICKELL, &c., ... ..                                                                                          | 268 |

## INDEX TO PART II.

The numbers with an asterisk belong to the Special Number on Indian  
Ethnology.

|                                                        | Page |
|--------------------------------------------------------|------|
| <i>Acanthocladia</i> , ...                             | 130  |
| <i>Achatina anamullica</i> , n. s.,                    | 37   |
| ——— <i>beddomeri</i> , n. s.,                          | 41   |
| ——— <i>testudo</i> , n. s.,                            | 169  |
| ——— <i>textilis</i> ,                                  | 41   |
| Aconcagua peak,                                        | 55   |
| <i>Ægialites ruficapillus</i> , (Gould),               | 156  |
| Agricultural tribes,                                   | *19  |
| Aha Tung Limestone quarry,                             | 193  |
| Alexandrowskaiá chain,                                 | 79   |
| Alto de Toledo Pass,                                   | 54   |
| Ammonia in the Hooghly water,                          | 224  |
| Analysis of tank water,                                | 232  |
| ——— of the river water,                                | 219  |
| Anamully land shells,                                  | 31   |
| Andria and Ariana,                                     | *127 |
| Animal life in Central Asia,                           | 70   |
| Animal life in High Asia,                              | 70   |
| <i>Anodonta soleniformis</i> , (Bens.),                | 150  |
| Arckbal peak,                                          | 185  |
| Arrah River, the,                                      | 162  |
| Artisans,                                              | *120 |
| <i>Athyris roissyi</i> ? Vernl.,                       | 133  |
| ——— <i>Sp. (subtilita, Hall)</i> ,                     | 133  |
| Augite of the Kaj Nag,                                 | 101  |
| <i>Aviculo-Pecten dissimilis</i> , (Flemming),         | 169  |
| ——— n. s. (allied to <i>A. circularis</i> , Verchère), | 169  |
| ——— n. s. (allied <i>A. testudo</i> , Verch.),         | 169  |
| ——— n. s. ? ( <i>A. gibbosus</i> , Verch.),            | 169  |
| Awans,                                                 | *95  |
| <i>Axinus</i> , n. s. (allied to <i>A. obscurus</i> ), | 169  |
| Bag'dees,                                              | *125 |
| Baidyas, ...                                           | *119 |

|                                                                                  | Page    |
|----------------------------------------------------------------------------------|---------|
| Bainjagas, ...                                                                   | *127    |
| Baloon ascents, ...                                                              | 67      |
| Balteers, ...                                                                    | *147    |
| Banteng, Domestication of the, ...                                               | 74      |
| Bára Lacha Pass, ...                                                             | 54      |
| Baramoola the extremity of the Kaj Nag Range, ...                                | 93      |
| Barhuis of Khelat, ...                                                           | *54     |
| Barhui and Panjabi examined, ...                                                 | *55     |
| Barns Speers, ...                                                                | 173     |
| Bashia, Longitude of the Village of, ...                                         | 49      |
| Batgool and Boorwag summits, ...                                                 | 104     |
| Batsch (The Rev. F.) On the Oraon language, ...                                  | *251    |
| Bedars or Beders, ...                                                            | *21     |
| Bedas or Beders, ...                                                             | *21     |
| Beloochees, ...                                                                  | *141    |
| Bengali Brahmans, ...                                                            | *69     |
| Bghai or Pieya, ...                                                              | 3       |
| Bhandari, or the Collector of rents, ...                                         | *173    |
| Bheels, ...                                                                      | *21     |
| Bhoomiz, ...                                                                     | *26     |
| Bhoonhars or bastard Brahmins, ...                                               | *67     |
| Bhootas, ...                                                                     | *147    |
| Bhooyas of Bengal, ...                                                           | *51     |
| Bhurs and Cheroos of Oudh, ...                                                   | *21     |
| Black tribes of the Hills, ...                                                   | *13     |
| Blanford and Stoliczka's Catalogue of meteoric stones, ...                       | 43      |
| Blanford's (W. T.) Contributions to Indian Malacology,<br>Nos. VI. and VII., ... | 31, 134 |
| Bodos, ...                                                                       | *149    |
| Bokhara, Routes across the Tian Shan to Little, ...                              | 49      |
| Boksas, Dr. Stewart on the, ...                                                  | *47     |
| Borahs, ...                                                                      | *140    |
| Borderers, ...                                                                   | *136    |
| Buddhist ruin at Buniar and Ori, ...                                             | 97      |
| Buis and Bustars, ...                                                            | *130    |
| <i>Bulimus nilagaricus</i> , (Pfr.), ...                                         | 38      |
| ————— <i>physalis</i> , (Bens.), ...                                             | 38      |
| ————— <i>bengalensis</i> , ...                                                   | 42      |
| ————— <i>trutta</i> , n. s., ...                                                 | 42      |
| Buniar Buddhist ruins, ...                                                       | 99      |
| Bunneahs, ...                                                                    | *113    |
| Burghers, ...                                                                    | *25     |
| Campbell's (Mr. Justice) Ethnology of India, ...                                 | *1      |
| <i>Carpophaga cuprea</i> , (Jerdon), ...                                         | 157     |
| ————— <i>insignis</i> , (Hodgson), ...                                           | 157     |
| ————— <i>pusilla</i> , ...                                                       | 157     |

|                                                                                   | Page |
|-----------------------------------------------------------------------------------|------|
| Carambers, ...                                                                    | *25  |
| Caspian Sea, Variations of the level of the,...                                   | 83   |
| <i>Cataulus recurvatus</i> , (Pfr.), ...                                          | 38   |
| Caucasian race, Physical appearances of the, ...                                  | *8   |
| Chamars, ...                                                                      | *121 |
| <i>Charadrius pusillus</i> , (Horsfield), ...                                     | 156  |
| Chenchwars, ...                                                                   | *31  |
| Chermars, ...                                                                     | *23  |
| Cheroos, ...                                                                      | *21  |
| Chimborazo peak, ...                                                              | 54   |
| Chinar lake near Sunager, ...                                                     | 55   |
| Chota Nagpore, Extent of, ...                                                     | *153 |
| Constituents of river water, ...                                                  | 211  |
| Coour and Cole languages compared, ...                                            | *41  |
| <i>Cyclophorus jerdoni</i> , (Bens.), ...                                         | 38   |
| ————— <i>deplanatus</i> , (Pir.), ...                                             | 38   |
| ————— sp. near <i>ravidus</i> , ...                                               | 38   |
| Dapsang peak, ...                                                                 | 55   |
| Dards, ...                                                                        | *146 |
| Destál, Glacier lake in Garhval, ...                                              | 56   |
| Dhanuks, ...                                                                      | *126 |
| Dhoonds, ...                                                                      | *95  |
| Dimals, ...                                                                       | *149 |
| Djungaria, Points determined by the Jesuits in, ...                               | 48   |
| Domestication of wild cattle in India, ...                                        | 74   |
| Dosads, ...                                                                       | *125 |
| Dravidian Aborigines, ...                                                         | *251 |
| Ellichpur Coours, ...                                                             | *158 |
| Ethnology of India by Mr. Justice Campbell, ...                                   | *1   |
| Everest, Mount, ...                                                               | 54   |
| <i>Falco babylonicus</i> , ...                                                    | 156  |
| ————— <i>peregrinoides</i> , ...                                                  | 156  |
| Fossiliferous rocks in Kashmir, ...                                               | 197  |
| Fauna of the Weean bed, ...                                                       | 160  |
| <i>Felis macrocelis</i> , ...                                                     | 156  |
| ————— <i>temminckii</i> , (Vigors), ...                                           | 156  |
| ————— <i>swinhoei</i> , ...                                                       | 156  |
| ————— <i>diardii</i> , ...                                                        | 156  |
| ————— <i>charltoni</i> , ...                                                      | 156  |
| <i>Felis marmorata</i> , ...                                                      | 156  |
| Felstone on the banks of the Jheelum, ...                                         | 94   |
| ————— and porphyry of the mountains South-West, South<br>and West of Cashmir, ... | 93   |

|                                                                                                                                | Page         |
|--------------------------------------------------------------------------------------------------------------------------------|--------------|
| <i>Fenestella sykesii</i> , Köninck, ... ..                                                                                    | 133          |
| — <i>megastoma</i> , Köninck, ... ..                                                                                           | 133          |
| Fireflies, Simultaneous flashing of, ... ..                                                                                    | 73           |
| Gámin Pass, ... ..                                                                                                             | 53           |
| Gardening tribes, ... ..                                                                                                       | *20          |
| Garnets of the Kaj Nag, ... ..                                                                                                 | 101          |
| Garrows of Assam, ... ..                                                                                                       | *53          |
| Geographical Configurations of High Asia, the Andes, and the Alps, ... ..                                                      | 52 et seq.   |
| Ghatwals, The half bred, ... ..                                                                                                | *35          |
| Glaciers of High Asia, ... ..                                                                                                  | 61           |
| Golubief's (Captain) Observations on the Astronomical points, determined by the Brothers Schlagintweit in Central Asia, ... .. | 46 et seq.   |
| Gond language, Dravidian origin of the, ... ..                                                                                 | *25          |
| <i>Goniatites</i> . <i>sp.</i> , like <i>G. henslowii</i> , ... ..                                                             | 169          |
| Goojars, ... ..                                                                                                                | *101         |
| Goozrati Brahmans, ... ..                                                                                                      | *69          |
| Gourisunkar or Mount Everest, ... ..                                                                                           | 54           |
| Gours of Udeypore, ... ..                                                                                                      | *32          |
| <i>Grauculus layardi</i> , ... ..                                                                                              | 157          |
| Grave stones of the Oraóns, ... ..                                                                                             | *193         |
| Gukkurs, ... ..                                                                                                                | *95          |
| Gurang and Magars, ... ..                                                                                                      | *148         |
| Gwallas of Orissa, ... ..                                                                                                      | *53          |
| Gyal and the Gour, domestication of the, ... ..                                                                                | 74           |
| Hapatikri, ... ..                                                                                                              | 115          |
| Harees, ... ..                                                                                                                 | *125         |
| Hazarehees of Ghuznee, ... ..                                                                                                  | *54          |
| <i>Helix anax</i> , (Bens.), ... ..                                                                                            | 41           |
| — <i>basilessa</i> , (Bens.), ... ..                                                                                           | 41           |
| — <i>monticola</i> , (Hutton), ... ..                                                                                          | 36           |
| Helots, ... ..                                                                                                                 | *120 et seq. |
| High Asia, the Andes, and the Alps, Hypsometrical Tableau of, ... ..                                                           | 51 et seq.   |
| Himalaya, Plateaux in the, ... ..                                                                                              | 52           |
| Hodgson's Himalayan tribes, ... ..                                                                                             | *46          |
| Hooghly water, Organic matter in the, ... ..                                                                                   | 219          |
| Hos, ... ..                                                                                                                    | *22          |
| Hurri Purbut, ... ..                                                                                                           | 117          |
| Hydrography of High Asia, ... ..                                                                                               | 55           |
| Influence of the tides in the Hooghly, ... ..                                                                                  | 208          |
| Islamabad Hill, ... ..                                                                                                         | 181          |
| Issyk-Kul, Position of, ... ..                                                                                                 | 50           |

|                                                                               | Page         |
|-------------------------------------------------------------------------------|--------------|
| Janguas of Cuttack, ... ..                                                    | E36          |
| Jatras among the Oraons, ... ..                                               | *183         |
| Jats and Zemindar equivalent terms, ... ..                                    | *4           |
| Kaffirs, ... ..                                                               | *145         |
| Kafir Kote mountains, ..                                                      | 184          |
| Kai, Gaikho or Prai-Ka-Young, ... ..                                          | 5            |
| Kailas range, ... ..                                                          | 114          |
| Kaj Nag, Porphyry of the, ... ..                                              | 100          |
| Kamlawan hill, ... ..                                                         | 115          |
| Kanouj Brahmans, ... ..                                                       | 65           |
| Karabougaz, gulf, ... ..                                                      | 83           |
| Karakoram Pass, Position of the, ... ..                                       | 46           |
| Karakoram Pass, Longitude of the, ... ..                                      | 46           |
| Karens, ... ..                                                                | 1            |
| Kashmiri Brahmans, ... ..                                                     | *57          |
| ———— Vocabulary, ... ..                                                       | *227         |
| Kashmir, Geology of, ... ..                                                   | 89           |
| Kashmir, the Western Himalaya and the Afghan Mountains,<br>Geology of, ... .. | 89           |
| Kaurs, ... ..                                                                 | *22          |
| Káyasthas, ... ..                                                             | *117         |
| Kaya or Red Karen, ... ..                                                     | 4            |
| Kazalks of Central Asia, ... ..                                               | *28          |
| Kazi Kourt chain, ... ..                                                      | 79           |
| Kharwars of Rewa, ... ..                                                      | *37          |
| Khatrees, ... ..                                                              | *108         |
| Kheriahs, ... ..                                                              | *155         |
| Khokandian ruins near Baidyr Tugai, ... ..                                    | 86           |
| Khonds, ... ..                                                                | *25          |
| Khotan, Cartographical position of, ... ..                                    | 48           |
| Kol, Derivation of the term, ... ..                                           | *154         |
| Kola or Kolar, ... ..                                                         | *28          |
| Kolarian Aborigines, Language of the, ... ..                                  | *268 et seq. |
| Koles, the generic name of the Aborigines of Chota-<br>Nagpore, ... ..        | *27          |
| Koonbees or Koormeas, ... ..                                                  | *92          |
| Kotahs, ... ..                                                                | *25          |
| Kothair bed, ... ..                                                           | 163          |
| ———— Fauna of the, ... ..                                                     | 190          |
| Kours of Western frontiers of Chota-Nagpore, ... ..                           | *39          |
| Kumoun Hindus allied to the Bengali, ... ..                                   | *68          |
| Künlun and the Karakorum Pass, Plateaux between, ... ..                       | 52           |
| Kurrals, ... ..                                                               | *95          |
| Kashgar, Cartographical position of, ... ..                                   | 48           |
| Kun Lun or Ser and Mer Peaks, ... ..                                          | 114          |

|                                                                                      | Page |
|--------------------------------------------------------------------------------------|------|
| Lagunillas, The pass of, ... ..                                                      | 54   |
| Lakes in the Himálaya, ... ..                                                        | 55   |
| Language of the Aborigines, Turanian, ... ..                                         | *23  |
| Lé in Ladak, Determination of the position of, ... ..                                | 46   |
| Lepchas, ... ..                                                                      | *148 |
| Light, Exclusion of, from specimens in Spirits, ... ..                               | 74   |
| Lunar and Solar Rajpoots, ... ..                                                     | *21  |
| Lurk Coles, ... ..                                                                   | *26  |
| Macnamara's (Dr. F.) estimate of Organic matters in the<br>Hooghly water, ... ..     | 204  |
| Magnetic iron ores in the Sub-Himalayan Valleys, ... ..                              | 103  |
| Mahratti Brahmans, ... ..                                                            | *70  |
| Mairs, ... ..                                                                        | *21  |
| Malacology, Contributions to Indian, No. VI., ... ..                                 | 31   |
| ..... No. VII., ... ..                                                               | 134  |
| Maleasur, ... ..                                                                     | *30  |
| Mallees, ... ..                                                                      | *105 |
| Manikarn, the hottest spring of High Asia, ... ..                                    | 57   |
| Mankees, ... ..                                                                      | *163 |
| Marang Booroo or the Landorians, ... ..                                              | *190 |
| Mason's (the Rev. F., D. D.) physical character of the Karens,                       | 1    |
| Max Müller on the language of savage tribes, ... ..                                  | *27  |
| Mechis of the Doars, ... ..                                                          | *50  |
| Meenars of Rajpootana, ... ..                                                        | *45  |
| Mercantile class, ... ..                                                             | *108 |
| Meteorite stones and irons, Catalogue of, in the Asiatic Society's<br>Museum, ... .. | 43   |
| Mhairs of the Aravallee range, ... ..                                                | *45  |
| Modelliars, ... ..                                                                   | *132 |
| Modern Indians, ... ..                                                               | *56  |
| <i>Monocondylæa crebristriata</i> , (Anthony), .. ..                                 | 153  |
| ..... <i>peguensis</i> , (Anthony), ... ..                                           | 153  |
| ..... <i>vondenbuschiana</i> , (Lea), ... ..                                         | 151  |
| Mont Blanc, ... ..                                                                   | 55   |
| Mont Rosa, ... ..                                                                    | 55   |
| Moondahs, ... ..                                                                     | *26  |
| Moonda and Oraon customs compared, ... ..                                            | *176 |
| Mopgha or Plau, ... ..                                                               | 5    |
| Moplas, ... ..                                                                       | *138 |
| Mountain ascents, ... ..                                                             | 65   |
| Mustágh Pass, ... ..                                                                 | 54   |
| <i>Mya radiata</i> , (Chem.), ... ..                                                 | 146  |
| Nagas, ... ..                                                                        | *149 |
| Naini Tal Lake, ... ..                                                               | 55   |

|                                                                               | Page    |
|-------------------------------------------------------------------------------|---------|
| Namberee Brahmans, ... ..                                                     | *75     |
| Namtso or Yúnám in Lahol, ... ..                                              | 56      |
| <i>Nanina acuducta</i> , (Bens.), ... ..                                      | 39      |
| ——— <i>ammonia</i> , (Vallenciennes), ... ..                                  | 33      |
| ——— <i>ampulla</i> , (Bens.), ... ..                                          | 38      |
| ——— ( <i>ariophanta</i> ) <i>intumescens</i> , n. s., ... ..                  | 32      |
| ——— <i>auris</i> ? (Pir.), ... ..                                             | 38      |
| ——— <i>bajadera</i> , (Pfr.), ... ..                                          | 33      |
| ——— <i>basileus</i> , (Bens.), ... ..                                         | 38      |
| ——— <i>carneola</i> , (Pfr.), ... ..                                          | 35      |
| ——— <i>chenui</i> ? ... ..                                                    | 34      |
| ——— <i>indica</i> , (Pir.), ... ..                                            | 38      |
| ——— ( <i>macrochlamys</i> ?) <i>hebescens</i> , n. s., (W. T. Blanf.), ... .. | 34      |
| ——— ( <i>macrochlamys</i> ?) <i>infausta</i> , n. s., (W. T. Blanf.), ... ..  | 36      |
| ——— ( <i>macrochlamys</i> ?) <i>lixa</i> , n. s., (W. T. Blanf.), ... ..      | 35      |
| ——— <i>orobia</i> , (Bens.), ... ..                                           | 34      |
| ——— <i>shiplayi</i> , (Pir.), ... ..                                          | 38      |
| ——— ( <i>hemiplecta</i> ?) <i>sisparica</i> , n. s., (W. T. Blanf.), ... ..   | 34      |
| ——— <i>subgesta</i> , (Bs.), ... ..                                           | 35      |
| ——— <i>travancorica</i> ? (Bens.), ... ..                                     | 38      |
| ——— <i>vitrinoides</i> , (Desh.), ... ..                                      | 36      |
| Nausherra and Ori felstone, ... ..                                            | 97      |
| Neemchahs, ... ..                                                             | *145    |
| <i>Neophron ginginianus</i> , (Latham), ... ..                                | 156     |
| <i>Neritina perrotettiana</i> , (Recluz), ... ..                              | 38      |
| Niti Pass, ... ..                                                             | 54      |
| Nitrates in river water, ... ..                                               | 228     |
| Nitrogenous matter in river water, ... ..                                     | 229     |
| <i>Opisthoporus Jerdoni</i> , (Bens.), ... ..                                 | 32      |
| Oraons, ... ..                                                                | *168,22 |
| ——— language, ... ..                                                          | *151    |
| Orenburgh, Topography of, ... ..                                              | 81      |
| Organic remains in the Hooghly water, ... ..                                  | 207     |
| <i>Orthis crenistria</i> , (Phill.), ... ..                                   | 133     |
| <i>Otocoris penicillatus</i> , ... ..                                         | 157     |
| ——— <i>longirostris</i> , ... ..                                              | 157     |
| <i>Otopoma hinduorum</i> , (W. T. Blanf.), ... ..                             | 32      |
| Paban or the village fruits, ... ..                                           | *171    |
| Pallers, ... ..                                                               | *133    |
| “Pampur knoll”, ... ..                                                        | 172     |
| Páráng Pass, ... ..                                                           | 54      |
| Pariahs, ... ..                                                               | *133    |
| Pasees, ... ..                                                                | *126    |
| Pastoral tribes, ... ..                                                       | *19     |
| Pasture ground in the Himalaya, ... ..                                        | 64      |

|                                                                                   | Page    |
|-----------------------------------------------------------------------------------|---------|
| Pathans or Afghans, ... ..                                                        | *143    |
| Perovski Fort, Rear admiral Boutakof's expedition to the, ...                     | 84      |
| Pir Punjal chain, ... ..                                                          | 111—114 |
| Plateaux, ... ..                                                                  | 52      |
| Porphyry of Buniar, ... ..                                                        | 107     |
| <i>Productus semi-reticulatus</i> , (Martin), ... ..                              | 131     |
| ————— <i>costatus</i> (Sow.), ... ..                                              | 131     |
| ————— <i>cora</i> (D'Orbigny), ... ..                                             | 133     |
| ————— <i>humboldtii</i> (D'Orbigny), ... ..                                       | 133     |
| ————— <i>flemingii</i> (D'Orbigny), ... ..                                        | 133     |
| ————— <i>longispinus</i> , (Verneuil), ... ..                                     | 133     |
| <i>Pterocyclos nanus</i> , (Bens.), ... ..                                        | 38      |
| <i>Pterocyclos tenuilabiatus</i> , (Metcalf), ... ..                              | 32      |
| Purbhoos, ... ..                                                                  | *119    |
| Puttoons, The leafclad, ... ..                                                    | *156    |
| Pwo or heu-phlong, .. ..                                                          | 5       |
| <i>Pycnonotus jocosus</i> , (L.) ... ..                                           | 157     |
| Rajpoot Brahmans, ... ..                                                          | *60     |
| Rawats or Rajis of Rohilcund, ... ..                                              | *48     |
| Reechpoora Spurs, ... ..                                                          | 177     |
| Rong, ... ..                                                                      | *140    |
| Russian Geographical operations in Asia, ... ..                                   | 77      |
| Sansees, ... ..                                                                   | *126    |
| Saij Aha hills, ... ..                                                            | 115     |
| Saraswata Brahmans, ... ..                                                        | *63     |
| Sarhools' feast of the Oraons, ... ..                                             | *185    |
| Sarry-kul, the source of the Amu, Determination of, ...                           | 50      |
| Schlagintweit's Physical Tableau of High Asia, the Andes, and<br>the Alps, ... .. | 51      |
| Scindees, ... ..                                                                  | *141    |
| Serairkilla and Thakoors of Khurswan, ... ..                                      | *165    |
| Sgau or Pgha-Knyan, ... ..                                                        | 3       |
| Shan Karens, ... ..                                                               | 6       |
| Shanar, ... ..                                                                    | *136    |
| Sheri Bal mountain, ... ..                                                        | 177     |
| Sherrias, The wild, of Bundelcund, ... ..                                         | *45     |
| Shinku La Pass, ... ..                                                            | 54      |
| Shokum Spring, ... ..                                                             | 161     |
| Singbhoom Ho or Lurka Kols, ... ..                                                | *163    |
| Snowfall in the Himalaya, ... ..                                                  | 58      |
| Snowline, The Himalayan, ... ..                                                   | 59      |
| <i>Solenopsis imbricata</i> ? (Koninck), ... ..                                   | 169     |
| Sontals, ... ..                                                                   | *29     |
| <i>Spiraculum hispidum</i> , ... ..                                               | 32      |
| ————— <i>beddomii</i> , n. s., ... ..                                             | 31      |

|                                                                | Page |
|----------------------------------------------------------------|------|
| <i>Spirifer vercherii</i> , (Verneuil), ... ..                 | 133  |
| <i>Spiriferina octoplicata</i> ? (Sow.), ... ..                | 133  |
| — <i>stracheyi</i> , (Salter), ... ..                          | 169  |
| St. Theodule Pass, ... ..                                      | 54   |
| Stoliczka's (Dr. F.) Catalogue of Meteoric stones, ... ..      | 43   |
| <i>Strophomena analoga</i> , (Phill.), ... ..                  | 133  |
| <i>Symphonota bilineata</i> , (Lea), ... ..                    | 139  |
| Syrdaria, ... ..                                               | 80   |
| Tanaolees, ... ..                                              | *95  |
| Tank water, Composition of, ... ..                             | 232  |
| Taru or Plu, ... ..                                            | 5    |
| Teers, ... ..                                                  | *137 |
| Tehon, Investigations beyond the, ... ..                       | 81   |
| Tertiaries near Ori Fort, ... ..                               | 94   |
| Thames, and New River, Quantity of solid matter in the, ... .. | 214  |
| Than Karens, ... ..                                            | 6    |
| Tharoots of Goruckpore, ... ..                                 | *47  |
| Todas, Peculiarities of the, ... ..                            | *24  |
| Total solid matter in river water, ... ..                      | 214  |
| Toungthu or Lau, ... ..                                        | 6    |
| Towns and villages in High Asia, ... ..                        | 62   |
| Tukt-i-Suliman, ... ..                                         | 117  |
| Turkistan and Western Thibetan lakes, ... ..                   | 56   |
| <i>Unio anodontinus</i> , (Lam.), ... ..                       | 138  |
| — <i>bengalensis</i> , (Lea), ... ..                           | 141  |
| — <i>bilineatus</i> , (Lea), ... ..                            | 139  |
| — <i>cæruleus</i> , (Lea), ... ..                              | 139  |
| — <i>corrianus</i> , (Lea), ... ..                             | 140  |
| — <i>corrugatus</i> , (Müll.), ... ..                          | 136  |
| — <i>favidens</i> , var. <i>marcens</i> , (Bens.), ... ..      | 139  |
| — <i>favidens</i> , ... ..                                     | 137  |
| — <i>favidens</i> , var. <i>trigona</i> , ... ..               | 139  |
| — <i>favidens</i> , var. <i>deltæ</i> , ... ..                 | 139  |
| — <i>favidens</i> , var. <i>chrysis</i> , ... ..               | 139  |
| — <i>favidens</i> , var. <i>viridula</i> , ... ..              | 139  |
| — <i>favidens</i> , var. <i>densa</i> , ... ..                 | 139  |
| — <i>involutus</i> , (Bens.), ... ..                           | 140  |
| — <i>lamellatus</i> , (Lea), ... ..                            | 141  |
| — <i>macilentus</i> , (Bens.), ... ..                          | 144  |
| — <i>marginalis</i> , (Lam.), ... ..                           | 138  |
| — <i>merodabensis</i> , (Busch.), ... ..                       | 142  |
| — <i>nagpoorensis</i> , (Lea), ... ..                          | 143  |
| — <i>nuttallianus</i> , (Lea), ... ..                          | 140  |
| — <i>olivarius</i> , (Lea), ... ..                             | 140  |
| — <i>rugosus</i> , (Gmelin), ... ..                            | 137  |

|                                                                                         | Page       |
|-----------------------------------------------------------------------------------------|------------|
| <i>Unio rajahensis</i> , (Lea), ... ..                                                  | 141        |
| — <i>sikkimensis</i> , (Lea), ... ..                                                    | 142        |
| — <i>theca</i> , (Bens.), ... ..                                                        | 144        |
| — <i>wyngungaensis</i> , (Lea), ... ..                                                  | 143        |
| Vegetation of Central Asia, ... ..                                                      | 69         |
| Velmas, ... ..                                                                          | *127       |
| Verchères' (Dr. A. M.) Geology of Kashmir &c., ...                                      | 89 et seq. |
| Vernag spring in Kashmir, ... ..                                                        | 56         |
| <i>Vincularia multangularis</i> (Portt), ... ..                                         | 131        |
| <i>Vitrina auriformis</i> , n. s., ... ..                                               | 36         |
| — <i>gigas</i> , (Bens.), ... ..                                                        | 37         |
| — <i>membranacea</i> , (Bens.), ... ..                                                  | 37         |
| Waldie's (Mr. D.) Investigations connected with the Water<br>Supply to Calcutta, ... .. | 203        |
| Walker's (Colonel J. T.) Russian Geographical operations in<br>Asia, ... ..             | 77 et seq. |
| Wastarwan, ... ..                                                                       | 172        |
| Water Supply to Calcutta, Investigations connected with the,                            | 203        |
| Water, Constituents of River, ... ..                                                    | 211        |
| Water at ebb and flood tide at Baranagur, ... ..                                        | 209        |
| Water, Amount of solid matter in the, of the Hooghly,                                   | 207        |
| Weean and Kohew valleys, ... ..                                                         | 168        |
| Western Thibet, Plateaux in, ... ..                                                     | 52         |
| Wokuls, ... ..                                                                          | *129       |
| Woolar Lake, ... ..                                                                     | 201        |
| Yarkand, Cartographical position of, ... ..                                             | 48         |
| Zebanwan spur, ... ..                                                                   | 128        |
| Zebanwan, ... ..                                                                        | 115        |



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PART II.—PHYSICAL SCIENCE.

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*Physical Character of the Karens.*—By the Rev. F. MASON, D. D.

[Received 7th January, 1865.]

KARENS.\*

The name Karen has been adopted from the Burmans, who apply it to various uncultivated tribes, that inhabit Burmah and Pegu; but it is used, in these notices, as designating a people that speak a language of common origin, which is conveniently called Karen; embracing many dialects, and numerous tribes. These tribes, though speaking a common language, have no common name with which to distinguish themselves; but in this respect, they do not differ from our own ancestors. Cæsar found some twenty or thirty different tribes in Britain, but it does not appear that they had any common name by which they designated themselves.

\* The following pages are offered as answers to "Queries respecting the human race addressed to travellers, by a Committee of the British Association for the Advancement of Science," at the request of Col. Phayre; and embrace all the writer has to say on the general division of the Queries, entitled "Physical Characteristics;" from Query 1 to Query 49.

No answers are given to Queries 5, 6, 7, 8, 9, 10, and 30, relating mainly to anatomy, because satisfactory ones have not been obtained. Nor are answers given to Queries 13, 14, 15, 16, because the writer has already published on the subject of Language in the Journal of the Asiatic Society of Bengal, and in his work on "Burmah." To write again on the subject, would necessarily compel him to repeat considerable of what is already in print, which seemed undesirable.

The word *Karen* has been supposed to signify *aboriginal*, from *yen*\* “first,” and *ka*† a formative particle; but the derivation is European, not Burmese. The Burmans have never been so recondite in naming wild tribes. When the Buddhist missionaries landed at Martaban, they denominated the aboriginal inhabitants *Beloos*, or “Monsters,” and the Burmese still retain the name for a tribe of Karens on the borders of Karenee. The subdued Bghais they dispose of as *Loo-Yaing*,‡ “wild men; while the more civilized Mopghas that bring honey and bees’ wax for sale, they call *Taubya*,§ “wild bees;” and they find in the dress of another a distinctive name, and call them “Red Karens.”

The word *Karen* is probably a Karen word. One of the northern Karen tribes, with which the Burmans must have held most intercourse before they conquered Pegu, call themselves *Ka-yong*, which is sufficiently near the Burmese to be the same word. Then we have a precisely parallel case in the name they give this tribe, which is *Gai-kho*,|| a Karen word that is manifestly identical with *Kai-khen*, the name the other Karen tribes give them.

Eight distinct Karen tribes are known, who speak dialects so diverse, that they cannot understand each other; and yet, on examination, the larger proportion of the roots of each dialect are of common origin.

These tribes have often several names, and not only are travellers misled by them; but residents often take up wrong impressions and give, for distinct nations, names that refer to the same tribe.

A few of the tribes only have distinctive names for themselves, and all, when speaking to each other, use the word for man to designate themselves; precisely as the Hebrews use the word for man as the proper name of the first man, Adam. Were these terms for man adopted in English, the tribes would be much more accurately distinguished than they are at present. Thus we should have

|                     |     |            |
|---------------------|-----|------------|
| Pgha-knyan          | for | Sgau.      |
| Pie-yà              | „   | Bghai.     |
| Prà-kă-yà, or Kă yà | „   | Red Karen. |
| Heu-phlong          | „   | Pwo.       |
| Peu                 | „   | Taru.      |
| Plau                | „   | Mopgha.    |

\* ရင် † က ‡ လူရှင်း § တော ဗျား || ရခို

|              |     |                |
|--------------|-----|----------------|
| Pray-kǎ-yong | for | Kay or Gaikho. |
| Lau          | „   | Toungthu.      |

*Sgau, or Pgha-knyan.*

This tribe is known by a diversity of names.

Sgau, the name the tribe give themselves.

Burmese Karens, thus designated by some English writers.

White Karens, the name given them by English travellers to distinguish them from the Red Karens.

Myeet-tho, so designated by the Burmese.

Shan, the name the Pwas give them.

Pa-ku, the name by which they are known in Toungoo, and to the Red Karens ; but it more properly denotes a sub-tribe of Sgaus.

Shan-ne-pgha, a name given to another sub-tribe of Sgaus.

We-wa, a small sub-tribe of doubtful origin, but probably originally Sgaus.

**BGHAI, OR PIE-YA.**

The Bghais have no distinctive name for themselves, besides Pie-ya.

Bghai is the name the Sgaus give them, and they recognise the name so far as to apply it with an adjective to sub-tribes among themselves.

Bghai-kǎ-teu, "Bghais at the end," is the name of the Tunic Bghais, as used by the Pant Bghais ; because they live at the extremity of the tribe nearest Toungoo.

Tunic Bghai is the name given to the above sub-tribe, by English writers, because they wear tunics or frocks.

Bghai-kǎ-ha, "Upper-Bghai." The Pant Bghais are thus denominated by the Tunic Bghais, because they live on the streams above them.

Pant Bghai is the denomination by which all the Bghais that wear pants are known to English writers.

A-yaing, or Ka-yen Ayaing, "Wild Karens," is the name the Burmese give to nearly all the Pant Bghai.

Leik-bya-gyie, "Great Butterflies" is the Burmese name of a portion of the Tunic-Bghai.

Leik-bya-guay, "Little Butterflies" are other villages of Pant Bghai.

Pra-pa-ku, is the name given by the Red Karens to the Bghais that live near the Pa-kus.

Manu-manau is a Burmese name given to a mixed sub-tribe of Bghais.

Pray is the Red Karen name applied to the Manu-manau and to some other clans related to the Bghais.

Lay-may is Burman for a sub-tribe of Bghais, called Pray by the Red Karens.

Shan-kho is a name given to a Bghai clan in the north-eastern part of Toungoo.

#### RED KAREN, OR KA-YA.

The Red Karens have no name for themselves, except Ka-ya, or Prà-kă-ya.

Ka-yeu-nie, "Red Karen" is the name given them by the Burmese, on account of the red-striped pants they wear.

Bghai-mu-hta, Bghai-mu-htay, names given them by the Bghais, signifying "Eastern Bghai."

Yang-laing, "Red Karens" is their name among the Shan tribes.

The-pya the name by which the Kay people designate them.

Ta-lya a small sub-tribe of Red Karens, are thus denominated by the Red Karens themselves.

Yen-ka-la, the Burmese name of the above clan.

Tha-vie, or Tha-vie-la-kha is a Red Karen name for a people of their own tribe living ten days' journey above them, on the Salween, and who were separated from them when driven from Ava, sixteen generations ago.

In 1861, our Assistant in Karenee reported a singular letter that was sent by them to Karenee; the object of which was not stated distinctly, but it was understood as a challenge to fight. The following is a translation:—

"Now, the words of God and his commands have come to us. Let all men give up the customs of their ancestors, and offerings to spirits, and live in peace. As for us in the land of Tha-vie, we will dwell in peace and obey the commands.

"Nevertheless, at the proper time we will make a feast; and this feast is not a woman's feast, but a man's feast; and when the time arrives to dance, we will dance. And the shades of the dead, and the

spirits will look on. We say to you, if you wish to look on, come and look, and bring sword and spear. We have appointed the month of March for the time of holding the feast."

PWO, or HEU-PHLONG.

The Pwos call themselves Sho.

Pwo is the name given them by the Sgau.

Meet-khyen is a name given them by the Burmese, signifying "River-khyens."

Talaing-Karens is a designation they have in some published papers, and they are sometimes thus designated by the Burmese, because they are principally found among the Talaings.

Shoung is a name given to a small sub-tribe of Pwos in the north of Toungoo.

TARU, or PLU.

Taru is the name given to a tribe nearly related to the Pwos by the Red Karens.

Khu-hta is the name they give themselves.

Be-lu or monsters is the name by which they are characterized by the Burmese. A part of the tribe shave the whole head excepting two tufts of hair, one on each temple, which gives them a sufficiently frightful appearance to account for the name the Burmese have given them.

Be-lu-ba-doung is the name given them by the Kay tribes.

MO-PGHA, or PLAU.

Mo-pgha is the name of one of the villages, from which the missionaries have named the whole tribe; but it is a name they do not recognise themselves. Neither do all call man Plau. Small as is the tribe, there are two or three different dialects among the people, and we have Pie-zau, and Pie-do for man, as well as Plau.

Tau-bya, "Wild Bees" is a name the Burmese give them in some settlements.

Bgha-Pwo is a designation sometimes given them.

KAI, GAIKHO, or PRAI-KA-YOUNG.

The Kai, or Kay, or Gaikho have no distinctive name for themselves, beyond Prà-kă-young, or Kă-young, their word for man.

Kà appears occasionally as designating the people, but it signifies land in their dialect, and properly denotes the country.

Kai, or Kay is the name given them by the Bghais, but they never use it alone. They make three divisions of the tribe.

Kai-kheu "Upper-Kai," often applied to the whole tribe.

Kai-la "Lower-Kai."

Kai-pie-ya "Kai's people."

Gai-kho is the name which the Burmese give them in imitation of the Bghai Kai-kho.

Pa-htoung is the name the Red Karens give them.

Hashwie is a small tribe related to the Kay, and thus denominated by the Bghais.

Hashu is the name they give themselves.

#### TOUNGTHU, or LAU.

The Tounghthus are related to the Pwos by their language.

Toung-thu is the name given them by the Burmese.

Pa-au is the name by which they designate themselves.

There is nothing to associate this tribe with the Karens but their language, excepting that the people have the appearance of being a Shan tribe.

#### SHAN KARENS.

The generic name that the Shans give the Karens in their own country is Yang, which is softened in Burmese into Yen, or Yein. Hence we have of the following Karen tribes is the Shan country of which we know little more than the names.

Yang-lang, "Black Karens."

Ying-ban.

Yen-seik.

Yein.

Sok, or Tsok is the name the Shans give all the Karens that reside in the Burmese territories, without distinction of tribe.

#### PHYSICAL CHARACTERISTICS.

Though the preceding tribes are one in language, they are scarcely one in anything else. They differ materially in their physical characteristics.

The Pwos and Tounghthus, that usually inhabit the lowlands, resemble the Burmese, who inhabit similar localities, in their physical traits more than they resemble the Karens that dwell on the mountains. They are a short muscular people with large limbs, larger than

the Burmese ; while the mountaineers are usually of little muscle and small limbs. It is a popular idea that mountaineers are stronger, and hardier than lowlanders, but, however, it may be in other lands, it is certain that in Burmah the mountain tribes are weaker people than those who live on the plains. The cause, however, may possibly be other than the locality.

In stature, all the Karens, excepting perhaps the northern tribes, are shorter on an average than Europeans. In a promiscuous assembly of one hundred men, embracing several tribes, two were *five feet seven inches* high, eight were *five feet six and a half inches*, and all the rest were shorter. An intelligent man that measured *five feet five inches and a half*, was confident that he was taller than the average of Karens. I should fix the average at from *five feet four and a half to five feet five*. The shortest man I have measured, is a Bghai chief, who was only *four feet eight inches* high ; and the tallest Karen I have seen, was not quite six feet.

A company of one hundred Karen women had only two that were *five feet one inch* high, eight were about *four feet ten* ; and the rest shorter. The average cannot be more than *four feet nine*. The shortest woman I have noted, was *four feet five*.

In different villages, the average would vary considerably from the above. A village of Mopghas, on the hills, that can be seen with a glass from the city of Toungoo, is remarkable for its short men, especially the younger ones. I doubt there being one over five feet high. On the contrary, the northern Bghais and Gaikhos are comparatively tall, perhaps as tall, usually, as Europeans ; but they are a small minority ; and I attribute their superiority, in part, to the higher and cooler region that they inhabit.

Though small in stature, the Karens appear to be tolerably well proportioned. No prevailing disproportion between different parts of the body has been noted.

In those parts of the body which are not exposed, the northern Karens, at least, are as fair as the Chinese. The young people, both male and female, among the Gai-khos and northern Bghais, often show red and white in strong contrast on their countenances ; altogether unlike the uniform clay colour of their more southern relatives. I have met with individuals, who, if seen alone, would be pronounced

part European. Indeed, if not exposed to the sun, some of them would be as fair, I think, as many of the inhabitants of Northern Europe.

The yellow tinge of the Chinese is very distinctly seen on many of the Karens, particularly the females; and yellow, as well as white, is considered handsome, by Karen connoisseurs of beauty.

The hair is straight and coarse, usually jet black; but a few have brownish hair.

The eyes are commonly black, but as we proceed north, many hazel eyes are met.

The head is pyramidal, the breadth of the face across the cheek bones wider than across the temples, and the bridge of the nose rises only slightly above the face. Occasionally a decided Roman nose is seen, but there is still a depression between the eyes not possessed by the Romans. The face is lozenge-shaped, and the whole countenance, in typical specimens, is Mongolian. There is a great diversity in individuals, and these traits are less developed in the more civilized Sgaus and Pwos than in the wilder Pakus and Bghais.

It is not easy to describe the characteristic countenances of the different tribes, yet there are characteristic differences, which the experienced eye detects. There is considerable too in locality, which affects the countenance, apart from the difference of race. Thus the Sgaus of Tavoy and Mergui can usually be distinguished from the Sgaus or Pakus of Toungoo. Education also affects the countenance. The Karens that have been educated in our Mission schools look like quite a different tribe from their wild countrymen on the hills.

The Karens rarely marry with other races; but among those who are settled near the Burmese, a Burman is sometimes found with a Karen wife, and in every instance that has come under my personal observation, the children have had a strong Burmese cast of countenance. There in a village near Toungoo where there are several of these mixed families; Europeans do not distinguish them from Burmans. Still, persons acquainted with the Karens, readily recognise them as a mixed race. There is a village, however, on the mountains called "Village of Talaingings," that tradition says was settled by a company of Talaing men who fled into the jungles during some of the wars in Pegu two or three centuries ago; but there is very little in the coun-

tenances of their descendants to distinguish them from other Karens. Their faces are a little longer, their cheek bones not quite so widely expanded, and their faces have a little less of the lozenge shape.

#### BIRTHS.

When a child is born, in some clans the mother, in others the mid-wife, cuts the umbilical cord, and puts the placenta into a joint of a large bamboo, and wraps it in a rag. The father then takes it and hangs it up on a tree. An abortion is treated in a like manner, but the tree selected is a species of *Ficus*, and the abortion is supposed to become one of the *Cicadæ* that are so often heard singing at evening.

On returning to the house, if the child be a girl, the father goes through the pantomime of performing a woman's labours, beating paddy in a mortar, and the like. If a boy, he spears a hog, and, seizing the first man he meets, wrestles with him, to indicate what his son will do when he comes to manhood.

The knife with which the navel string is cut, is carefully preserved for the child. The life of the child is supposed to be in some way connected with it, for, if lost or destroyed, it is said the child will not be long lived.

About the third day, when the navel string sloughs and comes away, the father takes his net, and, with a few friends, goes out fishing and hunting. The success of the party is deemed prophetic of the character of the child. If much fish or game is obtained, he will be prosperous; if little, he will be unfortunate.

On the return of the party, a feast is made, the friends are invited, and the child is purified and named. Children are supposed to come into the world defiled, and unless that defilement is removed, they will be unfortunate, and unsuccessful in their undertakings.

An Elder takes a thin splint of bamboo, and, tying a noose at one end, he fans it down the child's arm; saying:

“Fan away ill luck, fan away ill success;

Fan away inability, fan away unskillfulness:

Fan away slow growth, fan away difficulty of growth:

Fan away stuntedness, fan away puniness:

Fan away drowsiness, fan away stupidity:

Fan away debasedness, fan away wretchedness:

Fan away the whole completely.”

The Elder now changes his motion and fans up the child's arm ; saying :

“ Fan on power, fan on influence :  
 Fan on the paddy bin, fan on the paddy barn :  
 Fan on followers, fan on dependants :  
 Fan on good things, fan on appropriate things.”

He next takes a bit of thread that has been prepared for the purpose, and tying it round the child's wrist, says : “ I name thee A. B. ;” using the name that the parents had previously determined upon.

Sometimes a name is selected from among their ancestors, or other relatives ; but in such cases they are always careful to select one whose bearer was rich, or valiant, and prosperous ; ever avoiding the poor and unfortunate, as they suppose the name influences the character of the man.

Often a name is selected indicative of the state of the parent's mind at the time the child is born. A man rejoices at the birth of a son, and he names it “ Joy.” A mother is suffering, and she calls her daughter, “ grief.” Another has a son born when he is hoping for deliverance from Burmese oppression, and the advent of White Foreigners, so he names him “ Hope.”

Frequently a child is named from some circumstance connected with its birth. One is called : “ Father-returned,” because the father returned from a journey just as the child was born ; and another is named “ Harvest,” because born at harvest time. For like reasons we have, “ New-house,” “ Sun-rise,” “ Evening,” “ Moon-rising,” “ Full-moon,” and “ February.”

Sometimes the child is named from its appearance, and hence we meet with the names “ White,” “ Black,” and “ Yellow.” “ White” is about as common a name in Karen, as Smith or Jones in English.

The animal, vegetable and mineral kingdoms all occasionally furnish names. There are “ Tiger,” “ Yellow-tiger,” “ Fierce-tiger,” “ Gaur,” and “ Goat-antelope ;” “ Hornbill,” “ Heron,” “ Prince-bird,” and “ Mango-fish ;” “ Eugenia,” “ Job's-tears,” “ Cotton,” “ Gold,” “ Silver,” and “ Tin ;” with many others of a like character.

When the child grows up, and develops any particular trait of character, the friends give it another name, with “ father” or “ mother” attached to it. Thus, a boy is very quick to work, and he is named

“Father of swiftness.” If he is a good shot with a bow and arrow, he is called “Father of shooting.” When a girl is clever to contrive, she is named “Mother of contrivance.” If she be ready to talk, she becomes “Mother of talk.”

Sometimes the name is given from the personal appearance. Thus, a very white girl is called “Mother of white cotton;” and another, of an elegant form, is named “Mother of the pheasant.”

Occasionally, the name refers to locality. Thus, one living near the Sitang, is “Father of the Sitang;” and another, on the borders of the Thoukyekhat, is “Father of the Thoukyekhat.”

Frequently a second name is given without “father” or “mother” being attached to it. Thus, a handsome young person is denominated “Yellow-rising sun;” and one with remarkably long hair, “Horse-tail.”

When a man is married, and has a child born to him, his name is changed again to the father of that child. The mother’s name is changed in like manner. Thus, I have a Bghai writer called Shie-mo, and his father is known as the “Father of Shie-mo; and his mother, as the “Mother of Shie-mo.”

Where there are two persons of the same name, they are distinguished by appending to their names the names of the villages where they reside; analagous to the Norman *de* followed by the name of a place.

The Red Karen ceremonies, at the birth of a child, differ considerably from those noted above. With them, after the child is three days old, the time at which the mother is deemed convalescent and able to walk out, a feast is made by the parents, and the house is open for all to come and eat and drink who choose. All who come are treated as brethren. After the feast, the mother takes the child in a wrapper, on her back, and goes down out of the house. She is then supposed, by a legal figment, to proceed to the paddy field, but in fact she goes out a few yards, digs the ground a little with a hoe, or spade, pulls up a few weeds, and returns to the house. These are symbolical acts, by which the mother pledges herself to labour for the support of the child. The mother next carries her babe to the houses of her near relatives, where the people visited present the child, if a boy, with silver or iron; if a girl, with beads, or a chicken, or a pig.

After these preliminaries, the child is named; often after some person that has been visited who made handsome presents; and always

after some relative, that the memory of their ancestors may be preserved.

Infanticide is rare. Occasionally, when the mother dies, the infant child is killed and buried with her; and I have known a woman confess that she killed her little sister, soon after her birth, because it was ugly; but such things are not common. Children are not exposed.

No measures are taken to alter or modify the form of a child, or any of its limbs. It is carried about in a wrapper, naked, till it can walk, when it is sometimes clothed in a loose tunic; but more often, it is allowed to run about naked. No modification of the limbs is practised.

Among no people are children taught so little as among the Karens; and nothing is taught them to modify the character. They grow up like weeds, and are remarkable for nothing so much as for their wilfulness and disobedience. Yet the Sgaus have a very stringent injunction to obedience to parents. The Elders say:

“O children and grandchildren! respect and reverence your mother and father; for, when you were little, they did not suffer so much as a musquito to bite you. To sin against your parents, is a heinous crime.

“If your father or mother instruct or beat you, fear. If you do not fear, the tigers will not fear you.”

They are also taught to obey kings; another of the commands of the Elders being: “O children and grandchildren! obey the orders of kings, for kings in former times obeyed the commands of God. If we do not obey them, they will kill us.”

There is nothing remarkable in the sports of the child.

The age of puberty may be set down at from twelve to fifteen years. The people not having had the means of keeping their ages, nothing precise can be affirmed that depends on a knowledge of the age. The Karens consider fifteen as the marriagable age.

While writing, six Karens came in, and on inquiry, one says his mother had five children, two say their mothers had eight, two belonged to families of twelve children, and one man of about fifty years of age is the last surviving child of thirteen by one mother. Women that live to forty-five years of age probably bear on an average from nine to ten children. The Karens consider ten as the proper complement.

A verse from an old song intended to teach the duty of children taking due care of their aged mothers, says :

“ A mother can bear ten children,  
A child cannot bear ten mothers :  
A mother bears ten children  
And her strength is exhausted.”

Twins are very uncommon ; much more so than among European nations ; and I never heard of more than two at a birth.

A large family is deemed a great blessing. When seated around the fire at night, they sometimes sing :

“ People’s Kyee-zees many, I covet not,  
People’s money much, I covet not,  
I covet young paddy ten cubits high,  
Good children and good grandchildren.”

The proportion of sexes among adults is remarkably equal, for it is very rare to find either man or woman over twenty-five years of age that is not married or has been married. The proportion in infancy cannot be very diverse.

Children are reared with difficulty. Large numbers die in infancy from want of care, and from ignorance of the proper way to manage the diseases of children.

Nothing remarkable in their senses has been observed, excepting that their eyes are uncommonly good in seeing objects at a distance ; but which may be the result of habit. When I have shown them the villages on the distant hills through my glass, and asked if they did not see them plainly ; the reply has often been : “ Yes, but I can see them about as well without the glass.”

The women bear children to quite as late an age as Europeans. Women, that I should judge to be between forty and forty-five, may be often seen with children at the breast.

Three years is the period for which a child is deemed entitled to his mother’s milk ; but they are oftener suckled longer. It is not uncommon to see a woman suckling her babe at one breast, and its elder brother or sister at the other.

## BETROTHAL.

The Karens go on the principle that marriages are made in heaven. They believe that parties who marry do so in accordance with an engagement into which their sentient spirits entered in the presence of God, before they were born.

It is a very common practice among all the tribes, except the Red Karens, for parents to betroth their children while young, if not in infancy. They have an idea that children are benefitted by it. If a child is sickly, the parents say, "We had better seek a wife for this boy. A wife may invigorate him and make him stronger."

Some one then who has a daughter is selected, and if the parents are agreed, and the fowl bones give a favorable response, a feast is made, and the children are betrothed. The feast is provided by the parents of the boy, and one of the Elders offers the prayer of betrothal, saying: "Lord of the land and water, Mokhie of the land and water; these two are engaged to be united in marriage. May they have long life, may they produce seed, may their shoots sprout forth, may they grow old together!

After a boy and girl have been betrothed, should they, on coming to marriageable age, be unconquerably averse to the union, the parents say: "Ah! their spirits did not consent, their guardian angels did not make the agreement."

The young people sing:

"God and the spirit;

Without their consent,

No marriage is made.

God and the spirit,

And with their consent

No marriage is staid."

Should there be a mutual desire to sever the engagement, the parents of the youth go to the friends of the girl; and after the introductory remark that the union does not appear to have been agreed to in heaven, they say: "They were not planted together, they were not sown together, and they do not love each other. Water spilt, leaves the vessel empty; flour thrown out, leaves the basket empty. There must be the loss of half, and the paying of half." Then the parents of the girl pay half the expenses of the feast at the betrothal.

## ENGAGEMENT.

When a young man wishes to take a girl for a wife, the first persons to be consulted are her parents. If they make no objections, he employs a go-between to transact the business for him.

The go-between takes a fowl and gives it to an Elder who consults its bones, and if the response is unfavorable, the match is broken off and no further proceedings taken.

When the fowl's bones are read as approving the marriage, the go-between goes to the parents of the girl, when, in some sections, the following form of dialogue takes place :

*Go-between.*—“ Now I will creep up thy stairs, I will tread on the steps of thy ladder. Thou plantest up large house posts, thou flattenest out wide bamboo planks. Thou callest thyself the master of the house, a good man. When the sun rises, it shines upon thee ; when the moon rises, it shines upon thee. Thy head is as large as a still pot, thy tongue as long as the gigantic bean pod. How wilt thou reply ? The children lift their eyes on each other. They lift their hearts on each other's heart. Wilt thou approve ? ”

*Girl's Guardian.*—“ Man is the horse's tooth ; the elephant's tusk. Woman is a tree, a bamboo. We are the woman, the female. We cannot reach distant waters, nor arrive at far off lands. We dare not seize those who seize us, we dare not strike back again. The man can reach waters, and arrive at distant lands. Can he take upon himself the charge of a house and a field ? ”

*Go-between.*—“ Fear not, be not anxious, for the house and the field. Mother dying, occupy mother's chamber ; father dying, occupy father's hall. By day, there is one sun ; by night, there is one torch. Fear not, be anxious for nothing.”

*Girl's Guardian.*—“ If thy word is true to thyself ; if thy language is faithful to thyself ; if thy word is one, thy foot-print one—Let not the tree depart from its shadow, let not man leave his place—very good. Thou art a hunting dog, thou scentest the covert ; thou trackest the game. Art thou satisfied ? ”

*Go-between.*—“ I am a hunting dog, and in scenting the hiding place, and tracking the game, I have got to thee.”

*Girl's Guardian.*—“ Thou art a hunting dog. What ornaments hast thou brought ? Let me take a look at them.”

When the work of the go-between is done, the friends of the young man take a hog, an ox, or a buffalo, according to their circumstances, and, leading it to the dwelling of the parents of the girl, they kill it and examine its gall bladder. If the bladder is full, they say the omen is favourable to the union; but if flaccid, containing little liquid, it is deemed unfavourable. Still, a feast is made, but it is eaten in sadness, and the people murmur, "If they are married, they will have no children; they will be unsuccessful in their undertakings, and they will die young." Sometimes the marriage is broken off, and sometimes it proceeds.

If the gall bladder be plump, there is great rejoicing, and all say, the couple will live to old age, and have a numerous posterity. Before partaking of the feast, an Elder takes a bit of the liver and viscera of the animal together with boiled rice on a plate, and, pouring them out on to the earth, prays; "Lord of the heavens and earth, Lord of the lofty mountains and high hills, we give thee food and drink. May these two persons prosper and be successful, may they have a posterity, may they live to old age, that they may bring up sons and daughters." After the prayer, the elders eat, and then all the people eat after them. After eating, they drink spirits, beat kyee-zees, dance, and sing songs.

After this engagement feast, sometimes the marriage takes place in a few days, but frequently, for various reasons, it is delayed for a considerable period, sometimes for years; and when the delay is protracted, it is not uncommon for the engagement to be broken off.

Should the girl refuse to fulfil her contract, she must pay all the expenses of the engagement feast with interest. "If a hog was killed, she must repay a buffalo. If a horse was offered, she must repay an elephant; and there is the shame besides."

These exaggerated demands are never exacted to the letter. In general terms it is said: "If a man breaks his engagement, he loses his outlay; if a girl breaks her engagement, she must pay a fine."

If a young man wishes to break the engagement, he publicly declares that he will sacrifice all the affair has cost him, and ask no return: "Let the fowl be," he says, "as if the hawk had taken it. Let the food I furnished the parents be as if the tiger or leopard had devoured it. Let the presents I made her relatives be as if sunk in

the water, or destroyed by fire." After this public declaration, the girl is considered at liberty to receive proposals from others; which, without it, she is not.

#### MARRIAGE.

If there are no obstacles to an immediate union, after an interval of two or three days, the relatives of the bride conduct her to the house of the bridegroom's parents, with a procession of her friends blowing trumpets. When the bride ascends the ladder into the house, water is poured on her abundantly from the verandah, till her clothes are wet through. She then eats with the bridegroom's relatives, and, attended by her female friends, she goes into the chamber. The young man's friends make presents to all the party, giving the most valuable to the relatives of the bride.

When the time for the company to separate approaches, two of the Elders take a cup of spirits, which is called "the covenant drink," and one speaks for the bride, and the other for the bridegroom.

One says; "Now the woman is thy wife, thy daughter-in-law, thine own daughter, thy own wife who will live with thee. Should she be drowned, should she die by a fall, should she be bitten by a poisonous snake, we can say nothing. But should she be killed in a foray, should she be carried into captivity, should she be put in bonds, thou must purchase her freedom, or obtain the price of her blood."

The other Elder then says: "What thou sayest is true. She is not the child of another, she is my child, my wife, my daughter-in-law. Should she die by accident, I can do nothing. I will lay her out, put food in her mouth, drink by her side, make a funeral feast, and bury her. But should she be carried into slavery in a foray, I will carry a kyee-zee for her redemption, and thou must demand a fine. I will carry spirits to drink, thou must spread out food to eat. We together will purchase the woman. But if we cannot obtain her if she has been killed or is lost, we will demand her price. If I ask her price in kyee-zees, thou must demand it in slaves. We together will make it a reason for making reprisals; and if I am the father of the foray, thou shalt be the mother of it. If I am the head of the foray, thou shalt call the army; and if I call the army, thou shalt be the head of the

foray ; and we will work together. If I go first, thou shalt come last ; and if I come last, thou shalt go first."

Each one then gives to the other to drink, and each says to the other : " Be faithful to thy covenant."

This is the proper marriage ceremony, and the parties are now married.

Now, the people say, they are man and wife and may live where they choose, with the parents of the man, or with the parents of the woman, or may live independent of both. " They may have food or no food ; clothes or no clothes ; may live in peace, or fight and quarrel. No one will interfere. It is nobody's business but their own. No one has any right to control them." As a matter of fact, however, the young man usually goes to live with the parents of his wife, and remains with them for two or three years.

Marriage ceremonies among the Red Karens differ materially from those described above. They never betroth their children in infancy, but leave the young people to make their own engagements.

When the parties have agreed to marry, the man kills one or two hogs or fowls in his own house, and makes a feast. To this the friends of the bride, male and female, conduct her ; and she eats and drinks, and spends the night in the house with her companions.

In the midst of the feasting, and in the presence of the whole company, the bridegroom offers a cup of spirits to his bride, who drinks it up ; and then he asks her : " Is it agreeable ? " To which she replies : " Very agreeable."

The next day the bride returns home and makes a similar feast, to which the bridegroom and his friends go. It is now her turn to offer the cup to him, and when he replies to her question : " Is it agreeable ? " that it is " very agreeable," the two are regarded as married.

Often, however, the reply is playfully given : " Not agreeable," and then the feasts have to be repeated till the favourable response is obtained.

Marriages, according to the Bghais, ought to be always contracted among relatives. First cousins marry, but that relation is considered undesirably near. Second cousins are deemed most suitable for marriage. Third cousins may marry without impropriety, though that

relation is considered as undesirably remote. Beyond third cousins marriages are prohibited.

#### CHASTITY.

Among the Red Karens, chastity, both with married and unmarried, is reported as remarkably loose. The commerce of the sexes among young people is defended as nothing wrong, because "it is our custom." The Sau-bwakepho has a regular rule to give six rupees damages in cases of rape; but these are the only cases of *crim. con.* that he entertains in his courts.

Chastity is cultivated, however, by the other Karen tribes; and one means by which it is preserved, is early marriages. The great majority are married soon after the age of puberty. Still, while the young people are as chaste as most people in Christian nations, lapses among the married are not uncommon; but illegitimate children are very rare.

The Sgaus at least are not wanting in good precepts, notwithstanding, for a contrary course. The Elders say:

"O children and grandchildren! do not commit adultery, or fornication, with the child or wife of another; for the Righteous One looks down from above, and these things are exposed to him. Those that do thus, will go to hell.

"If you meet the wife of another, avoid her, and pass on the lower side of the road."

Though the Bghais do not appear to have precisely the same form of command, yet they regard adultery as particularly offensive to God, and as being the cause sometimes of bad crops.

Human nature is the same everywhere, and the betrothal of children in infancy often results in unhappy marriages, and unfaithfulness to the marriage tie.

Sometimes the parties, on becoming of marriageable age, so dislike each other, that they rebel against the authority of the Elders, and form connections for themselves more congenial to their tastes.

#### POLYGAMY.

Polygamy is neither permitted nor practiced by any of the Karen tribes; but Karens who live in the neighbourhood of the Burmese

sometimes adopt the Burmese custom of taking an additional wife, as they do that of worshipping idols. The Sgau Elders charge their children :

“ O children and grandchildren ! If you have one husband or wife, lust not after another, male or female ; for God at the beginning created only two, one male and one female.”

#### DIVORCE.

Divorces are not unfrequent, arising often from marriages being made by the parents of the betrothed in infancy, and the children grow up without any love for each other.

If a man leaves his wife, the rule is that the house and all the property belongs to her. He is allowed no claim on his money and valuables that may be in the wife's possessions, after he has left her. Nothing is his but what he takes with him.

If a woman forsakes her husband, it is usual to allow a share of the property, but no more than the husband consents to allow.

#### WIDOWS.

Widows retain their husbands' fireplace, and endeavour to support themselves. When young they usually marry again ; but if old and unable to support themselves, they look for help to their own relations, and often suffer from neglect. The obligation to treat widows kindly is recognised in theory, but often neglected in practice. The following story from the Bghai gives a too true picture of this matter.

“ Formerly, there was a woman whose husband died, and left her to get a support as best she could. All her children were small. Their father had forsaken them, and the mother took care of them in any corner or interstice she could find.

“ She had no relations of her own in that country. She had none but her husband's relations, and her husband was dead, and his relations would not help her. She could not therefore get curry to eat, and she fed her children on the sheaths of the blossoms of the wild plantain flowers : these she called to the children “ brains,” and they knew not, but that was the proper name.

“ When the neighbours heard the children say they lived on brains, they said : ‘ The woman is a witch ! Morning after morning it is

brains; evening after evening it is brains. It must be she goes and gets human brains to eat. We cannot get so many brains: and they have no father. Where can so many brains come from?’

“After awhile they concluded they would kill her for being a witch, and they made known their intentions to an uncle of hers. He said: ‘Wait till I can go and see her.’ When at leisure, he went to see the family. He killed a deer, took the head to the children, and showed the brains to the children, asking: ‘Does your mother feed you with brains like these?’ They all replied: ‘No, uncle, mother feeds us with brains that are bright red.’ There are no fibres in them like these.’

“The uncle then repeated his enquiries successively with the heads of a horse, an elephant, a bear, a goat-antelope, a bison, a barking deer, a porcupine, a bamboo-rat, a squirrel, a tupai, a rat, a bird, a fowl, a snake, a frog, a fish, and every kind of animal known in the country; but the children said to all, ‘Uncle, our mother feeds us with no such brains as these.’

“He thought to himself; ‘It is not this, and it is not that. Surely the woman is a witch, for there is no other kind of brains it can be, but human brains.’ So he concluded it was best to kill her.

“However he went out hunting one day more, and all day he met with nothing; so on his return home he plucked two sheathes of wild plantain blossoms, and bringing them into the house, he laid them down by the wash stand. One of the children saw the bright red sheathes; ‘My uncle has brought me some brains, I will eat them all myself, I will not give a taste to any one else.’ All the children rejoiced greatly, and said ‘These are the brains on which mother fed us.’

“When the uncle knew that his niece was not a witch, he almost fainted at the thought of having so nearly consented to her death.”

#### FOOD.

A Karen is a most omnivorous animal. Always excepting the feline race, he eats every quadruped from a rat to an elephant; and there is scarcely a reptile unacceptable to his palate, from a sand lizard to a crocodile, and from a toad to a serpent. Flying ants and crawling grubs are in his bill of fare; and there is no bird too tough, no fish

too bony for his table. Dogs are not eaten by the Southern Karens, but they are as great delicacies in the Bghai country as they are in China.

To this great mass of animated nature, the whole vegetable kingdom is made to serve as greens. Nearly every weed is a vegetable, and the young shoots of the largest trees serve as spinage. They are so careless about what they gather for greens, that one of our young teachers poisoned himself, not long ago, by the vegetable curry he made by the way, while travelling.

Besides game, the Karens raise hogs and fowls for home consumption as well as for sale, and on festive occasions, those who are able, purchase and kill a buffalo or ox; so they do not seem to lack for animal food. Still, they may be often seen sitting down to rice and vegetable curry, with perhaps a taste of dried fish, and they certainly do not eat as much animal food as Europeans. They live much like the wild beasts of the forest. When chance, or something very like it, sends them a whole beast, they eat meat to surfeit; and then they live on vegetables and rice, till the wheel of fortune turns round again.

The meat is often cut into small pieces and boiled in curry; but it is also frequently roasted or grilled. Fish is often dried, as is also the flesh of game sometimes; but dried so imperfectly, that it usually has a very bad odour.

The Karens distil from rice or millet a kind of whiskey, of which men, women, and children often drink to intoxication. But, like their meat, this too they have not on hand constantly; and they are sober a great part of the year, because they cannot get anything to drink to be intoxicated.

In the matter of quantity, they take more food at a meal than Europeans; and yet, if labouring hard, require to eat more frequently. I have often walked with them, up hill and down; and though I could walk all day, from sunrise to sunset, after an early breakfast with a couple of crackers, and water from the brook by the way; the Karens were always knocked up by noon; and had to stop and eat a hearty meal, before they were able to proceed. This is true of all the natives in the country; but is not quite understood by some of our medical men. Natives are sometimes taken into the hospitals, and

actually starved to death by not having food enough allowed them to keep up their strength.

#### DRESS.

The dress of Karen men, south of Toungoo, is a tunic, or frock, and a wrapper; the latter serving for a sheet to sleep in at night. Each one, too, usually carries a bag slung over his shoulder.

The tunics of different tribes and clans are distinguished by the peculiar embroidery of each.\* The Sgau tunic has red horizontal parallel lines on a white ground. The Bghai tunic, on the contrary, has the red lines perpendicular. The Pgho tunic has a broad belt of embroidery at its base, and the Pahu tunic has a narrow band, and the figures varied for every village, originally distinct families, so the markings are equivalent to coats of arms.

One clan of the Bghais wear tunics, but by far the larger portion of the tribe wear pants, and no tunic; and all the tribes beyond them, as the Gaikho, Tarus, and Red Karens wear pants; but each tribe or clan has some variation in the stripes of figures worked on them, so that, like those who wear tunics, they can be distinguished at a glance.†

Excepting the Red Karens, all the women wear a short gown, petticoat, and large turban, all variously ornamented. The Red Karen women have corresponding articles of dress, but each one is merely a rectangular piece of cloth.

The dresses are made of cotton, which the women usually plant, gather, clean, spin into thread, and weave into cloth. The Northern Bghais and Gaikhoş, who raise the silkworm, adorn their dresses with a profusion of silk embroidery.

In some of their clans, the Elder who officiates as high priest in their offerings, or sacrifices, has a longer and more ornamented tunic presented to him than ordinary, but nothing in their traditions has been found to explain the reason.

To describe the different modes of ornamenting their dresses, would require a long article by itself, and a series of drawings.

\* There is one exception. The Mopghas wear the same tunic as the Tunic-Bghais, but why, no reason is known. They speak widely different dialects.

† There is one exception. The Northern Bghais, and the Gaikhoş wear the same pants.

Tattooing is a practice quite foreign to all the Karen tribes, excepting the Red Karens, who are all tattooed across the back with a figure resembling the rays of the rising sun. They can give no account of the origin of the custom. Karens who are brought in contact with the Burmese and Talaings, often adopt their customs, so that Karens are often found, especially among the Pghos, tattooed and dressed like Burmans.

No characteristic mode of amusement has been observed. The Karens dance, wrestle, and show their agility much like the other nations around them.

Games of chance are not unknown to the people, but they are little addicted to them, and never bet on them, unless they have been corrupted by the Burmese or Shans.

Every village has a good complement of old people in it, and I have met with two men, who considered themselves a hundred years of age. Every village has persons over sixty, seventy is not uncommon, eighty is rare, but ninety is met occasionally.

No marked difference has been noticed between the sexes in respect to longevity.

#### SICKNESS.

Where diseases are not deemed contagious, ordinary attention is bestowed upon the sick by their friends and relatives; but when contagious diseases appear, like the small-pox, the whole population seems struck by a panic, and they abandon their houses and scatter into the jungles, where they build booths, and remain till they consider the disease to have passed away. They deem the cholera as contagious as small-pox, and though husbands and wives, parents and children will unite and watch each other to the end; yet all often run away, as soon as a person is dead, and leave him unburied. It is extremely difficult to get people buried in times of cholera.

The Karens attribute diseases to the influence of unseen spirits, and hence, to cure them, they resort to making offerings to appease the spirits that are supposed to be offended. They have twenty or thirty distinct names for different offerings that are made for the sick. They do not, however, exclude the use of medicine altogether; and the Karen Elders have a large *Materia Medica*, consisting of roots and

herbs, leaves and bark, to fall back upon when the offerings do not prove efficacious.

From satisfactory statistics the annual death rate of the Mountain Karens has been ascertained as a little over two and a half per cent., or about the same as in London. The same years that these statistics were collected, the death rate among the acclimatized European soldiers in Toungoo, was only one per cent. The difference should be attributed, it is believed, to difference in constitution, difference in habits, and difference in treatment of the sick; and not to locality. The Karen Mountains appear as healthy as the Scotch Mountains, or the Mountains of Pennsylvania. That something does affect the death rate besides the locality, is manifest from the deaths in the Toungoo jail. The very years that one man only in a hundred was dying in Cantonments, from eight to seventeen in a hundred were dying in the jail.

Karens lack vigour of constitution, and therefore present a weak resisting power to disease. They are subject to intermittent fevers throughout life. I have prescribed to shivering infants at the breast and to shaking old men of threescore and ten. An European does not escape them, but he has a strong constitution, which struggles hard, and if it comes off victor, it is a victor for life. For the first four years of my jungle travels, I had fever every year, but for thirty years since, with one slight exception, I have been entirely exempt. Bites from land leeches often result in bad sores on Karens; while an European will sit down and pick off a dozen from his legs after a walk, without the slightest subsequent inconvenience. In some localities, there is a species of gad fly that bites severely, and its bite is often followed by an ulcer on a Karen; while I have had the backs of both my hands dotted all over with blood spots from their bites, without suffering anything beyond the temporary inconvenience.

The Karens are a dirty people. They never use soap, and their skins are enamelled with dirt. When water is thrown on to them, it rolls off their backs, like globules of quicksilver on a marble slab. To them, bathing has a cooling, but no cleansing effect. Dirt is death's half brother, and is the father of a host of skin diseases to which the Karens are subject. About half of them have the itch, and

many in the form of dreadful sores. Shingles, and fish-skin, and ring-worm are nearly as common as *psora*.

Many diseases, common to all nations, are much more fatal to Karens than to Europeans. The measles are as fatal as the small-pox in Europe, and the hooping cough often makes sad havoc among children. I have known more than twenty die of this disease in a small village of some two hundred inhabitants.

Consumption kills a few, dropsy more, dysentery many, and occasionally considerable numbers are reported to me as dying of fevers; and yet I have never met with a single case of fever among the Karens, that did not yield to medicine. Enlarged spleen is very common, and is sometimes fatal. Ulcers do not kill, but they are as common as skin diseases, and are in great variety.

There is a disease very prevalent among the Sgau tribes, in which large ulcers appear on the limbs. I have had patients brought to the towns, where they have been sent to the hospitals; and sometimes they have been slightly benefited; but in no case has a cure been effected by European treatment; and I have never found a Surgeon who understood the nature of the disease. One said: "It is not leprosy;" but I think it is a kind of leprosy. Another remarked on the cases submitted to his treatment: "I cannot help thinking there is something venereal in it." This the Karens uniformly deny, but I have certainly seen cases in which both legs were masses of what appeared to be incurable sores completely cured, by severe salivation administered by a Burmese doctor; which favours the idea of the venereal character of the disease; but I have seen others die under the same treatment. The disease is hereditary in most instances, but whenever an ulcer appears, the Karens consider it infectious, and will not have the patient in the same house with them. They insist on his living in a separate house, as much as they would a leper. The Burmese, however, do not consider the disease infectious, in which they are partly correct. The Bghais say it is a foreign disease, and some call it "the Paku disease," and others the "Burmese disease;" while the Burmese in some sections call it "the Martaban disease," and in others "the Toungoo disease."

Goitre is common on the hills in special localities. It abounds in one village on the granite mountains, while villages three hours' walk

distant are nearly exempt, though located on the same hills, with the same geological formation. Three or four days' journey beyond this, in an extensive region, where the rocks are exclusively secondary limestone, goitre is again found in excess, while other villages, on the same limestone range, are quite free from the disease. In neither of these districts has any metallic mineral been found. Still, there must be something special in the localities where it abounds to produce it; but what that is, remains to be discovered. All that can be said of it with certainty is, that it is a disease of the hills, for it is not found on the plains; nor did I ever meet with it on the hills in the Tenasserim Provinces. The Karens attribute it to the soil, and say that the disease is caught by eating beans, pumpkins, and other vegetables raised in the infected locality, and by drinking the water that runs through it. Their theory has probably some foundation in fact.

Fowls and hogs that the Karens raise, are occasionally attacked by a violent disease by which they die off as if they had the cholera; and buffaloes on the plains are subject to a like complaint.

#### WORMS.

Entozoa are very abundant. The round worm, *ascaris lumbricoides*, is often vomited up by Karens, both children and adults. The common tape worm, *tenia solium*, is a common inhabitant of the bowels, as are also thread worms, *ascaris vermicularis*.

#### DEATH.

When an elder among the Bghais, with a large number of descendants, dies, the people build a place in the hall for the deposit of the corpse, and they hew a coffin out of the body of a tree, and hew a cover for it, like the Chinese coffins.

The body lies in state three or four days, and during the time men blow pipes, and the young men and maidens march round the corpse to the music. At night, the piping is discontinued, and singing is substituted.

When the piping and marching is not going forward, the exercises are diversified by weeping and mourning; or by the men knocking pestles together, and others showing their dexterity by putting their hands or heads in between, and withdrawing them quickly before the missiles come together again.

Before the burial, an elder opens the hand of the dead man and puts into a bangle or some other bit of metal, and then cuts off a few particles with a sword, saying: "May we live to be as old as thou art." Each one in the company goes through the same ceremonials, and the fragments gathered are looked upon as charms to prolong life.

When about to bury the corpse, two candles made of bees-wax are lighted, and two swords are brought. A sword and a candle is taken by the eldest son, and a sword and a candle by the youngest; and they march round the bier in opposite directions three times, each time they meet exchanging swords and candles. After completing the circuits, one candle is placed at the foot of the coffin, and the other at the head.

A fowl or a hog is led three times round the building in which the body is placed, and on completing the first round, it is struck with a strip of bamboo once; on completing the second round twice; and at the third round it is killed. If a fowl, it is killed by twisting its head off. The meat is set before the body as food.

Young people are buried in a similar manner, but with some abridgement of the forms.

When the day of burial arrives, and the body is carried to the grave, four bamboo splints are taken, and one is thrown towards the west, saying: "That is the east." Another is thrown to the east, saying: "That is the west." A third is thrown upwards towards the top of the tree, saying: "That is the foot of the tree;" and a fourth is thrown downwards, saying: "That is the top of the tree." The sources of the stream are then pointed to, saying: "That is the mouth of the stream;" and the mouth of the stream is pointed to, saying: "That is the head of the stream." This is done, because in Hades everything is upside down in relation to the things of this world.

The body is then buried, and the grave filled in without further ceremony, and when the top of the grave has been neatly smoothed off, a little fence of trellis work is built around it. Within this fence, boiled rice and other food is placed for the dead.

On returning from the grave, each person provides himself with three little hooks made of branches of trees, and calling his spirit to follow him, at short intervals, as he returns, he makes a motion as if hooking it, and then thrusts the hook into the ground. This is done

to prevent the spirit of the living from staying behind with the spirit of the dead.

After the funeral, the grave-digger washes his clothes, or the neglect to do so renders him unfortunate. Married children may dig the grave for a parent, but young ones are prohibited. They must hire some one to do the work, and give him five rupees.

#### FEAST FOR THE DEAD.

Like the Chinese, the Bghais make annual feasts for the dead, for three years after a person's death. The feast is made at the new moon near the close of August, or the beginning of September; and all the villagers that have lost relatives, partake in it.

Before the new moon, they prepare food, plantains, sugar-cane, tobacco, betel nuts, betel leaves, and other articles of consumption. A bamboo is laid across one angle of the roof of the room, and on it are hung up new tunics, new turbans, new petticoats, beads and bangles; and at the appropriate time, when the spirits of the dead are supposed to be present, having returned to visit them, they say: "You have come to me, you have returned to me. It has been raining hard, and you must be wet. Dress yourselves, clothe yourselves with these new garments and all the companions that are with you. Eat betel together with all that accompany you, all your friends and associates, and the long dead. Call them all to eat and drink."

After dark, all the people eat bread made of boiled rice beaten in a mortar. The bread is spread down, and the people are invited: "All who are hungry, eat bread here."

Next morning, the first day of the moon, which is deemed the proper feast day, the previous last day of the month being regarded as the day of preparation, all who have *Kyee-zees* hang them up, and beat them. Then they kill a hog, and make thirty bottles of bamboos. Into one bottle, they put honey, into another water, in a third whiskey, in a fourth salt, in a fifth oil, in a sixth chillies, and into the seventh tumeric. The other twenty-three are laid aside. Loopholes are made to each bottle through which a string dyed yellow is tied.

After setting apart the seven bottles that have been filled, the remaining twenty-three are filled with food indiscriminately. Some with pork, some with boiled rice, some with bread, some with whiskey, and some with betel. When these are filled, rice bread is rolled

up in leaves, and the rolls piled up together ; and then a large basket of open work is woven, into which all these bamboo bottles and the rolls of bread are put.

When the rice and meat is cooked for the feast, after the above arrangements have been made, the food is placed on kyee-zees, or little bamboo stools, if they have no kyee-zees ; and they have to be very particular to spread out all the food at the same instant, lest some of the spirits of the dead, being delayed in eating, should be left behind by their companions.

So soon as the food is arranged on the tables, the people beat the kyee-zees and begin to cry, which they say is calling the spirits to come to eat. Each one calls on the particular relative, for whom he has prepared the feast, as father, mother, sister or brother. If a mother, he says ; weeping : " O prince-bird mother, it is the close of August, Oh ! It is the new moon in September, Oh ! You have come to visit me, Oh ! You have returned to see me, Oh ! I give you eatables, Oh ! I give you drinkables, Oh ! Eat with a glad heart, Oh ! Eat with a happy mind, Oh ! Don't be afraid, mother, Oh ! Do not be apprehensive, Oh ! "

After the weeping exercises are over, the spirits are supposed to have finished their repast, and then the people sit down to eat what is left.

More food is then prepared and put into the basket with the bamboo bottles, that the spirits may have food to carry away with them ; and at cock-crowing next morning all the contents of the basket, including the bamboo bottles, are thrown out of the house on the ground ; when the same scene of crying and calling on the spirits of the dead is repeated, as detailed above.

They do not weep long, because it is related that in ancient times a woman had a daughter, whom she loved much, and after her death she made this annual festival for her and wept long ; when a prophet reproved her, saying : " That is enough. Your daughter says : ' My companions have left me. They have all gone on before.' " Then the mother said : " Seize her for me," and the prophet attempted to grasp her, but he got only a single hem from her garment. Hence the people never weep long, that the departed spirits of their friends may not be left behind by their companions.

*Contributions to Indian Malacology, No. VI. Descriptions of new land shells from the Nilgiri and Anamullay Hills, and other places in the Peninsula of India.*—By W. T. BLANFORD, A. R. S. M., F. G. S.

[Received 3rd February, 1866.]

Of the shells described in the following pages, the greater portion were collected by Captain Beddome, Deputy Conservator of Forests, in the Madras Presidency. This is the case with all the shells from the Anamullay hills, and also the remarkable species of *Spiraculum* from the neighbourhood of Vizagapatam. The Nilgiri Hill shells were found by myself in a recent visit, and *H. intumescens* was given to me some years since by Mr. Theobald as *H. Bajadera*, Pir. I have since collected the shell myself living at Mahableshtar.

### 1. SPIRACULUM BEDDOMEI, n. s.

Shell very broadly umbilicated, depressed, sub-discoidal, smooth, (?) solid, white with transverse chestnut zigzag stripes. Spire flat or sub-convex, suture deep. Whorls 5, rounded, the last cylindrical, descending gradually towards the aperture, and furnished, 7-10 millimetres behind the peristome, with a short open sutural tube, projecting forwards and upwards, not touching the penultimate whorl. Aperture diagonal, circular, peristome double, both lips continuous, the inner slightly expanded, curved back into a shallow angular sinus at the suture, the outer expanded, and inverted upon the upper and dextral margins, rising near the suture into a compressed wing, which is attached throughout on the left side to the penultimate whorl. Operculum horny, concave within, convex without, flattened near the centre, 2 or 3 outer whorls furnished with a free spiral testaceous lamelliform border.

|                                   | Millim. | Inches. |
|-----------------------------------|---------|---------|
| Major diameter, .....             | 27      | 1.12    |
| Minor ditto,.....                 | 23      | .92     |
| Height, .....                     | 10      | .4      |
| Interior diameter of aperture, .. | 8       | .32     |

Habitat. Kimery Hills near Waltair (Vizagapatam), northern division of the Madras Presidency.

This species is of about the same size as *Sp. hispidum*, Pearson, which it closely resembles in many particulars, though differing in several essential characters. Of these perhaps the most remarkable is the forward direction of the sutural tube, which, in all the previously described species of *Spiraculum* (even if the Moulmein *Opisthoporus Fordoni*, Bens. be included), is retroverted. In several forms of *Opisthoporus*, however, the spiracle projects forward, as in the present species. The wing of *Sp. Beddomei* is much more distinct, higher and more pterocycloid than that of *Sp. hispidum*; the inner peristome, (which is deficient in the last named species), is angularly sinuate beneath the wing, but there is no approach to the deep sub-circular opening of the Indian species of *Pterocyclos*. All the specimens procured by Captain Beddome were dead and weathered, and had lost their epidermis, but the traces which remained, shewed no approach to the hispidity from which the Khasi hill shell derives its name. The operculum has even more resemblance to that of *Pterocyclos tenuilabiatus*, Metcalfe, than has that of *Sp. hispidum*.

This is the first discovery in the peninsula of India of a species of *Spiraculum*, that genus having hitherto only been met with to the east of the Bay of Bengal, in Assam and Burmah, while the sub-generic form *Opisthoporus* occurs in the Malay countries and Borneo. In a country like India, which intervenes between two great zoological provinces, the Malayan, and the Africano-Asiatic, such exceptional occurrences are natural, and instances are known not merely of outlying species, but of genera, such as *Cataulus* and *Cyclotopsis*, peculiar to the Indian peninsula or to Ceylon, though belonging to Malayan or African families. The presence of a *Spiraculum* on the eastern coast of India, is a parallel case to the existence of *Otopoma Hinduorum*, W. Blanf. in Hattiwari. It should also be noted that the discovery of specimens of the two Burmese helices, *H. Castra*, Bens. and *H. levicula*, Bens., on the hills of Orissa, shews that some few Burmese species even have extended their range down the western side of the Bay of Bengal.

## 2. NANINA (ARIOPHANTA) INTUMESCENS, n. s.

Shell sinistorse, narrowly and sub-obtely umbilicated, globose, thin, finely, subplicately, transversely striated with obsolete decussating

sculpture, dull fulvous brown, horny, rather lighter in colour just above the periphery and around the umbilicus. Spire convexly conoid, apex very obtuse, suture scarcely impressed. Whorls  $4\frac{1}{2}$ , slightly convex; the last bluntly carinate, descending very little near the aperture, tumid beneath, compressed around the umbilicus. Aperture large, diagonal, truncately sub-circular; peristome white, sub-expanded, margins approaching each other, columellar margin nearly vertical, rather broadly reflexed, partly covering the umbilicus.

|                       | Millim. | Inches. |
|-----------------------|---------|---------|
| Major diameter, ..... | 32      | 1.3     |
| Minor ditto,.....     | 26      | 1.05    |
| Axīs, .....           | 22      | 0.9     |

Habitat. Mahableshtar. Western Ghats of Hindustan.

This fine species of *Ariophanta* has long been confounded with *Nanina Bajadera*, Pfr. which is, however, although a variable shell, easily distinguished. *N. Bajadera* is more globose and thicker, being at the same time more transparent, it has much stronger sculpture (and deeper sutures) and is always rounded at the periphery near the mouth, and frequently throughout, while in *N. intumescens*, the blunt angulation is persistent. *N. Bajadera* too has a fine vitreous lustre, while *intumescens* is dull, and the former shell is usually of a greenish olive colour, though varying in this character and sometimes resembling the latter. The animals also shew a difference in colour, that of *N. intumescens* is uniformly, so far as I have seen, dark cinerous, while that of *Bajadera* is much lighter, but very variable. The latter shell is found mostly on shrubs, the former on the ground, and while *intumescens* has as yet only been found at Mahableshtar, 4,500 feet above the sea, *Bajadera* (which is rare at Mahableshtar) abounds on the equally or nearly equally high hills of Singhur and Poorundhur, and along the summit of the Western Ghats at about 2,000 feet. It abounds at Khandalla at the top of the Bhoze Ghat.

I have already mentioned, in a previous paper, (An. Mag. Nat. Hist. for February, 1863) that an examination of the type specimens of *N. Bajadera*, Pfr. and *N. ammonia*, Valenciennes, has shewed these two supposed species to be identical. I long doubted the distinctness of the species now described from *N. Bajadera*, but although

I have specimens of the latter from many different places, they are all easily distinguished from *N. intumescens*.

### 3. *N. (Hemiplecta?) SISPARICA*, n. s.

Shell openly perforated, subumbilicated, depressed, rather thin, striated, white with a yellowish brown epidermis, having a rather dull oily lustre. Spire convex, apex obtuse, suture flat, linear, submarginate. Whorls 4, very flatly convex above, apical whorl marked with very fine decussated plicate striation, the last not descending distinctly, but bluntly angulate above the periphery, convex beneath. Aperture oblique, semiovally lunate, white and pearly within, the breadth exceeding the height, peristome thin, margins distant, united by a thin callus, columellar margin very oblique, and triangularly reflexed close to the perforation.

|                       | Millim. | Inches. |
|-----------------------|---------|---------|
| Major diameter, ..... | 37      | 1.5     |
| Minor ditto,.....     | 31      | 1.3     |
| Axis, .....           | 18      | .75     |

Habitat. Sispara ghat, Nilgiri hills, S. India, rare.

I know of no near Indian ally of this species. *N. Orobia*, Benson, from Darjeeling, which approaches it in some respects, is more globose and more solid, and has impressed sutures. The Ceylonese *N. Chennai*, however, closely resembles the species above described in form, though it is easily distinguished by its peculiar impressed sculpture. I obtained but two specimens, one of which was living, near the top of Sispara ghat. It is remarkable that so fine a shell should have escaped detection before.

The animal differs in no essential character from those of the sinistrorse *Ariophanta* section. It has a large mucus pore at the end of the foot without any lobe above, the mantle is of moderate size, the head and neck granulated, the caudal portion of the body marked by oblique parallel, impressed wrinkles, and broadly margined near the sole with a double, impressed line.

### 4. *N. (Macrochlamys?) HEBESCENS*, n. s.

Shell scarcely perforate, inwardly depressed, yellowish or fulvous, thin, horny, dull, marked with very close microscopic impressed

oblique lines above, more polished and radiately striated below. Spire low, apex rather acute, prominent, sub-acuminate, suture deep. Whorls  $5\frac{1}{2}$ , rounded, the first narrow, the last much broader, very bluntly sub-angulate at the periphery, and tumid beneath. Mouth large, nearly vertical, lunately sub-ovate, breadth exceeding the height; peristome thin, straight, margins sub-distant, united by a very thin callus, columellar margin nearly vertical above, very briefly and broadly reflexed, nearly covering the perforation.

|                       | Millim.         | Inches. |
|-----------------------|-----------------|---------|
| Major diameter, ..... | 15              | 0.6     |
| Minor, .....          | $12\frac{1}{2}$ | 0.5     |
| Axis, .....           | $8\frac{1}{2}$  | 0.33    |

Habitat. Anamullay hills. S. India.

This species resembles the Bengal *N. subgesta*, Bs., and the Ceylonese *N. carneola*, Pir. (as figured by Reeve) in form, but has a duller lustre and deeper sutures, resembling in the latter character some of the Ceylon *Naninæ* of the same section. The microscopic sculpture is peculiar, the impressed lines being very close, but somewhat irregular and wavy. They cause the dull appearance of the surface. An ordinary lens is insufficient to shew them: under a microscope with a  $1\frac{1}{2}$  in. objective they are very distinct.

#### 5. *N. (Macrochlamys?) LIXA*, n. s.

Shell obtectly perforate, rather depressly turbinate, very thin, fulvous, horny, dull, obliquely striated and marked with very fine and close impressed lines, also oblique, only visible under the microscope, polished beneath. Spire conical, apex acute, suture impressed. Whorls  $5\frac{1}{2}$ , convex, gradually increasing, the last much broader, obsoletely sub-angulate at the periphery, tumid beneath. Aperture nearly vertical, roundly lunate, breadth very little exceeding the height. Peristome thin, straight, margins sub-distant, columella nearly vertical and very briefly reflexed above, almost concealing the perforation.

|                       | Millim.         | Inches. |
|-----------------------|-----------------|---------|
| Major diameter; ..... | $13\frac{1}{2}$ | 0.54    |
| Minor ditto, .....    | 12              | 0.48    |
| Axis, .....           | $9\frac{1}{2}$  | 0.38    |

Habitat. Anamullay hills. E. side.

This is a shell with a similar dull greasy lustre to the last and owing it to the same cause, *viz*, microscopic sculpture. It is a well marked species. Very possibly, however, intermediate varieties may be found connecting it with *N. hebescens*.

#### 6. *N. (Macrochlamys) INFAUSTA*, n. s.

Shell openly perforated, convexly depressed, very thin, fulvous horny, obliquely finely striated, spire convex, apex distinct, suture scarcely impressed. Whorls 6, flattish above, gradually and regularly increasing, the last not descending, depressed, swollen beneath, obsoletely sub-angulate above the periphery. Aperture oblique, lunate, breadth exceeding the height; peristome thin, margins distant, united by a very thin callus, columellar margin vertical above, briefly and triangularly reflexed.

|                       | Millim. | Inches. |
|-----------------------|---------|---------|
| Major diameter, ..... | 23      | 0.92    |
| Minor ditto, .....    | 20      | 0.8     |
| Axis, .....           | 12½     | 0.5     |

Habitat. Anamullay hills, S. India.

Three specimens of this species occur amongst Captain Beddome's Anamullay collections. The above dimensions are those of the largest and most perfect specimen. In both of the smaller specimens which measure respectively in their major and minor diameters and axis 19½, 18, 10, and 17, 15, 9 millimetres, there is more or less descent of the last whorl at the aperture, but both specimens have a stunted appearance, and irregular descent of the last whorl is very common in abnormal individuals of all forms of *Helix*.

This species has no very marked character. It is very near *N. vitrinoides*, Desh., but may be recognised by its smaller and rounder mouth, narrower last whorl and more convex form. In shape it resembles *H. monticola*, Hutton.

#### 7. *VITRINA AURIFORMIS*, n. s.

Shell very depressed, irregularly ovate, ear-shaped, very thin, striated, polished, with a membranaceous epidermis, greenish or brownish yellow in colour, paler at the nucleus. Spire flat, suture slightly impressed. Whorls 1½. Aperture oval, occupying the whole under

part of the shell, and exposing the interior to the apex; peristome membranaceous.

|                | Millem. | Inches. |
|----------------|---------|---------|
| Length, .....  | 13      | 0.52    |
| Breadth, ..... | 8       | 0.32    |
| Height, .....  | 2½      | 0.1     |

Habitat. Sispara ghat, Nilgiri hills, Southern India.

This species is very near *V. gigas*, Bens. and still more closely allied to *V. Peguensis*, Theobald, being, however, a more depressed species than either, and more open. It is also less solid than the last named species. I have not met with the animal, which may possibly differ from those of other *Vitrinæ*.

If the animal resemble those of *V. gigas* and *V. Peguensis*, the occurrence of this mollusk on the western flank of the Nilgiri Hills will be one of the most anomalous with which I am acquainted amongst the land-shells of India, since I know of no other instance of a Malayan type, unrepresented on the Himalayas, of which species occur on the hills of Southern India. A small auriform shell such as this may, however, have been easily overlooked, and the Himalayan Molluscan fauna is, probably, far from thoroughly known.\*

The animal of *V. Peguensis* has been partly described by Mr. Theobald who, however, has unfortunately not mentioned the form of the mantle, the presence or absence of lobes covering the shell, nor the existence of a caudal gland, unless by the expression "caudali papilla nulla" is intended to imply its absence; more probably Mr. Theobald's meaning is that the overhanging lobe, so conspicuous in some forms of *Nanina* is absent, the gland existing, as in *Ariophanta* &c.

This *Vitrina* is not the only south Nilgiri species. A larger membranaceous form also occurs, which requires comparison with Mr. Benson's *V. membranacea* from Ceylon.

#### 8. ACHATINA ANAMULLICA, n. s.

Shell turrito-ovate, thin, finely striated, horny with high vitreous lustre. Spire turrated, sides convex, apex obtuse, suture impressed.

\* Mr. Theobald (J. A. S. B. XXXIII. p. 244,) includes *V. gigas* in his list of Himalayan shells, but the species is found on the Khasi hills, the fauna of which differs widely from that of the Himalayas.

Whorls 8, scarcely convex, the last rounded beneath. Aperture oblique, peristome thin, columella moderately arcuate, obliquely truncated below.

|                | Millem. | Inches. |
|----------------|---------|---------|
| Length, .....  | 27      | 1.1     |
| Diameter,..... | 12      | 0.48    |

Aperture 10 millemetres high,  $6\frac{1}{2}$  broad. Habitat. Anamullay Hills.

Intermediate in its characters between *A. Nilagarica*, Bens., and the oblong ovate, *Achatina* of Ceylon.

Captain Beddome's Anamullay collections comprise the following species in addition to those above described:—

*Nanina vitrinoides*, Desh. var.

*N. Shiplayi*, Pfr.

*N. Indica*, Pfr. var.

*N. Travancorica*? Bens.

*N. Basilens*, Bens.

*N. ampulla*, Bens.

*N. auris*? Pfr.

*Bulimus Nilagaricus*, Pfr. var.

*B. physalis*, Bens.

*B. sp.* near *B. trifasciatus*, Rv., one imperfect specimen.

*Cyclophorus Jerdoni*, Bens.

*C. deplanatus*, Pfr.

*C. sp.* near *C. ravidus*, Bens. (or possibly an immature *Aulopoma*.)

*C. sp.* (apparently near *C. Shiplayi*, Pfr., but finely costulated, possibly the young of an *Alycæus*.)

*Pterocyclos nanus*, Bens.

*Pt. rupestris*, ?! Bens.

*Paludomus*, sp.

*Neritina Perrotettiana*, Recléiz.

To which there only remains to be added *Cataulus recurvatus*, Pfr., to complete the list of known shells from the Anamullays. I add a few remarks upon the species above quoted.

But one specimen occurs of the shell which I am disposed to consider a variety of *Nanina vitrinoides*. It is small, measuring only  $18\frac{1}{2}$  millemetres by 16 in its two diameters, and  $8\frac{1}{2}$  in height. It is depressed in form, and of a greenish tinge, but appears to differ in no

essential particular from the Bengal variety. The species has not before, so far as I am aware, been found in Southern India. *N. Ship-layi*, Pfr. inhabits the eastern base of both the Anamullays and the Nilgiris; on the latter hills I have found it at the foot of the Coonoor ghat. The animal is a *Nanina*, closely resembling *N. indica*, Pfr. and *N. acuducta*, Bens., having a large mucus pore at the caudal extremity of the foot without an overhanging lobe, or with but a very rudimentary one. The mantle lobes are small, and the animal in all respects closely resembles that of the sub-genus *Ariophanta*. A solitary specimen of *N. indica* from the Anamullays is very solid and rather strongly marked, the sculpture being less regular than in the common Nilgiri form, and scarcely granulate, the last peculiarity being perhaps due to weathering, as the specimen is decorticate and somewhat bleached. It is a dwarf form, less depressed than the type, and measures 17 and 15 millem. in its two diameters, and 10 in height. The shells found on the Nilgiris vary considerably.

*N. Basilens*, Bens. (*H. Titanica*, Pfr.), I learn from Captain Beddome, is far from scarce in the teak forests of the Anamullays, a tract 2,000 to 3,000 ft. above the sea, where *N. ampulla*, Bens. also occurs. The range of the latter shell extends a considerable distance to the north in the Wynand district, where it was found by Dr. Jerdon, if not to the base of the Coorg hills, while *N. Basilens* does not appear to be found north of the remarkable gap in the Western Ghats at Paulghat cherry, which, traversing the very highest portion of the whole chain, divides the Nilgiris from the Anamullies, and through which the railway from Madras to Beypoor passes. Both *N. ampulla* and *N. Basilens* have only been found west of the Hills.

I have not had an opportunity of comparing the shell referred doubtfully to Mr. Benson's recently published *N. Travancorica* with the full description, and the identification is therefore unsatisfactory. The shell referred to *N. auris*, Pfr. is identical with a species found at Neddiwuttom on the Nilgiris, and corresponding closely with Reeve's figure of that *N. auris* in *Conchologica Iconica*.

The little shell which I have called *Bulimus Nilagaricus*, I was at first disposed to consider a distinct species. It is only 14 millem. in length, and base by 6 in diameter. But some specimens from the Nilgiris are no larger, and there are graduations in size from these to

the typical shells. The solitary specimen of *B. physalis* has only traces of spiral sculpture, but it appears to agree in every other respect with Mr. Benson's description.

A dwarf form of *Cyclophorus Jerdoni*, only 29 millem. in diameter and 19 high, and 2 species of *Pterocyclos*, one of them unquestionably identical with *Pt. nanus*, Bens., are also comprised in Captain Beddome's collections. The second species of *Pterocyclos* of which a single weathered specimen was found, shews no essential distinction from the Bengal *Pt. rupestris*, Bens., but it appears improbable that that form should really exist so far to the south.

*Cyclophorus deplanatus*, Pir. some decorticated specimens of which were amongst the Anamullay shells, occurs abundantly on Sispara ghat, at the western extremity of the Nilgiri plateau. A small shell in Captain Beddome's collections, with more colouring than *C. ravidus*, Bens., and ornamented with zigzag transverse stripes, may possibly be a young specimen of that species, but its thin and continuous peristome recalls that of some forms of *Aulopoma*, and the possibility of its belonging to that genus is strengthened by the deficiency of the epidermis close to the peristome. As the Anamullays have already furnished a *Cataulus*, the occurrence of a species of *Aulopoma* is by no means improbable.

The *Paludomus* is perhaps a variety of the species common near Bombay. The little *Neritina Perrotettiana* was previously unknown except in the Pykara river on the Nilgiris.

We have evidently, as yet, only an instalment of the molluscan fauna of the Anamullays. None of the shells above specified are from the higher ranges. So far as they have been collected, there is, as might have been anticipated, a general identity with Nilgiri shells, but at the same time a somewhat closer approximation to the Cingalese fauna.

*P. S.*—The above paper was written six months ago, and would have been sent for publication in the Society's Journal at once, but that I hoped to be able to procure drawings of the shells for the purpose of illustrating it. In this, I have again been disappointed, and I am compelled to forward the descriptions of the shells by themselves.

In the meantime, however, I have received from Captain Beddome several additional shells from the Anamullay hills collected by him

during the past year. Besides several new species, the collection comprises *Helix Anax*, Bens., and a fine large *Nanina* resembling *N. Cysis*, Bens. but dextrorse, and which is very possibly a large variety of Mr. Benson's *H. Basilessa*. It occurred at a height of 7,000 feet above the sea. I append descriptions of 3 of the new species sent.

### 9. ACHATINA BEDDOMEI, n. s.

Shell turrito-ovate, solid, finely and closely sub-costulately striated, dark purplish brown, epidermis in parts having a tendency to assume a dirty cream colour, especially in dead specimens. Spire convex below, slightly acuminate above, apex obtuse, rather inclined to the right, suture impressed. Whorls  $7\frac{1}{2}$ -8 convex, the last  $\frac{2}{3}$  of the entire length, rounded at the base. Aperture nearly vertical, sub-pyriform, milky within; peristome thickened, white, outer margin rather straight, not arcuate, columella deeply curved, lined with callus, sub-obliquely and rather broadly truncated at the base.

|                 | Millem.         | Inches. |
|-----------------|-----------------|---------|
| Length, .....   | 30              | 1.2     |
| Diameter, ..... | $11\frac{1}{2}$ | .45     |

Aperture 10 millem. long, 6 broad.

Habitat. Anamullay Hills, 5,000 to 7,000 feet (Beddome.)

This is a more solid form than any of the Nilgiri species, and it differs from all of them, and also from the solid Ceylonese forms, in its sub-acuminate apex. It is a well marked species.

### 10. ACHATINA TEXTILIS, n. s.

Shell ovate-oblong, rather solid, translucent, striated near the suture, smooth, polished, dark chesnut with close vertical and horizontal lines of a greyish yellow colour, varying in breadth and resembling the threads of an irregularly woven cloth. Spire elongated, conoidal with convex sides, apex obtuse, sutures impressed. Whorls 7, convex, the last about  $\frac{2}{3}$  of the entire length, rounded beneath. Aperture vertical, truncately semioval, milky within; peristome slightly thickened, white, right margin slightly sinuate toward the base, columella deeply curved, obliquely truncated beneath, margins united by a thin callus.

|                 | Millem. | Inches. |
|-----------------|---------|---------|
| Length, .....   | 26      | 1.05    |
| Diameter, ..... | 13      | 0.52    |

Aperture  $10\frac{1}{2}$  millem. long, 7 broad.

Habitat. Anamullay Hills, 6,000 feet, (Beddome.)

This is the only indigenous Indian *Achatina* with which I am acquainted, possessing coloured markings. In form it approaches some of the Ceylon *Achatinæ*, and also an undescribed Deccan species.

#### 11. *BULIMUS TRUTTA*, n. s.

Shell perforated, conically ovate, thin, finely striated, light yellowish, with two spiral rows of sub-distant chesnut spots, sub-quadrate in form, on all the whorls, and two spiral chesnut stripes, the lower sometimes very faint, upon the last whorl below the periphery. Spire conical, apex acute, sutures impressed. Whorls  $5\frac{1}{2}$ , convex. Aperture nearly oval, slightly oblique. Peristome thin, margins united by a thin callus, columellar margin vertical, narrowly reflexed, the reflexed portion meeting the penultimate whorl at an angle.

|                | Millem. | Inches. |
|----------------|---------|---------|
| Length, .....  | 14      | .55     |
| Diameter,..... | 9       | .35     |

Aperture 7 millem. long,  $4\frac{1}{2}$  broad.

Habitat. Anamullay Hills, (Beddome.)

There is some doubt whether the shells above described be adult. They have a somewhat immature appearance, but all the specimens sent, four in number, are of precisely the same size, and the thin peristome is characteristic of the group of *Bulimus Bengalensis*, to which the present species belongs. From that species and its allies, it is easily distinguished by its short conical form.



*Catalogue of the specimens of Meteoric Stones and Meteoric Irons in the Museum of the Asiatic Society of Bengal, Calcutta, corrected up to January, 1866. By Dr. STOLICZKA and H. F. BLANFORD, ESQ. F. G. S.*

| Number.             | Date of fall. |                | Name of locality and geographical situation.         | Weight.*                  |                                 |
|---------------------|---------------|----------------|------------------------------------------------------|---------------------------|---------------------------------|
|                     | Year.         | Month and day. |                                                      | Of the largest specimens. | Of the specimens in the Museum. |
| 1.—METEORIC STONES. |               |                |                                                      |                           |                                 |
| 1                   | 1492          | 7th Nov.       | Ensisheim, Elsass, France, ...                       | ...                       | 1 oz. 44 grs.                   |
| 2                   | 1798          | 13th Dec.      | Benares (near Krakhut) East Indies, ...              | ...                       | 1 oz. 347 grs.                  |
| 3                   | 1803          | 8th April,     | L' Aigle (Dept. de l' Orne) France, ...              | ...                       | 1 oz. 434 grs.                  |
| 4                   | 1807          | 14th Dec.      | Weston, Connecticut, U. S. A. (2 specimens,) ...     | ...                       | 111 grs.                        |
| 5                   | 1808          | 22nd May,      | Stannem (near Iglau) Moravia, ...                    | ...                       | 5 oz. 228 grs.                  |
| 6                   | 1808          | p              | Moradabad, East Indies, §                            | ...                       | 287 grs.                        |
| 7                   | 1812          | 5th August,    | Chantonnay, Vendée, France, ...                      | ...                       | 2 oz. 319 grs.                  |
| 8                   | 1814          | 15th Feb.      | Bachmut, Yekaterinoslaw, Russia, ...                 | ...                       | 4 oz. 13 grs.                   |
| 9                   | 1815          | 18th Feb.      | Duralla, territory of Patyala, East Indies, †        | ...                       | 3 oz. 407 grs.                  |
| 10                  | 1821          | 15th June,     | Juvenas near Libonnez, Ardèche, France, ...          | ...                       | 3 lb. 13 oz. 42 grs.            |
| 11                  | 1822          | 30th Nov.      | Bittoura 75 miles N. W. of Allahabad, East Indies, † | ...                       | 1 oz. 108 grs.                  |
| 12                  | 1822 or 23    | ...            | Umbalah, East Indies, ...                            | ...                       | 4 oz. 234 grs.                  |
| 13                  | 1827          | 16th Feb.      | Mhow, Ghazepore, East Indies, †                      | ...                       | 304 grs.                        |
| 14                  | 1838          | 18th Feb.      | Akburpore, Sarahanpore, Eas Indies, †                | ...                       | 67 grs.                         |
| 15                  | 1838          | 6th June,      | Chandakapoor, Berar, East Indies, ...                | ...                       | ...                             |
| 16                  | 1838          | 13th October,  | Cold Bokkeveldt, Cape of Good Hope, ...              | ...                       | ...                             |

\* Weights are given in pounds, ounces and grains.

Note 1.—Specimens with a mark † are besides represented by a cast of the entire stone in addition to the specimens of the original.

Note 2.—Specimens with a mark † are represented by a cast only.

§ According Mr. Piddington the Society possessed in 1845 3 pieces of this interesting meteorite.

| Number. | Date of fall. |                                    | Names of locality and geographical situation.                       | Weight.                   |                                 |
|---------|---------------|------------------------------------|---------------------------------------------------------------------|---------------------------|---------------------------------|
|         | Year.         | Month and day.                     |                                                                     | Of the largest specimens. | Of the specimens in the Museum. |
| 17      | 1841          | 12th June,                         | Château Renard, Loiret, France,                                     | 5 oz. 328 grs.            | 5 oz. 328 oz.                   |
| 18      | 1843          | 25th March,                        | Bishopsville, S. Carolina, U. S. A. (2 specimens,)                  | 160 grs.                  | 223 grs.                        |
| 19      | 1843          | 6th July,                          | Manegaon, Kandeish, East Indies, (2 specimens,)                     | 268 grs.                  | 1 oz. 67 grs.                   |
| 20      | 1846          | Found in the Society's collection. | Assam, East Indies, ... ..                                          | 10 oz. 96 grs.            | 10 oz. 96 grs.                  |
| 21      | 1847          | 27th Feb.                          | Iowa, Linn County, U. S. A., ... ..                                 | 6 oz. 426 grs.            | 6 oz. 426 grs.                  |
| 22      | 1850          | 30th Nov.                          | Shalka, 10 miles S. of Bancoorah, East Indies, (several specimens,) | 2lbs 15oz. 100grs.        | 5lbs. 7oz. 140 grs.             |
| 23      | 1852          | 23rd Jan.                          | Nellore near Madras, East Indies,†                                  | ...                       | ...                             |
| 24      | 1852          | 4th Sept.                          | Mezö, Madaras, Marasch, Transylvania,                               | ...                       | ...                             |
| 25      | 1852          | 2nd Dec.                           | Bustee, (between Goruckpore and Fyzabad,) East Indies,†             | 15 oz. 348 grs.           | 15 oz. 348 grs.                 |
| 26      | 1853          | 6th March,                         | Segowlee, Sarun, East Indies, (3 specimens,)+                       | ...                       | ...                             |
| 27      | 1855          | 5th August,                        | Petersburgh, Lincoln country, Tennessee, U. S. A., ... ..           | 8lbs 11oz. 266grs.        | 19lbs. 1oz. 61l grs.            |
| 28      | 1857          | 28th Feb.                          | Parnallee, S. of Madura, East Indies,†                              | 42 grs.                   | 42 grs.                         |
| 29      | 1860          | 28th March,                        | Kheragur, N. of Bhurtpoor, Agra, East Indies,                       | ...                       | ...                             |
| 30      | 1860          | 14th July,                         | Dhurnsala, Punjab, East Indies, (2 specimens) ... ..                | 4 oz. 412 grs.            | 4 oz. 412 grs.                  |
| 31      | 1861          | 12th May,                          | Goruckpore (Pijsnaisi), East Indies, (3 specimens)+                 | 15 oz. 306 grs.           | 1 lb. 7 oz. 66 grs.             |
| 32      | 1863          | 11th August,                       | Dacca (Shytaal 40 m. N. of) East Indies, (several specimens,)+      | 10 lbs. 12 oz.            |                                 |
| 33      | ...           | ...                                | Shergotty, ... ..                                                   | 10lbs. 6oz. 12l grs.      | 11lbs 2oz. 380grs.              |
| 34      | ...           | ...                                | Jessore,†                                                           | 3lbs. 9 oz. 259grs.       | 3 lbs. 9 oz. 259grs.            |

|| The total weight at the fall was somewhat exceeding 5 lbs. 1 oz. 313 grs.

† The total weight of the original specimens which are as yet undistributed.

| Numb <sup>r</sup> . | Date of fall. |                | Names of locality and geographical situation.                 | Weight.                   |                                 |                 |
|---------------------|---------------|----------------|---------------------------------------------------------------|---------------------------|---------------------------------|-----------------|
|                     | Year.         | Month and day. |                                                               | Of the largest specimens. | Of the specimens in the Museum. |                 |
| 2.—METEORIC IRONS.  |               |                |                                                               |                           |                                 |                 |
| 1                   | 1776          |                | Knasnojarsk, Teniseisk, Siberia (Pallas-iron,) (2 specimens.) | ...                       | 324 grs.                        | 1 oz. 95 grs.   |
| 2                   | 1784          |                | Toluca, Xiquipileo, Mexico, (2 specimens,) ...                | ...                       | 11 oz. 71 grs.                  | 17 oz. 139 grs. |
| 3                   | 1792          | Found,         | Zacateras, Mexico, ...                                        | ...                       | 1 oz. 87 grs.                   | 1 oz. 87 grs.   |
| 4                   | 1811          |                | Ellbogen, Bohemia, (2 specimens,) ...                         | ...                       | 310 grs.                        | 1 oz. 66 grs.   |
| 5                   | 1814          | Disc.          | Texas, Red river, U. S. A., ...                               | ...                       | 18 oz. 180 grs.                 | 18 oz. 180 grs. |
| 6                   | 1815          | Found.         | Lénarts, Scharosch, Hungary, ...                              | ...                       | 2 oz. 342 grs.                  | 2 oz. 342 grs.  |
| 7                   | 1827          | Found,         | Atacama, Belvia, S. A., ...                                   | ...                       | 3 oz. 276 grs.                  | 3 oz. 276 grs.  |
| 8                   | 1840          |                | Coke Country (sevier-iron), Tennessee, U. S. A., ...          | ...                       | 188 grs.                        | 188 grs.        |
| 9                   | 1840          |                | Smith Country, (Carthago) Tennessee, U. S. A., ...            | ...                       | 239 grs.                        | 239 grs.        |
| 10                  | 1841          |                | Kuffs Mountain, Lemington Country, U. S. A., ...              | ...                       | 244 grs.                        | 244 grs.        |
| 11                  | 1843          |                | Arva, Hungary (2 specimens,) ...                              | ...                       | 1 oz. 207 grs.                  | 1 oz. 207 grs.  |
| 12                  | 1847          | 14th July,     | Braunau, Bohemia, ...                                         | ...                       | 7 oz. 29 grs.                   | 7 oz. 29 grs.   |
| 13                  | 1847          | Disc.          | Seelaesgen, Neumark, Brandenburg, Prussia, ...                | ...                       | 5 oz. 284 grs.                  | 5 oz. 284 grs.  |
| 14                  | 1850          |                | Tucson, Onora N. Mexico, ...                                  | ...                       | 385 grs.                        | 385 grs.        |
| 15                  | 1856          |                | Tewall Hill, Madison Country, N. Carolina, U. S. A., ...      | ...                       | 2 oz. 31 grs.                   | 2 oz. 31 grs.   |
| 16                  | 1857          |                | Tula, Netschaëvo, Russia, ...                                 | ...                       | 4 oz. 420 grs.                  | 4 oz. 420 grs.  |
| 17                  | 1861          |                | Robertson Country, Tennessee, U. S. A., ...                   | ...                       | 1 oz. 249 grs.                  | 1 oz. 249 grs.  |
| 18                  | 1861          | Disc.          | Bittersgrün, Saxony, ...                                      | ...                       | 10 oz. 232 grs.                 | 10 oz. 232 grs. |

*Observations on the Astronomical points determined by the brothers Schlagintweit in Central Asia.\*—By Captain GOLUBIEF.*

From the Journal of the Imperial Russian Geographical Society. Part 4th, 1861.

[Received 11th January, 1866.]

During the current year, the first volume of the Narrative of the Scientific Expedition of the brothers Schlagintweit to India and High-Asia, extending over a period of four years, from 1854 to 1858, has made its appearance. This remarkable production is all the more valuable, inasmuch as it will not only embrace the results of the explorations of the brothers Schlagintweit, but likewise those of many learned travellers who were their predecessors in this field of inquiry. The first volume contains a collected series of astronomical and magnetic determinations. The number of the points for which geographical co-ordinates are given is 112, but the degree of their exactness differs considerably. Many of the points for which co-ordinates are given were obtained from Indian triangulations; but many others were determined from march-routes alone. The determinations which are less exact, belong naturally to the northern portion of the journey, to Tibet and Turkestan. The corrections which it would be necessary to make in the existing maps, in consequence of the Schlagintweits' determinations, would be very considerable, particularly in longitudes. Thus, for instance, Lé, in Ladak, is alleged to lie 44' more to the West than was originally supposed, and altogether the whole of western Tibet would have to be removed about 20' to the westward. The changes in the latitudes are less extensive, the highest do not exceed 10', as in the case of Balti. The Karakoram pass, the highest point attained by Europeans who had preceded the Schlagintweits, lies more northwards by 11', and the same distance farther to the West than marked on any previous map.

\* This paper was read at a general meeting of both sections of the Russian Geographical Society. The president of the section of physical geography, M. Seménof, who had only just returned from abroad, took occasion to express his own doubts as to the correctness of some of the determinations and conclusions of the brothers Schlagintweit. He communicated to the members present that these results, which bear evident traces of haste, are regarded with equal doubt by the learned in Germany. The extensive range of the labours, the multiplicity of the collections and observations which devolved on the celebrated travellers, produced the confusion and irregularity apparent in their observations and collections.

The weight which is to be attached to these corrections, must depend on the degree of exactness which regulates the scientific labours of the brothers Schlagintweit; but unfortunately, in the volume that has been issued, this consideration is not dwelt on, that is to say, the probability of errors in the determinations is nowhere alluded to. The determinations themselves are not particularised minutely enough, to enable us to estimate their value.

In order to judge of the correctness of these labours, we bring forward some examples. Thus, in the determinations of Lé in Ladak, the error which should be expected in the latitude would amount to 30"\*. The longitude of Lé was determined by the transfer of one chronometer which was rated at Simla on the 15th May, at Lé on the 17th September, at Srinagar the 24th October; the longitudes of Simla and Srinagar are known. The rate of the chronometer should have been deduced from the longest transfer occupying 162 days, from which, in the main result, a considerable error was to be expected† amounting to no less than 7'.5. Further an error has crept into the calculations of the brothers Schlagintweit which, when corrected, will alter their result by 8' (instead of 77° 14' 6" it should be 77° 22' 5" east of Greenwich). The correction of the chronometer was determined on the Karakoram pass on the 9th of August; by its action from Simla (15th May) to Srinagar (24th October) the longitude of the pass was determined at 77° 30' 4". But corrections of the chronometer at Lé were also obtained on the 11th July and 17th September, according to which the determinations of the Karakoram pass is found to be 77° 39' 5" or, otherwise, differing by 9'.

\* The latitude of Lé was determined twice by polar heights.

|                                    |         |
|------------------------------------|---------|
| 11th July, . . . . .               | 34° 7'5 |
| 16th September, . . . . .          | 34° 9'2 |
| Mean, . . . . .                    | 34° 8'3 |
| According to Cunningham, . . . . . | 34° 9'1 |
| „ Moorcroft, . . . . .             | 34° 9'3 |

† The chronometer was rated in the Observatory of Calcutta in March, 1855 and April, 1857 (pp. 98 and 102). From this it must appear, that the probable 24 hourly disturbance of the chronometer on the spot would not be less than ±s. In the longitude of Lé, also, one can suspect an error of at least  $\frac{\pm s. 125.37}{162} = \pm 29s.$  From Simla to Lé is a journey of 125 days, from Lé to Srinagar 37 days; whole duration of the journey 162 days.

But the Schlagintweits express their doubts as to the correctness of the determination of time at Lé on the 11th July, and, therefore, do not take it into account. Nevertheless, an error of no less than 10' must, in all probability, be suspected in the longitude of the Karakoram pass as well as in the longitude of Lé. It remains, consequently, open to doubt, which longitude is to be accepted, that given by the Schlagintweits, or that previously adopted by Humboldt, which Thompson, who visited this pass in 1848, found to be quite accurate. Up to this point, the corrections are less than  $\frac{1}{2}^{\circ}$ , and applied to the map attached to the description of their journey, they excite curiosity, but not surprise; but the upper portion of the map representing Central Asia puzzles every one, by its marked difference to every thing that has hitherto been known of these countries. It is sufficient to say that the position of the three bases of the cartography of this part of Asia, namely the towns of Khotan, Yarkand and Kashgar, disagrees with those hitherto generally accepted, by nearly 180 versts, for all the three points nearly equally lie 10' in latitude, and 130' in longitude, more southward and westward, according to the dictum of the Schlagintweits.

At the same time, the determinations of little Bokhara, which belong to the Jesuits, cannot call forth strong doubts; on the contrary, there is strong reason for believing, that if these determinations are not altogether correct, they are but very slightly incorrect. In Djungaria, there are several points determined by the Jesuits, and some subsequently by me in 1859. From a comparison of these determinations, it becomes evident that the latitudes given by the Jesuits are correct to a minute. But the astronomical observations in Djungaria were, in all probability, not made by the Jesuits themselves, but by Chinese whom they had instructed. It must therefore be supposed, that the points in little Bokhara, where the Jesuit fathers worked themselves, are equally correct. As regards the longitudes, it is well known that the existing itineraries coincide perfectly well with the determinations of the Jesuits, though it must be acknowledged that the marche-routes having almost a meridional direction, cannot point out any appreciable error in the longitudes. Generally speaking, the better acquainted we become with Chinese Turkestan, the more convinced we are of the accuracy of the determinations of the Jesuits.

In support of this, we shall here bring forward the following example. There are two routes, besides others, across the Tian Shan leading to little Bokhara; one from Kuldja to Aksu, the other from the southern shore of Lake Issyk-kul by way of the Faükù pass, to Ush. Until the astronomical labours of 1859, both these routes presented on the map considerable angles with the axis of the mountain range; the first one of nearly  $45^{\circ}$ , and the other that of  $30^{\circ}$ , but according to the astronomical results obtained in 1859, it was found that the inclination of routes from Kuldja to Aksu, to the axis of the range, did not exceed  $30^{\circ}$ , while the route to Ush intersects the ridge in a direct line, and runs north and south. It appears strange then after this, if, seeing the great inclination of the transverse routes to the axis of the mountains, that Issyk-kul, with the neighbouring countries on the northern side of the Tian Shan, had not been before removed to the west, as was done subsequently in consequence of the astronomical determinations; or that all the series of points in Little Bokhara were not removed to the east, and in every case not to the west. Facts like these, speak in favour of the positions of Ush and Asku, and other towns of Little Bokhara determined by the Jesuits; and it must be observed, that up to the present time no one has had the same means, as possessed by them, of determining the relative positions of these towns. The last point that the Schlagintweits determined instrumentally, is Suget, a halting place for caravans, proceeding from Ladak to Yarkand. This route is marked on a very rare map, which is a direct copy of an original one compiled by the Jesuits and translated by Klaproth; a point on this road under the same latitude with Suget, as determined by the Schlagintweits, has nearly one and the same longitude. Beyond Suget, all the other points on the Kuen-lun and in Turkestan, are determined by the marche-routes; the most northern of these and nearest to Khotan, which the two brothers Herman and Robert succeeded in reaching, is the village of Bashia. This point is also given on the map of the Jesuits, its position being fixed by marche-routes, not by direct determination. The difference in the positions of Bashia, as given by the Jesuits and the brothers Schlagintweit, amounts to  $6'$  in latitude, and  $47'$  in longitude. How is it then possible, after this, to accept the position of Khotan, and with it that of the other towns of Turkestan, as given by the Schlagintweits,

differing as it does by 130' in longitude from the astronomical determinations of the Jesuits, when neither Herman nor Robert visited Khotan, while the papers of Adolph perished with him in Kashgar?

But how are we to regard the more recent labours in the country adjoining Little Bokhara, which cannot be reconciled to the points of the Schlagintweits?

Thus Sarry-Kul, the source of the Amu, which was determined by Wood, the Schlagintweits could not place on their map, according to the determination of Wood, but were obliged to remove it nearly 2° to the westward.

Issyk-kul is also marked on the map 2° more to the west than it should be, according to the last Russian astronomical determinations in 1859. And if this Lake be marked in its true position on the map of the Schlagintweits, Sarry-kul would then fall back on Yarkand, and the western extremity of Issyk-kul will appear above Asku, which, of course, would be impossible.

Petermann, in his notice of the labours and researches of the Schlagintweits, is of opinion that a review of their determinations in Little Bokhara is premature, more especially as the marche-routes by which they were guided, are not yet published. But the astronomical results of 1859, which so distinctly contradict the determinations of the Schlagintweits, belong to the Russian Geographical Society, and this is our excuse for expressing our doubts of the correctness of a certain portion of the results of the brothers Schlagintweit, before receiving the data on which they are based.



*Comparative, hypsometrical and physical Tableau of High Asia, the Andes, and the Alps.*—By ROBERT DE SCHLAGINTWEIT, Professor at the University of Giessen.

- Contents.*—I. *Geographical configurations.* 1. Plateaux. 2. Passes  
3. Peaks.  
II. *Hydrography.* 1. Lakes. 2. Springs.  
III. *Physical phenomena.* 1. Snow-fall. 2. Snow-line.  
3. Glaciers.  
IV. *The varieties of habitation.* 1. Towns and villages.  
2. Pasture grounds.  
V. *Extreme heights visited by man.* 1. Mountain-ascents.  
2. Balloon-ascents. 3. Effect of height.  
VI. *Limits of vegetation and animal life.*

*Remarks.*—1. Drawings of many of the objects (plateaux, peaks, towns, &c.) mentioned in this Tableau, as well as panoramic profiles and maps, are contained in the Atlas to the “Results of a scientific mission to India and High Asia,” by Hermann, Adolphe, and Robert de Schlagintweit.

2. The heights, given in English feet, are absolute, referring to mean sea-level.

*Transcription.*—Vowels and diphthongs sound as in Italian and German: ä = u in “but;” â = an in the French “gant;” ü = ü in German.—Consonants as in English. The sign ‘ marks the syllable to be accentuated.

The materials, upon which this comparative tableau is based, are :

For *High Asia*, viz.—The Himálaya, Western Tibet, the Karakorúm and Künlün, our own travels and observations, combined with the valuable data of the Great Trigonometrical Survey of India, and with those of our predecessors.

For the *Andes*.—The celebrated “Voyages aux régions équinoctiales,” by Alexander de Humboldt, which possess to this day the highest value and importance; in his recent publications,\* the newest contributions of science have been added with a master’s hand.

\* Kosmos.—Ansichten der Natur, 3rd edition.—Kleinere Schriften.—I always quote the original, German edition.

For the *Alps*.—The two volumes “*Untersuchungen über die physikalische Geographie und die Geologie der Alpen*,” published by my brothers Adolphe and Hermann.

## I. GEOGRAPHICAL CONFIGURATIONS.

### 1. Plateaux.

Plateaux, in consequence of their being more or less intersected by deep and broad valleys, or from being covered with ridges, are so variable in their form, that the use of the name, in many instances, appears to be somewhat arbitrary. I prefer not to extend the meaning of the name too far, and in so doing diverge from the practice of earlier travellers, who commonly applied the term to every mountainous region of great *general* elevations—as the natives of the *Himálaya* have a tendency to do—irrespective of its form.

In the *Himálaya*, which is composed in almost every direction of lofty and irregular ridges, and intersected by numerous valleys of inconsiderable width, no plateau of any extent has been discovered as yet, nor is it at all probable that one exists.

*Western Tibet* was for a long time supposed to be little else than a country of plateaux—an erroneous impression emanating from the first observers, though Humboldt had early pointed out the error of this belief,\* as well as later travellers (the Stracheys, Cunningham, and Thomson). Plateaux certainly do occur in Tibet; they are, however, much less numerous and considerably smaller than I had been led to expect. In *Bálti*, the plateau *Deosái* is 14,200 ft. high.

Between the *Karakorúm* and *Künlün*, especially near the western crest of the former, several well-defined plateaux of extraordinary height occur. Some of the highest are called: *Dápsang* (17,500 ft.), *Búllu* (16,883 ft.), *Aksáe Chin* (16,620 ft.), and *Voháb* (16,419 ft.) In summer, no snow covers these plateaux, but also no vegetation: in the far distance there are some isolated, lofty, snowy peaks, besides which the eye discerns nothing but barren rocks, and extensive sterile plains, all well watered by streams, to which the glaciers covering the flanks of the peaks afford an ample and lasting supply. If water was wanting to these plateaux, they would be a complete desert, as uninhabitable to man as to any animal.

\* *Ansichten der Natur*. Vol. I., p. 104.

In the *Andes* are to be found, if not the highest, at least the most extensive plateaux of our globe, which generally lie along the very ridge of the mountains, and on which large towns are situated, as Cerro de Pasco (14,098 ft.), Potosi (13,665 ft.), and Cuzco (11,380 ft.). There is also a large plateau surrounding the elevated lake Titicaca (12,843 ft.).

In the *Alps*, plateaux occur only at their base; the Swiss plateau having a mean height of 1,460 ft., the Suevo-Bavarian plateau of 1,420 ft.

## 2. Passes.

The mean of a sufficient number of such passes, which lead over the *principal crests*, is particularly to be taken into consideration, it being approximatively proportional, or, to express it more clearly, equal to the general mean height of these crests. The passes situate in the lateral ramifications of the principal crests—though they are numerous—cannot be included in these general means, being geographically of subordinate importance.

The mean height of passes in the three principal mountain-chains of *High Asia* is as follows :

A. For the *Himálaya* (mean of 19 passes,)..... 17,800 ft.

From Síkkim to Kishtvar : Bhután and Kashmír being excluded : the former for want of materials, and Kashmir on account of the Himalaya there losing the character of one well-defined and predominant chain.

B. For the *Karakorúm* (mean of 3 passes,)...18,700 ft.

From long. E. Gr.  $76^{\circ}$  to  $79\frac{1}{2}^{\circ}$ , the heights in the eastern continuation being quite unknown.

C. For the *Künlün* (mean of 2 passes,) ..... 17,000 ft.

As the two passes are situated in parts not differing in any particular from the general mean of this chain, they may be looked upon as representatives of the other.

From these numbers it appears, that the *Karakorúm* has by far the greatest mean height of passes; but the one pass which we must still consider the highest, is situated in the *Himálaya*. This is the *Ibi Gámin* pass (20,459 ft.) leading from Gärhvál to Gnári Khórsum, which my brother Adolphe and I myself crossed as the first, and as yet as the only Europeans, Aug. 22, 1855. The pass next in height

is the Mustágh pass in the Karakorúm chain (19,019 ft.), the third the Changchénmo, or Yéngi Daván (about 18,800 ft.), in the same chain. None of these passes are generally used as commercial roads. The highest pass as yet known to be regularly crossed with horses and sheep, for the purposes of commerce, is the Párang pass (18,500 ft.; Mr. Theobald, Jr. makes it 19,132 ft., which seems too high—); and between this height and 18,000 ft. are situated several of the most important and frequented passes, as the Mána (18,406 ft.) the Karakorúm (18,345 ft.) and the Kióbrang (18,313 ft.). The lowest passes in the Himálaya chain are the Shínku La (16,684 ft.) and the Bára Lácha (16,186 ft.); the well known Níti pass reaches 16,814 ft.

In the *Andes*, the general mean elevation of the passes is, according to Berghaus :

For the Western Andes, ..... 14,500 ft.

For the Eastern Andes,..... 13,500 ft.

The highest passes are : Alto de Toledo (15,590 ft.), Lagunillas (15,590 ft.), and Assuay 15,526 ft.). The latter pass attains, according to Schmarda, only 14,517 ft.

In the *Alps*, the mean of the passes is ..... 7,550 ft.

The highest pass, at least in former times not frequently used for commercial purposes, is the St. Théodule (11,001 ft.), upon which the brothers Platter have now erected a meteorological observatory.

### 3. Peaks.

In the beginning of this century, the *Andes* were supposed to contain the highest peaks on our globe, and Chimborazo to rise supreme above the rest. Though as early as 1816 this was proved by Captain Webb's measurements to be incorrect, yet some time elapsed, before the superiority of the *Himálaya* above the *Andes* was generally admitted. Now we know, from the valuable and accurate observations of the G. T. Survey of India, that Gaurisánkar, or Mount Everest (29,002 ft.) is the highest peak of the world. The memoir of Major J. T. Walker in the *Journal of the Asiatic Society of Bengal*, 1862, No. I., pp. 32—48, gives a detailed enumeration of the peaks hitherto measured in the *Himálaya*; this memoir, as well as the publications of Captain Montgomerie and private communications kindly received from the Surveyor General's Office, enable me to state, that 216 peaks are now accurately measured in the chain of the *Himálaya*. Among

these 216 peaks, 17 exceed the height of 25,000 ft., 40 the height of 23,000 ft., and 120 the height of 20,000 ft.

In the *Karakorúm*, peaks have lately been discovered, which are scarcely inferior in height to the loftiest in the *Himálaya*, though only its western part has as yet been explored. With regard to the heights of its eastern continuation, there is not enough known to allow even of an estimate being made.

The highest peaks of the *Karakorúm* are the *Dápsang* (Ko of the G. T. S. 28,278 ft.), the *Diámar* (26,629 ft.), and the *Masheribrúm* (25,625 ft.)

With reference to the *Künlün*, we can only mention the peaks that we saw and measured between the *Yurungkásh* pass and the western termination of this chain; our idea about the general height is the more limited, as we have not even itinerary reports of former travelers to assist us. None of the peaks seen there by ourselves exceeds 22,000 ft.

In the *Andes*, important alterations have very recently been made with reference to the succession of the peaks, when arranged according to height, and, even now, the same amount of accuracy cannot be ascribed to the hypsometrical determination of its principal peaks as to the trigonometrical operations in the *Himálaya*. The highest peak in the *Andes* is the *Aconcagua* (23,004 ft.) in *Chili* (*Pissis* gives only 22,451 ft.): and there are as many as five peaks higher than the *Chimbarozo* (21,422 ft.). In *High Asia*, forty-five peaks are known, which exceed in height the dominating peak of the *Andes*, the *Aconcagua*.

In the *Alps*, *Mont Blanc* (15,784 ft.) and *Monte Rosa* (15,223 ft.) are well known to be the highest peaks. Other high peaks are; *Täschhorn*, or *Lagerhorn* (14,954 ft.), *Weisshorn* (14,813 ft.), *Mont Cervin* (14,787 ft.), and *Dent Blanche* (14,305 ft.).

## II. HYDROGRAPHY.

### 1. Lakes.

In the *Himálaya*, there are but very few lakes. That of *Nainital* (6,520 ft.), in *Kámáon*, the *Vúllar lake* (5,126 ft.), and the *Chinär lake* near *Srinágar* in *Kashmír*, suffice to exhaust the category of those deserving mention.

Glacier lakes.—Accumulations of water formed by one glacier obstructing the outlet of a higher one—are of much more frequent occurrence. At times, the wall of ice breaks away before the pressure of the swollen waters, when the lower lands become suddenly inundated, and the torrent rushes on with uninterrupted violence for miles, exercising a marked influence even down to the lower parts of the river. Similar inundations, some of them of a most destructive character, have several times occurred. Two of the most elevated glacier-lakes are the Destál (17,745 ft.), in Gärhvál, and the Námtso, or Yúnám (15,570 ft.) in Lahöl.

*Western Tibet and Turkistán* possess many lakes, all of which are situated in great heights; they are, however, gradually drying up, as becomes apparent by the unmistakeable marks of larger surfaces remaining from former times. They contain a greater quantity of salt than lakes in general, and most of them to an amount which renders them more or less brackish.

The following are the names and the heights of the principal:—

*Lakes of Western Tibet and Turkistán.*

|                                  |         |                            |        |
|----------------------------------|---------|----------------------------|--------|
| Aksáe Chin, ... ..               | 16,620  | Níma Kar, ... ..           | 15,100 |
| Tso Gyagár, ... ..               | 15,693  | Háule, ... ..              | 14,600 |
| Tso Kar, or Khauri Taláu, ... .. | 15,684  | Tso Gam, ... ..            | 14,580 |
| Múre Tso, ... ..                 | 15,517  | Tso Bul, ... ..            | 14,400 |
| Kiúk-Kiöl, ... ..                | 15,460  | Tso Mitbál, ... ..         | 14,167 |
| Mansaráur, or Tso Mápan, ... ..  | 15,250  | Upper Tsomognalari, ... .. | 14,050 |
| Rákus Tal, or Tso Lánag, ... ..  | 15,250  | Lower Tsomognalari, ... .. | 14,010 |
| Tsomoríri, ... ..                | *15,130 |                            |        |

In the *Andes*, the most remarkable lake is that of Titicaca (12,843 ft.)

The foot of the *Alps* is adorned with a great many lakes, all in low elevations of from 600 to 1,600 ft.

## 2. Springs.

Springs of an ordinary, mean temperature, commonly called cold springs, are of frequent occurrence in High Asia; the finest and most copious springs are to be found in *Kashmír*, as the spring Vérnag, Vétur Vúllar, Kókar Nag, Achibál, A'nat Nag and others. The spring Sóna Bréri, also in *Kashmír*, situate about five miles south-east of Shahabád, is the only intermittent spring as yet known in High Asia.

\* According to Mr. Theobald, Jr. (see Journ. As. Soc., Beng, 1862, No. V., p. 513) only 14,272.

In *Western Tibet*, where rains in the higher parts are rare, and where the dryness in summer is so excessive that even the formation of dew is scarcely perceptible, cold springs are comparatively rare. In Turkistán, in Bálti, and Hasóra, we find a greater number of springs, a fact intimately connected with the general meteorological conditions of these provinces.

With reference to the limit, at which springs are to be found still in High Asia, I give the following data, derived from our own observations. The greatest height, at which we found a spring in the Himálaya, was 15,920 ft.; this spring was situated on the slopes of the Kyúngar pass. In Tibet, we discovered a real spring on the slopes of the Ibi Gámin peak still at a height of 17,650 ft.; this spring is probably the highest spring hitherto found.

As the highest spring in the Andes, Humboldt names the one called "Ladera de Cadlud," at a height of 15,526 ft. above the level of the sea; in the Alps, Adolphe and Hermann have found the highest cold spring at 10,440 ft.

Hot springs occur in High Asia in a surprisingly great number,\* from the sea-level up to heights of more than 16,000 ft. The highest hot springs of High Asia are at Murgái, (16,382 ft.), in Núbia, at Momái (about 16,000 ft.), in Sikkim, at Púga (15,264 ft.), in Ladák, near the lake Aiúkkió (15,010 ft.), in Turkistán, and at Chagrár (about 15,000 ft.), in Pangkóng. As a curious and remarkable fact I may add, that the highest hot spring in India, at Hazaribágh, in Bengal, is only 1,750 ft. above the level of the sea.

The hottest spring of High Asia is at Manikárn (temp. 202° Faht.) in Kúlu (this is the hottest spring as yet found all over Asia), at Jámnotri (temp. 193° Faht.) in Gárhvál, and at Chorkóna (temp. 190° Faht.) in Bálti. The hottest springs of the world (if we exclude those, which rise in the immediate neighbourhood of volcanoes) are to be found in the Andes. There "Agua de Comangillas," near Chichemequillo and Quanaxuato, at a height of about 6,200 ft., in latitude north 21°, show a temperature of 205°.3 Faht.;† and the springs "Las Trincheras" between Porto Cabello and Valencias, in

\* See the "Enumeration of the hot springs of India and High Asia, given by me in *As. Soc. Journal*, 1864, No. I., p. 49.

† Humboldt's "Essai pratique sur la Nouvelle Espagne." 2nd Ed., Vol. III. (1827), p. 190.

Mexico, have increased, between the years 1806 and 1823, from 195° Faht. to 206°.6 Faht.,\* thus exceeding at present the temperature of the "Aguas de Comangillas" by 1°.3 Faht.

The hottest known spring of Europe, unconnected with present volcanoes, is that of Chaudes Aigues in Auvergne (temp. 176° Faht.).†

### III. PHYSICAL PHENOMENA.

#### 1. Snow-fall.

The lowest height at which snow has fallen in the *Himálaya* during the winter, is about 2,500 ft., but such cases are extremely rare, having occurred in Kāmdon and Gārhwál only twice (in 1817 and 1847), since the British took possession of the country.‡ Snow has fallen in the memory of man only once in Nahán§ (3,207 ft.), in the province of Simla. The snow, which falls once within several years in the Kángra valley, down to heights of 3,000 and 2,700 ft., disappears almost immediately. At Haribágh the snow melts away on the day it falls, or at least within thirty-six hours. During my travels in Kúlu, I was informed by the natives, as well as by several gentlemen who knew this part of the country thoroughly, that the village of Mándi (2,480 ft.), is below the limit of snow-fall.

At an elevation of 5,000 ft. scarcely one year passes by without snow-fall; but, even at this height, the snow disappears after a few days, and sometimes even hours. "It snows, but one does not see it," the natives of Kathmándu (4,354 ft.) very significantly use to say, meaning, that the rare nightly snow-falls are melted away by the earliest rays of the sun. 6,000 ft. may be assigned as the limit in the *Himálaya*, where snow regularly falls in winter, with the probability of remaining some time upon the ground.

In *Western Tibet* and in the *Karakorúm*, the general elevation of the country is so great, even in its lowest regions, that no part lies below the limit of hibernal snow-fall. But the quantity of snow actually falling is inconsiderable, and this circumstance it is, which forms one of the chief causes that the passes of the *Karakorúm*, even

\* Humboldt's "Kosmos," Vol. IV., p. 246.

† Newbold, in "Philos. Transactions," 1845, p. 127.

‡ Colonel R. Strachey, in this Journal, Vol. XVIII., Part I., p. 309.

§ This Journal, Vol. III., p. 367.

the highest, remain open throughout the year. In some parts of Tibet the winter is the only season, when atmospheric precipitation at all takes place.

In the *Künlün*, even on its southern slopes, a greater amount of snow is precipitated than on the northern side of the *Karakorúm*, whilst its *Turkistani* (northern) slopes differ still more from the *Karakorúm* in this respect, they being visited by very heavy rains and great snow-falls. Even at *Káshgar* (about 3,500 ft), in *Turkistán*, there are said to be several snowy days every winter.

The data, which I was able to collect on snow-fall in the *Andes*, are so few and vague, that I could not draw any conclusion from them. Also for the *Alps*, I could not bring forward any new facts with reference to the snow-fall.

## 2. *Snow-line.*

The snow-line, or the average height where snow remains perpetually throughout the year, has offered unexpected difficulties in its determination for the *Himálaya*. When *Webb* and *Moorcroft* first pointed out the general heights reached by the snow-line, when they first discovered the remarkable fact, that, in spite of the influence arising from exposition, the snow-line of the *Himálaya* descends lower on its *southern* (Indian) than on its *northern* (Tibetan) slopes, the statements of these travellers, now proved to be correct in all material points, were discredited by men of science both in Europe and in India. *Humboldt*, however, was among the first who endeavoured to remove the distrust with which these discoveries were received; he also gave an explanation\* of the causes which were possibly sufficient to originate so remarkable a phenomenon as this of the unlooked-for differences existing between the snow-lines of the Tibetan and Indian slopes. He considers it "the results conjointly of the radiation of heat from the neighbouring elevated plains, the serenity of the sky, and the infrequent formation of snow in very cold and dry air." Of all these causes, however, the last is the most important. The direct insolation, being less interrupted on the Tibetan side, has also its share of influence; but the effect is comparatively small. As the best corroboration of the quantity of snow-fall being the principal cause of the depression on the southern (Indian) slope of the *Himálaya*, may

\* "Asie Centrale," pp. 284, 327; "Kosmos;" Vol. I. p. 358.

be adduced the fact, that we found the isothermal lines for the year and the summer, which coincided with the snow-line on the Indian side, decidedly warmer than those on a level with the Tibetan snow-line. The fact, moreover, of the *Karakorúm*—though on an average three degrees farther north—having the snow-line so excessively high on both its slopes, offers another instance of the influence of limited precipitation.

In the *Künlün*, the meteorological conditions also become apparent in the different limits of the snow-line on either side; but here the effect is the reverse of that perceived in the *Himálaya*, the greater precipitation on the “northern” slopes (towards the plains of *Turkistán*) lowering the snow-line on that side to a considerable extent.

Although, in the *Himálaya* at large, the snow-limit of the Tibetan side does not descend so low as that of the Indian, yet the influence of exposition at once becomes apparent in the ordinary sense, corresponding to these latitudes, if we examine the slopes of a crest or mountain, of which, by the nature of its position, both slopes belong either to the Indian side of the ridge in general, or to the Tibetan side. The many and vehement disputes upon the much-discussed subject of snow-limits have chiefly arisen from the entire neglect of this modification.\*

The values we obtain for the height of the snow-line on the three mountain chains of *High Asia* are :

|                       |                                              |     | Feet.  |
|-----------------------|----------------------------------------------|-----|--------|
| A. <i>Himálaya</i> .  | Southern (Indian slopes), ... ..             | ... | 16,200 |
|                       | Northern (Tibetan slopes), ... ..            | ... | 17,400 |
| B. <i>Karakorúm</i> . | Southern (Tibetan slopes), ... ..            | ... | 19,400 |
|                       | Northern (along the Turkistani plateaux),    |     | 18,600 |
| C. <i>Künlün</i> .    | Southern (facing mountainous ramifications), |     | 15,800 |
|                       | Northern (facing the Turkistání plain),† ... |     | 15,100 |

For the *Andes*, the snow-limits are, according to Humboldt and Pentland :

\* See Batten, in the “*Calcutta Jour. of Nat. Hist.*,” Vol. IV. p. 537; Vol. V. p. 383. Capt. T. Hutton, “in the same Journ.” Vol. IV. p. 275; Vol. V. p. 379; Vol. VI. p. 56; and Capt. A. Jack, “in the same Journ.” Vol. IV. p. 455.

† “*Asie Centrale*,” 1847, Vol. II. pp. 165 and 177.

|                                              | Feet.  |
|----------------------------------------------|--------|
| Eastern Andes of Bolivia, ... ..             | 15,900 |
| Western Andes of Bolivia, ... ..             | 18,500 |
| Andes of Quito, ... * ... ..                 | 15,700 |
| For the <i>Alps</i> , my brothers obtained : |        |
| Southern slopes, ... ..                      | 9,200  |
| Northern slopes, ... ..                      | 8,900  |
| Extremes (near the Mont Blanc and Monte      |        |
| Rosa group), ... ..                          | 9,800  |

### 3. *Glaciers.*

The existence of the glaciers of High Asia was first made known for *Western Tibet*, by Vigne, who alludes to them repeatedly in his "Travels in Kashmír," London, 1842. Colonel Richard Strachey was the first\* who (in 1847) proved their existence in the *Himálaya*. The recent date of this discovery will appear the more surprising, when the immense number of glaciers now positively ascertained to be in this region is taken into consideration. The great amount of ice to be met with, even in lower elevations of the *Himálaya*, could not of course escape the observation of previous travellers; these masses, however, they used to designate as "hard, frozen snow-beds," and to consider them as local phenomena, analogous to remains of avalanches.

On both sides of the *Karakorúm* and the *Künlün*, we also found glaciers, having forms identical with those of the *Alps*, and following the same laws of motion. Some of them are considerably larger than the glaciers in Europe. The *Aletsch* glacier in the *Alps* extends a little over fifteen miles in length, whilst some of the glaciers, surveyed by Captain *Montgomerie* and his party in *Bálti* (on the southern side of the *Karakorúm*)" boast of no less than thirty-six miles in length, with a breadth of from one to two and a half miles. The *Bíáfo* glacier forms, with the glacier on the opposite slope towards *Miggáir*, a continuous river of ice of sixty-four miles running in an almost straight line, and without any break in its continuity beyond those of the ordinary crevasses of glaciers. The *Bíáfo* glacier is supplied in a great measure from a vast dome of ice and snow, about one hundred and eighty square miles in area, in the whole of which only a few projecting points of wall are visible. The *Bálsoro* main glacier, thirty-

\* See this Journal, Vol. XVI., part II. p. 794; Vol. XVII., part II. p. 203.

six miles in length, and with fourteen large tributary glaciers of from three to ten miles in length, would form a study in itself, and give employment for several summers, before it could be properly examined."\*

In the *Himálaya*, the lowest glaciers go down to 11,000 ft. and even 10,500 ft.; the Píndari ending at 11,492 ft., the Timtimna at 11,430 ft., the Tsóji at 10,967 ft., and the Chàia at 10,520 ft.

In *Western Tibet*, they descend to about the same elevation; thus, the Mustágh 11,576 ft., the Tapto 11,508 ft., the Támi Chúet to 10,460 ft., the Bépho (Biáfo of Capt. Montgomerie?), near Askoli, even to 9,876 ft. The latter is worthy of notice as a remarkable case of low termination.

In the *Künlín*, the glaciers end probably at heights not much differing from those in Western Tibet; at least so we infer from the general appearance of the upper part of the glaciers we saw during our travels in these regions. The glaciers on both flanks of the Elchi pass presented, however, no instances of particularly deep descent.

In the *Andes*, no glaciers are as yet known to exist,† and they do not occur in tropical America, from the equator to 19° latitude north.

In the *Alps*, the lowest glacier is that of Lower Grindelwald, ending at 3,290 ft., but in general 5,000 ft. must be considered as a rather low end of a glacier.

#### IV. THE VARIETIES OF HABITATION.

##### 1. *Towns and Villages.*

The *Himálaya* rises, in general, so abruptly above the plains of India, and the latter, particularly in the western regions, are in themselves of such an elevation, that even in the lower parts of the valleys there are but few, if any points of less height than 1,000 ft. above the level of the sea. Two causes more especially have tended to displace the order of population in these districts, the lower parts being almost deserted in favour of the lands lying immediately above. In the first instance, the prevailing steepness of the country hereabouts, which is still considerably increased by the erosion of the rivers, precludes the successful cultivation of the soil; and, again, the fertile, well cultiva-

\* Montgomerie, in "Journ. As. Soc. Beng. 1862, No. II. p. 210.

† Humboldt, "Asie Centrale," Vol. II. p. 167.

ted plains of India are converted, wherever they touch the southern foot of the Himálaya, into swampy and marshy lands, called the Tarái, which in some parts form but a narrow strip or belt, whilst in others, as in Nepál, they attain a breadth of thirty to forty miles. The Tarái abounds with large and lofty forest trees. Owing to the swampy and malarious character of the Tarái, which skirts the extremities of the valleys, the neighbourhood is rendered as uninhabitable to the tribes of the Central Himálaya as to the highly susceptible and less seasoned visitor from European climes. Consequently (from all these reasons stated), in the inferior stratum of heights, ranging between 2,000 and 3,000 ft., the number of places inhabited by the natives is comparatively insignificant; while population reaches its maximum in the rich belt of life rising from 5,000 to 8,000 ft., the traces of man and his dwelling-place begin rapidly to disappear at 11,000 ft., and even before.

The *highest limits of habitation*, however, very often present themselves under a form which almost excludes the possibility of strictly comparing them as dependent upon climate. It is a remarkable fact, that in some provinces of the Himálaya, especially in Nepál, Kámáon, and Gärhvál, many villages are deserted in winter, though as far as regards their elevation and the solid construction of the houses, they might very well be inhabited throughout the year. The natives, however, prefer removing to villages less elevated, where they spend the colder months. In the Himálaya west of Gärhvál, such modifications do not occur; at least we are not aware of the existence of villages in Simla, Kúlu, Kishtvár &c., where the inhabitants follow regularly the nomadic example furnished in other parts of the hill country.

The Alps of Europe also present instances of this kind in Findelen (7,192 ft.), Bresily (6,594 ft.), and many other summer villages of greater or less elevation on the French side of the Alps.

*Western Tibet* is a country of such general elevation, that only in the province of Bálti villages are to be found below a height of 6,000 ft. Some of the chief towns are built at considerable elevations; Leh, the capital of Ladák, lies 11,527 ft. above the level of the sea. The *highest permanently* inhabited places are, however, Buddhist monasteries, the most elevated being probably that of Hánle, (15,117 ft.), in Ladák. I state it positively as my conviction, that nowhere in

the world there exists a permanently inhabited place at a height exceeding 15,600 ft. Paul de Carmoy's "Pueblo de Ocoruro," in the Sierra Nevada, 18,454 ft. high, will prove, on a closer examination, to be a temporarily inhabited place, similar to the *summer villages* of Tibet, of which I name Gártok (15,090 ft.), Nórbu (15,946 ft.), and Púga (15,264 ft.)

In the *Künlün*, even the foot of its southern (Tibetan) slopes is so elevated, that no villages exist at all. By combining with our own observations a variety of reports received, I obtain for its northern slopes 9,400 ft. as the limit of permanently inhabited villages; summer villages reach about 10,200 ft.

In the *Andes*, large and important permanently inhabited places have been built at great heights (Cerro de Pasco, 14,098 ft., Potosi 13,665 ft.); they are generally situated on plateaux. Santa Barbara, a mine with solid houses, about three miles south of Huancavelica, is situated at a height of 14,508 ft.

For the *Alps*, I have already had occasion to mention their summer villages. The highest permanently inhabited villages are in the valley of Avers in Graubündten, where Juf lies at an elevation of 7,172 ft., and that of Cresta exceeds 6,700 ft. But the roads leading across the passes have rendered it necessary to construct houses near the top which are permanently inhabited; the highest of these at present being the well known monastery of St. Bernard (8,114 ft.) As long as the road over the Stelvio or Stilfser Joch was kept up, Santa Maria (8,146 ft.) was also inhabited throughout the year.

## 2. Pasture-grounds.

In the *Himálaya*, pasture-grounds "Kárik," for sheep and bovine cattle, are for the most part in low elevations, and at no great distance from the villages. The Kárik Biterguár, in Kámáon, must be mentioned as an exception to this general rule, it being situated at an elevation of 14,594 ft. Nowhere are there built on these pasture-grounds *châlets* (Alpenhütten), which are as little used in the *Himálaya* as tents in the Alps.

Dairies, which are dispersed all over the Alps, and which form the source of a profitable income under an able management, are quite unknown in the *Himálaya*, even in those parts, as Kashmír and Nepál,

where ample tracts exist extremely favourable for erecting such establishments even on a large scale.

The pasture-grounds of *Tibet*, to which the numerous herds of sheep are driven in summer, reach an elevation from 15,000 to 16,349 ft., beyond which the Tibetan shepherds, who sometimes remain upon the mountains from June to September, cannot be supposed to make any permanent residence. The most elevated pasture-grounds of Tibet are, Lársa (16,349 ft.), Zinchín (16,222 ft.), Kyángchu (15,781 ft.), Rúkchin (15,064 ft.), Amlung (15,300 ft.), and Júgta (15,058 ft.)

Though many cloudless days succeed each other in these lofty regions, thus leaving the power of direct insolation unimpaired, the climate always remains bleak; while the prevailing winds not only aggravate the effects of a low temperature, but also that of a low barometrical pressure, thus presenting a remarkable modification of climate, of which I shall hereafter give some detail in the considerations upon the influence of height in general. The shepherds with difficulty provide themselves with a sufficient supply of fuel for cooking purposes; sometimes they contrive with much labour and pains to erect rude stone walls, behind which they may take shelter during the night. These walls are usually circular in form, from four to five feet high, and without a roof.

In the *Künlün*, the slopes on its southern side are so elevated, that there exist no pasture-grounds at all; on its northern slopes, they do not occur above 13,000 ft.

For the *Andes* no data with reference to pasture-grounds are at my disposal.

The pasture-grounds in the *Alps*, which are generally in the neighbourhood of Châlets, may be met with at heights of 8,000 ft. and upwards: the Fluhalde (8,468 ft.) on the Findelen glacier near the Monte Rosa, and the Torrenthütte, in the Anniviers valley, being instances of the greatest elevations.

## V. EXTREME HEIGHTS VISITED BY MAN.

### 1. *Mountain-ascents.*

Temporary habitations, frequented for some months, as we have seen from the discussion of the highest pasture-grounds, sometimes reach a height of nearly 16,300 ft. As far as my experience goes, I

may state, that for short periods of ten or twelve days, man may considerably exceed this height, not without suffering, but at least without positive injury to himself. During our explorations of the Ibi Gámin glaciers, August 13th to 23rd, 1855, we encamped and slept during these ten days in company with eight men at very unusual heights. During this period, our lowest camp was pitched at 19,326 ft.—the greatest height at which we ever passed a night: — another was at 19,094 ft.; two camps exceeded 18,300 ft., and the remainder ranged between 18,000 and 17,000 ft. Apart from the extreme elevation and consequent cold, the bodily exertions imposed upon us during our stay, proved a great tax upon our powers. Once we crossed a pass of 20,439 ft., and three days earlier, August 19th, 1855, we had ascended the flanks of Ibi Gámin to a height of 22,239 ft. This, as far as we know, is the greatest height yet reached on any mountain, though considerably below that to which man has arisen in balloons.

On the Sáassar peak we attained (August 3rd, 1856) an elevation of 20,120 ft. As early as 1818, however, the brothers Alexander and James G. Gerard ascended (October 18th) a peak in Spiti 19,411 ft. high, not far from the Porgyál, or Tazhigáng. Subsequently, August 31st, 1828, Dr. James G. Gerard reached 20,400 ft.

From Captain T. G. Montgomerie we learn, that a station of 19,979 ft. has been reached twice by Mr. W. H. Johnson, and another of 19,958 ft.\* in height by Mr. W. G. Beverley. Mr. Johnson took, besides, observations in Ladák at one station more than 20,600 ft. high, the greatest altitude yet attained as a station of the Trigonometrical Survey of India.† A trigonometrical mark has even been erected on a point 21,480 ft. above the level of the sea, “but unfortunately there was not sufficient space to put a theodolite on it.”

In the *Andes*, Humboldt ascended the flanks of Chimborazo (June 23rd, 1802) to a height of 19,286 ft.; this being the extreme elevation attained at that period. Some years afterwards (December 16th, 1831), Boussingault reached, on the same peak, a height of 19,695 ft.‡

In the *Alps*, my brothers Adolphe and Hermann once remained in the Vincenthütte, on the slopes of Monte Rosa, fourteen days at a

\* See this Journal, 1861, No. II., pp. 99, 110.

† See this Journal, 1863, No. II., p. iii.

‡ Humboldt's “Kleinere Schriften,” p. 157.

height of 10,374 ft. The well known English Professors Tyndall and Frankland even passed the night of August 21st, 1859, on the top of the Mont Blanc (15,784 ft.)

## 2. *Balloon-ascents.*

In the free atmosphere the greatest height was reached by Mr. Glaisher in a balloon, which was directed by Mr. Coswell; he ascended, September 5th, 1862, the extraordinary height of at least 30,000 ft., but, as he was unable to make any observations above that height, being suddenly overtaken by sickness, it is supposed that the balloon rose as high as seven miles = 36,960 ft.

Not less remarkable than this ascent was the one performed by Gay-Lussac, as early as the beginning of this century (September 16th, 1804), when he rose to 23,020 ft. Between Gay-Lussac's and Mr. Glaisher's ascent, several attempts have been made to reach great heights in balloons, especially in England, during one of which the late Mr. Welsh reached (November 10th, 1852) 22,930 ft.\* The balloon-ascents made in England were all combined with experiments of a highly interesting nature, and instituted by a scientific committee, among whose members it is sufficient only to name Sabine and Sykes.

Previous to Mr. Welsh, Messrs. Bixio and Barral rose (July 27th, 1850) to a height of 23,009 ft.

As a balloon-ascent, remarkable not only on account of the height reached, but on account of the horizontal distance performed, I must mention the one made by Mr. Nadar, in company with eight persons, October 18th, 1863. Mr. Nadar rose from Paris and let himself down—or he rather fell down—near Rethem, a small town on the river Aller, in Hanover. The direct distance between these two towns is about 395 miles, and as it took 15 hours, 47 minutes to travel through this distance, the balloon flew 2,227 ft. per minute, or 37 ft. per second. But, as the balloon was far from going in a straight line, it has been computed, that the greatest velocity attained by it amounted to 50 ft. per second.

## 3. *Effect of height.*

The effect of height is chiefly perceptible in the decrease of temperature and barometrical pressure. According to our observations,

\* "Philosophical Transactions," 1853, Part III., p. 320.

the atmospheric pressure is, at a height of about 18,600 or 18,800 ft., one-half of that at the level of the sea. At an elevation of 22,200 ft. (so trivial a height when compared with the extreme upper limit of the atmosphere), we observed a barometrical pressure of 13.364 inches, so that nearly three-fifths of the weight of the atmosphere lay below the point reached by us at the time.

It is evident that there must be a limit beyond which the degree of rarefaction is incompatible with the conditions of human existence; but it will ever remain extremely difficult to determine the line of demarcation, with any approach to scientific precision.

The influence\* which height exercises upon man, varies with the individual; a man in good health having the chance of less suffering. The difference of race has apparently no appreciable importance. Our Hindu servants suffered far more from the cold than our Tibetan companions, though not more from the diminished pressure. For the generality of people the influence of height begins at 16,500 ft., a height nearly coinciding with that of the highest pasture grounds visited by shepherds.

The complaints produced by diminished pressure are,—headache, difficulty of respiration, and affection of the lungs, the latter even proceeding so far as to occasion blood-spitting, want of appetite and even sickness, muscular weakness, and a general depression and lowness of spirits. Bleeding of the nose we experienced ourselves, though very rarely, the loss of blood on such occasions being insignificant; but bleeding of the ears and lips we neither experienced personally, nor observed in others during our travels in *High Asia*. Humboldt,† however, states, that on the Antisana, at a height of 18,141 ft., his companion, Don Carlos Montufar, bled heavily from the lips, and that during the ascent of the Chimborazo, every one suffered from bleeding of the lips and even the gums.

The effects here mentioned, which disappear in a healthy man almost simultaneously with his return to lower regions, are not sensibly increased by cold, but the wind has a most decided influence for

\* Notices and remarks on this subject are to be found in "Gleanings in Science," Vol. I., p. 330; Gerard's "Koonawur;" Hooker's "Himalayan Journals," Vol. II., p. 413; Thomson's "Western Himálaya and Tibet," p. 135 and p. 433.

† "Kleinere Schriften," Vol. I., p. 148.

the worse upon the feelings. As this was a phenomenon we had not hitherto found mentioned by former observers, we directed our particular attention to it, and remarked instances where fatigue had absolutely nothing to do with it. In the plateaux of the Karakorúm, it was a common occurrence, even for the sleepers in the tents, where they might be considered as somewhat protected, to be waked up in the night with a heavy feeling of oppression, the entire disturbance being traceable to a breeze, which had sprung up during the hours of rest.

The effects of diminished atmospheric pressure are considerably aggravated by fatigue. It is surprising to what a degree it is possible for exhaustion to supervene; even the act of speaking is felt to be a labour, and one gets as careless of comfort as of danger.

## VI. LIMITS OF VEGETATION AND ANIMAL LIFE.

### 1. *Vegetation.*

In *India*, the vegetation is not limited by climate in the elevations existing; the highest peaks, as the Dodabétta (8,640 ft.), in the Nilgiris, the most elevated plateaux are covered with trees, shrubs, and in fact a luxurious vegetation, not only along their slopes, but even on their top.

In the *Himálaya*, trees grow very generally up to heights of 11,800 ft., and in most parts there are extensive forests covering the sides of the mountains at but a little distance below this limit. Those forests are especially beautiful in the higher valleys of Kámáon and Gárhvál, in the Bhagiráthi valley.

In *Western Tibet*, though we did traverse it in various directions, none of us found anything at all corresponding to a forest. Apricot trees, willows, and poplars are frequently cultivated on a large scale; poplars, indeed, are found at Mángnang, in Gnári Khórsum, still at a height of 13,457 ft.; but they are the objects of the greatest care and attention to the Lamas.

In the *Künlün*, we found the trees on its northern side not to grow above 9,100 ft. On the northern side, we saw no trees at all; here the considerable height of the valleys we passed excluded them.

In the *Andes*, trees end at about 12,130 ft.; in the *Alps* on an average at 6,400 ft., isolated specimens occurring, however, above 7,000 ft.

The cultivation of grain coincides, in most cases, with the highest permanently inhabited villages : but the extremes of cultivated grain remain below the limit of permanent habitation. In the *Himálaya*, cultivation of grain does not exceed 11,800 ft., in *Tibet* 14,700 ft., and in the *Künlün* 9,700 ft. For the *Andes*, the limit is 11,800 ft. ; in the *Alps*, some of the extremes are found near Tindelen, at a height of 6,630 ft., but the mean is about 5,000 ft.

The upper mean limit of grass-vegetation is, in the *Himálaya*, at 15,400 ft., in *Western Tibet* at 16,500 ft. ; in the *Künlün*, grass is not found above 14,800 ft.

Shrubs grow, in the *Himálaya*, up to 15,200 ft., in *Western Tibet*, as high as 17,000 ft. On the plateaux to the north of the *Karakorúm*, shrubs are found at 16,900 ft., and, which is more remarkable, they occasionally grow there in considerable quantities on spots entirely destitute of grass. As an example, I mention the Voháb Chilgãne plateau (16,419 ft.) and Bashmalgún (14,207 ft.)

In the *Künlün*, the upper limit of shrubs does not exceed 12,700 ft. ; above this height grass is still plentiful ; and shrubs being here, as generally everywhere else, confined to a limit below the vegetation of grass, the range presents an essential contrast in this respect to the characteristic aspect of the *Karakorúm*.

In the *Andes*, shrubs grow up to 13,420 ft., in the *Alps*, their upper limit is at 8,000 ft.

The very extreme limit of phanerogamic plants appeared in *Tibet* at the north-eastern slopes of the Ibi Gãmin pass, at a height of 19,809 ft. ; next in order came those of the Gunshankãr peak, in Gnári Khórsum, at 19,237 ft. In the *Himálaya*, the highest plants were found by us at 17,500 ft., on the slopes of the Jánte pass, in Kãmáon.

In the *Andes*, Colonel Hall found the highest phanerogamic plants on the slopes of Chimborazo, at 15,769 ft., consequently 4,040 ft. lower than the Ibi Gãmin plants in *Tibet*.

In the *Alps*, my brothers found an analogous extreme on the southern slopes of the Vincent pyramide at 12,540 ft.

## 2. *Animal life.*

*Monkeys* appear to frequent, in the *Himálaya*, regions exceeding 11,000 ft. in height ; the *Semnopithecus schistaceus*, Hodgs. ascending

higher than others. These monkeys, called "Langúrs" by the natives, have been frequently seen at 11,000 ft., while the fir-trees among which they sported were loaded with snow-wreaths. This species is not known in India, whilst the *Macacus Rhesus* is met with in India, as well as in the Himálaya.

In *Western Tibet*, and farther to the north, no monkeys have yet been found. *Tigers* ascend to 11,000 ft. in the Himálaya; they are not, however, seen in Western Tibet or the Künlün.

*Leopards* may be met with, in the Himálaya and in Tibet, even at 13,000 and 14,000 ft. The *lion*, though intimately connected with the mythology of High Asia, has been forthcoming, in historical times, only in Kashmír. In India, the lion occurs at the present day only in Guzrāt, and there only in very small numbers.

*Jackals* were found by us in the Karakorúm between 16,000 and 17,000 ft. *Wolves* are not known to frequent the Himálaya Proper, but they are found in Tibet, where we saw traces of them in sand close to the Karakorúm pass (18,345 ft.)

Various species of beautiful *wild sheep* and *ibex*, together with the *Kyáng* and the *wild yak*, are met with in large herds on the highest plateaux between the Karakorúm and the Künlün.

The *cat* is common in Tibet; *dogs* are the companions of the Tibetan shepherds, whom they follow over passes exceeding 18,000 ft.

Some species of *bats* are seen in the Himálaya up to 9,000 ft.; and the Tibetan *hare* occurs even in heights exceeding 18,000 ft.

*Migratory birds* are not known to cross the Himálaya, as many birds of Europe cross the Alps. *Doves* were seen by us at very great heights in the Karakorúm and Künlün; this was the most surprising, as other birds were very rare.

The domestic *fowl* has recently been introduced with great success by Guláb Singh into Bálti, Ladák, and Núbra.

*Fishes* were found by us in some rivulets of Tibet exceeding 15,000 ft. In the *Alps* they cannot live beyond 7,000 ft.

Of *reptiles* we found snakes and saurians as high as 15,200 ft. In the *Alps* they go up to 6,000 ft., in the *Pyrenees* to 7,000 ft. In the *Andes*, snakes were found by Schmarda at about 11,500 ft.

For *butterflies* we found in the Himálaya 13,000 ft., in Tibet and Turkistán even 16,000 ft. as localities of permanent habitation. *Bee-*

*tes* probably follow the highest formation of grassy turf in the Himá-laya, as well as in the Andes and the Alps. *Mosquitoes* go up to 8,500 ft. ; and *peepsies* make themselves very troublesome during the rainy season as high as 13,000 ft.

The existence of *infusoria* seems as little subject to limitation by height in High Asia, as in the Andes and Alps. In a few fragments which we chipped off from the rocks of the Ibi Gamin pass (20,459 ft.) Prof. Ehrenberg of Berlin detected their presence, and found them not insignificant in quantity ; he discovered twelve species new to science.

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## (Notes and Queries.)

[Received 20th December, 1865.]

*Camp, near Myanoung, November 22nd, 1865.*

During a visit to Calcutta a few months ago, Mr. Grote drew my attention to a sort of controversy which had been started at home, touching the habit, which fireflies were stated to exhibit occasionally, of a concurrent exhibition of their light, by vast multitudes acting in unison; a statement which appeared to have been somewhat sceptically received. Mr. Grote does not appear to have ever witnessed this phenomenon in Bengal, and questioned me if I had ever observed any confirmatory instance. Fireflies are tolerably well known, of course, to the resident in Bengal, but I had never there observed any such habit among the countless fireflies, which form such fiery-like ornaments to the shrubberies about Calcutta. In Pegu, however, I have witnessed the exhibition in question; myriads of fireflies emitting their light, and again relapsing into darkness, in the most perfect rhythmic unison. I much regret, that I did not secure specimens, but the circumstances were as follows. I had halted my boat for the night, alongside a small clearing in the low lying tract of country, forming part of the Irawadi estuary (Delta), east of the Bassein river, where the water was salt, and the entire country not more than a foot, if so much, above the flood level. Night had closed in, and my servant, who brought in the tea, asked me to step out of my tent and see the fireflies which, he said, he had never seen the like of before. On stepping out of the tent, a truly beautiful sight presented itself. In front was the broad and deep river sweeping on, *νικτι εὐκρῶς*, with its indistinctly seen background of primæval forest on its opposite bank. Around me was the recently-formed clearing, with its two or three huts and my own camp, as the sole proof of man's occupancy, for miles and miles, but, for all the wildness and almost desolation of the scene, the bank on which I stood was a glorious spectacle, and those acquainted with the class of native servants will well understand that it must have been at once unusual and beautiful indeed to rivet the attention of a listless *khitmutgar*!

The bushes overhanging the water were one mass of fireflies, though, from the confined space available for them on low shrubs, the

numbers may not have been actually more than are often congregated in Bengal. The light of this great body of insects was given out as I have said, in rhythmic flashes, and, for a second or two, lighted up the bushes in a beautiful manner; heightened, no doubt, by the sudden relapse into darkness which followed each flash. These are the facts of the case (and I may add, it was towards the end of the year), and the only suggestion I would throw out, to account for the unusual method of luminous emanation, is, that the close congregation of large numbers of insects, from the small space afforded them by the bushes in question, may have given rise to the synchronous emission of the flash, by the force of imitation or *sympathy*.

Mr. Montgomery, of the Survey Department here, also fully corroborates the habit of our Pegu fireflies simultaneously emitting their light, but adds, he has only remarked it under conditions similar to those described above, in low swampy ground. It still remains, therefore, to be decided if the insect is different from the ordinary one, or if, as I am inclined to think, the simultaneity is produced by sympathy and great crowding of individuals.

Whilst my pen is in my hand, I would add a few words on the address of Dr. J. E. Gray to the Zoological Section of the British Association, printed at page 75 of the Notices and Abstracts appended to the Report of the Association for 1864.

The excellent remarks on the aim and arrangement of Public Museums will, it is to be hoped, not escape the attention of those interested in our own Calcutta Museum, and the especial stress he lays on the exclusion of light from collections on spirits, is what I urgently brought to the notice of the Society but a short time since. It is not, however, to this portion of Dr. Gray's address that I would now refer, but to the statement at page 82 that, "*the natives of India and of the islands of the Malayan Archipelago have brought into a semi-domesticated state various species of wild cattle, such as the Gyal, the Gour, and the Banteng.*"

Of the first of these, the Gyal, we know that such is the case, but I should much like to know in what part of India or Malaynesia the *Gour* or the *Banteng* are "semi-domesticated," certainly, the feat has never been performed by any "*native of India,*" of whose geography and powers incurably lax notions appear to be stereotyped in England,

from the ablest downwards. I would enquire, therefore, through the pages of this Journal, to what instances Dr. Gray can allude, as the fact is certainly novel to those in India. The Governor of Rangoon, at the time of the last war, I am told, had a pair of Gour sufficiently tame to be yoked in a cart, but this is quite insufficient to establish their claim to be viewed as semi-domesticated. In India, the difficulty of rearing the calves is notorious.

Again, immediately before the passage I have quoted above, Dr. Gray remarks, "In the lower and warmer region of Central and Southern Asia, the Zebra has been completely domesticated."

In the passage, Dr. Gray is alluding to wild species brought by man into a state of domestication, and I confess to some curiosity as to the wild stock of the domesticated Zebra. There is, I fancy, some little confusion, however, in Dr. Gray's ideas here, as, on the previous page, he tells us, "the oxen" "are never found *truly wild*."

The distinction, too, which Dr. Gray draws (*loc. cit.*) between the "*truly domesticated*" animals, the ox, the sheep, the horse, the camel, the dog and the cat, and the "*semi-domesticated*," as the buffalo, the goat, the pig, the rabbit, the reindeer, the yak &c., appears forced and to a great extent imaginary.

The distinction between these two classes of animals is more due to the efforts of the *Breeder* than to *mere domestication*, and I should have thought, that the highest triumphs of some of our rabbit fancies and of our breeds of pigs merited quite as much as our "sheep" to be considered as "*truly domesticated*," if thereby is intended an unnatural deviation from the wild stock, solely produced by the art of the *Breeder*.

I cannot enter at greater length on this most interesting question, but I hope that some of the readers of this Journal who have perused Dr. Gray's report, will be able to furnish some explanation of the points indicated above.

Another query I would ask is, to what *race* of *Calotes mystaceus* can Gunther refer to, when he states that "an old male measures nearly 24 inches, the tail taking 19 inches?" Now *Calotes mystaceus* is common in *Birma*, and more than a score have passed through my hands, but no specimen that I ever saw attained to even 12 inches of total length!

Are not two races or species here united, a smaller one from Birma, and a larger one from Camboja or elsewhere south?

The type in the Paris Museum, Gunther says, is "not full grown," but it was from Birma, and is probably the size of ordinary Birmese specimens.

W. THEOBALD, JR.

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JOURNAL  
OF THE  
ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. II.—1866.

*Russian Geographical Operations in Asia.—Communicated by Lieut.-  
Col. J. T. WALKER, R. E.\**

[Received 8th March, 1866.]

TRANSLATION OF A PORTION OF THE "COMPTE RENDU DE LA SOCIÉTÉ  
IMPÉRIALE GÉOGRAPHIQUE DE RUSSIE" FOR 1864.

The Society has never failed to profit by every opportunity that has presented itself, for extending our geographical knowledge of the countries bordering on Central Asia; consequently, in the month of February last year, M. Severstow, a distinguished Naturalist, who was accompanying an expedition into the countries beyond the Ili and the Tchou, was charged to collect information, with a view to preparing a physico-geographical description of all the countries through which the expedition would pass.

\* Of the two accompanying papers, one is a translation of a portion of the "Compte Rendu de la Société Impériale Géographique de Russie," for the year 1864, while the other is a translation from the 4th volume of the Journal of the Russian Geographical Society for 1864.

In the first the names are spelt as in the original French memoir.

The Society has just been enriched by highly interesting geographical materials, thanks to the cordial co-operation of its honorable members M. Milioutine, the Minister of War; M. Duhamal, the Governor-General of Eastern Siberia, and Admiral Boutakow.

We have been furnished with a very interesting manuscript chart prepared by the Staff Major. It represents, on a scale of 40 verstes (27 miles) to the inch, the southern portion of the Kirghiz Steppe, or, approximately speaking, the region between the Eastern shore of the sea of Aral, and the Chinese frontier, extending from  $76^{\circ}$  to  $102^{\circ}$  of longitude, and from  $40^{\circ}$  to  $50^{\circ}$  of latitude, and comprising the northern half of the district called Touran. On this map we have the result of all the geographical operations of the past few years represented for the first time. Until now they had remained isolated, and almost unknown to the scientific world. They greatly modify the general geographical aspect of this region. There are now determined a sufficient number of astronomical points to serve as a basis for an exact cartographic representation of the region above mentioned. We must observe, however, that the fixed astronomical points are as yet very irregularly distributed. They are comparatively numerous in the western part of the map, along the road from Orenburgh to the Syr-Daria, and along the lower course of that river, also along the Chinese frontier in the Eastern part of the map, but, about the middle, they are very sparsely scattered.

We now possess many orographic and hydrographic data, thanks to the military expeditions, and reconnoissances of 1864, and to the operations carried on for several years in the basin of the Syr-Daria by Admiral Boutakow. These data serve to correct the hitherto confused notions of the countries situated within and around this region. We have also received more accurate information regarding the races that people these countries, their mode of life, their migrations, the remains and traces of their ancient condition, and the possibility of their future civilization. We can here only point out the most salient geographical features of the mass of materials we have received, and of which the Society will avail itself for its future publications. The geographical position of all the region above mentioned will have to be considerably altered, more especially as to western Turkestan, and the Khanat of Khokan. For instance, Louliéta, a town

of Khokan, ought to be shifted, on the map, half a degree towards the south, and one degree towards the east; the town of Turkestan at least a degree and a half towards the south, &c. Similar changes are equally necessary for many other points. The eastern part of this region is essentially mountainous. The principal chain of mountains is found to be a western branch of the Tian Chan; its direction is from east to west from the lake Issik Koul, down to the lower course of the Syr-Daria; these mountains were vaguely known under the general name of Karataou. They may be divided into three groups, the chain of the Kentchi-Alataou, the chain called Alexandrowskaïa, and that of Kazikourt.

The Kentchi-Alataou consists of two parallel chains, which follow the northern bank of the Issik Koul; they are separated (on the east of the Issik Koul) from the Tian Chan by the Pass of San Tash; their greatest height is 14,000 feet. From this range, a lower range trends in a north-western direction, separating the waters of the Ili from those of the Tchou.

The second group, the Alexandrowskaïa, or the Alataou-Kirghisyn chain, whose summits are covered with perpetual snow, joins the first at the defile of Baoum, on the western extremity of the Issik-Koul; thence it stretches due west towards Aouliçta, separating the river Tchou from the river Talas; its greatest height is 15,000 feet. To the west of this chain, other hills, rising not higher than 5000 or 6000 feet, stretch as far as the Syr-Daria, following the direction of that river down to Djoulek, and forming, so to say, a prolongation of the Alexandrowskaïa chain. It is to these hills that the name of mount Karataou, which has been wrongly given to the whole system of mountains in this country, properly belongs.

Lastly, the third group forms the Kazikourt chain and lies to the south of the Alexandrowskaïa, from which it is separated by the basin of Talas. The Kazikourt mountains appear to be a continuation of the principal branch of the Tian Chan; winding along the southern bank of the Issik-Koul, they fill the territory of Khokan with their southern ramifications. The disposition of these chains of mountains fixes the watersheds of the basins of the Tchou and the Syr-Daria, the two principal valleys of this country, lying almost parallel to each other. The valley of the Syr-Daria trends, with many

windings, from the south-east to the north-west. The Tchou flows in the same direction. Conformably with the general disposition of the whole mountain system of this region, these great basins are much narrowed towards the east, near Issik Koul, where all the above mentioned ramifications of the Tian Chan are concentrated. It must be observed, that the predominant direction of these chains of mountains, not only in this country, but in all mountainous parts of Central Asia, is always to the north-east. We now have more accurate data concerning the course of the Tchou, especially about its various sources, also its relation to the Issik Koul, from which it does not take its source, but with which it is connected by its affluent, the little river of Koutemalda.

The central portion of the basin of the Syr-Daria has been explored in detail, and with much success, thanks to the expeditions made during many years by Admiral Boutakow, who has quite recently communicated to us the general results of his enquiries, but especially of his late explorations between Fort Perowsky, and the locality called Baïldir Tougai.

It is impossible to set forth here all the accumulated data of these countries of Central Asia, but seeing the interest that they excite, we must add a few more words about their population. It consists chiefly of nomadic Kirghises, and a rather restricted number of Khokans. Their mode of life and degree of civilization correspond with those of the Kirghises who inhabit the country north of the Syr-Daria and the river Tchou.

Their chief wealth consists in cattle, horses and camels. They also cultivate their land and sow wheat, barley and tobacco.

After the military expedition of 1862, a great part of these Kirghise wanderers, from beyond the Tchou, passed into our territory.

To retain these tribes in subjection, the Khokans constructed forts, called Kourgans, in great numbers. Tho four chief ones were Pichpek, Merké, Aouliéta, and Souzak. Aouliéta on the Talas (between the valley of the Tchou, and the chain of mountains which trend from Issik Koul towards the west) has an important position, for it is situated on the grand commercial road from Tachkend and Turkestan, towards the fortifications of Vernoï, Kouldja and Sémi-palatinsk. It is by this road that the caravans come from the southern

regions of Central Asia to go to China, as well as to Russia. On a branch of this road, which stretches towards the north-west, at a junction of the roads of Orenbourg, Troïtsk and Oufa, is situated the town of Turkestan which encloses within its walls a sacred edifice, the mosque built over the tomb of Azret Sultan.

Passing now to the topographical operations executed in these Kirghise steppes of Siberia, we will mention the surveys that were effected on the western borders of China, under the direction of Colonel Babkow. These operations embrace two distinct circles,—the northern parts of the Tarbagataï mountains, and the valley of the river Borokhoudzîr. In the first of these circles, Captain Nifantiew of the Topographical Corps, surveyed the region that is bounded on the *west* by the road which crosses the Khabar Assou Pass, and by the course of the river Tamyrsk ; on the *south*, by the chain of the Tarbagataï ; on the *east*, by the line of the Chinese posts, and on the *north*, by the Kitchkiné Taou mountains, branches of the Manak, and of the Tarbagataï. This region includes an area of 5,270 square verstes.

In the country beyond the river Tchou, the topographers who formed part of the detachment with the expedition, surveyed the following localities. 1st, From the post of Kastek, by the pass of the same name, to the mouths of the little Kebin, and thence re-ascending the river Tchou, to the mouths of the great Kebin, then 40 verstes of the lower course of this last river. Then again, from the mouths of the little Kebin, along the river Tchou, to the ford of Tchoumitch. All these surveys have been mapped on a scale of 250 sagènes (or 1750 feet) to the inch. 2nd, From the river Talas, crossing mount Kara Boura, to the river Tchotkala (Tchirtchik). 3rd, The marching roads along the valley of the Arys, and those from Tchemkent to Aouliéta, also from Tcholak Kourgen to Aouliéta, have been drawn on the scale of 5 verstes to the inch. 4thly, Plans of the forts of Tokmak, Merke and Aouliéta have been drawn out, on a scale of 250 sagènes to the inch.

We have received from M. Bésae, the Aide-de-camp General, a map of the topographical operations, executed and projected in the country of Orenbourg, from the year 1861 to 1865, with a Memoir.

The total survey is 17,687 square verstes done in detail, and 3,928 in half detail ; 168,178 reconnoitered, and 21,100 triangulated. During

a period of four years, the total amount of survey operations is 212,019 square verstes.

These surveys embrace the following localities ; 1st, the two banks of the river Yany Daria ; 2ndly, the left bank of the Syr-Daria, from the fort Perowsky to Yany Kourgan, a destroyed fortress belonging to the Khokans, and thence to the place called Baildyr Tougai ; 4thly, the northern and southern slopes of the Karataou chain ; 5thly, the mouths of the river Emba, and the Bay of the Caspian Sea at the mouth of this river. Among the newly made maps, the principal are, the map of the country of Orenbourg, on a scale of 50 verstes to the inch ; a new map of Central Asia and the country of Orenbourg, 200 verstes to the inch ; and 24 sheets of a special map of this country, on a scale of 10 verstes.

The Society is continuing the publication and translation of the 7th Vol. of Ritter's Geography of eastern Touran. M. Grigoriev is compiling and making the necessary additions for completing this work, and is carrying on his labours with such activity, that we may look for the first part of his work during 1865.

However short our account may seem of all the important geographical operations in Asia, it is nevertheless sufficient to show that they embrace a large extent of this part of the world, and give rise to questions of both local and general interest. The several expeditions and explorations, in which our Society has taken part, form an uninterrupted chain which extends along our Asiatic frontier, from the Pacific Ocean to the Caspian Sea ; from the valley of the Onssouri and the peninsula of Corea to the Oust Ourt, Turkestan and Khorasan. With the exception of some conflicts with the Khokans, our enterprises along the frontier have been of a strictly peaceful, scientific or commercial character, and our commerce has been considerably developed. These friendly relations are strengthened by an event of great importance which marks the past year, viz., the final pacification of the Caucasus, the point of our Asiatic frontier that is nearest to Europe.

We must now pass on to the hydrographic operations executed in the Caspian Sea, which have always greatly interested our Society.

Last year, our honorable member, M. Ivachinzew, who is the chief of these operations, read out to the Society, at a public meeting,

a remarkable Memoir on the question of the variations of the level of the Caspian Sea. The same persons who carried on these hydrographic operations in 1863, continued them in 1864. At the beginning of the year, the Surveyors were concentrated in the southern parts of the sea, between Bakow and Lenkoran, a region bristling with rocks and volcanic islands. From January up to May, they explored and fixed the positions of several isolated volcanic reefs, which, as they undergo frequent change from the action of subterranean forces, often become very dangerous to navigators, and consequently require frequent soundings and examinations. The materials thus collected, regarding this volcanic region, may some day serve as valuable contributions towards the composition of a complete monograph of this extremity of the Caucasus.

In the month of May, the hydrographic expedition crossed over to the eastern shore, between Tub-Karagane and the gulf of Karabougaz. During the subsequent five months, an extent of more than 200 verstes was surveyed and sounded, chiefly between the isthmus of Manguich-lac and the gulf of Krasnovodsk, under the command of Lieut. Phillippow and Lieut. Dournew of the Pilot Corps. Soundings were also taken by Lieut. Onlsky, in the middle of the Caspian Sea, with an apparatus specially constructed for bringing up specimens of the different soils, and the fossil and animal life they contain.

In June and July Captain Phillipow's party explored the entrance to the gulf of Karabougaz. At the same time, Lieut. Staritzki made some interesting observations on the speed of an uninterrupted current of water directing its course through the Gulf towards the Sea.

The object of these observations was to determine the quantity of water which enters the gulf of Karabougaz, and the quantity of saline particles which is brought there. The exploration of the mouth of the Karabougaz will serve as a basis for a complete study of this interesting gulf. It is the opinion of M. Baer, the Academician, that this study will lead to a solution of the question regarding the variations of saltness in the Caspian Sea. No one will doubt the economical importance of this question, which is intimately connected with the future fisheries of the Caspian. The results of the hydrographic operations are developing gradually, and are partly published. In addition to the maps and plans of different parts of this sea

that have already appeared, a report of the astronomical and magnetic operations is being actually printed.

In speaking of the favourable results that have been obtained by the activity of our Society, we have not had the least intention to attribute it to one more than to another of its functionaries. Among us, individuals change and succeed each other so rapidly, that we cannot say the progress and strength of our institutions rest with them. It is the general conditions of our activity, and the liberal spirit by which they are pervaded, that unite and attract a constant succession of individual labourers. Besides the actual operations of the Society during the past 20 years, a vast amount of labour has been undertaken voluntarily, and without remuneration, by members of the Society, as well as by strangers, in private and in official capacities. Such are the public lectures, which many of our colleagues have delivered without any remuneration, and which have attracted large audiences to our reception Halls. We need not mention, in this place, the number of persons who, during the past and many preceding years, have disinterestedly brought accounts of their labours to the Society. It is doubtless through the liberal spirit which unites and animates all our members and constitutes our strength, that this great amount of work has been accomplished. Religiously to preserve this spirit should be our first duty, and our most sacred obligation.

TRANSLATION OF A PORTION OF THE JOURNAL OF THE RUSSIAN GEOGRAPHICAL SOCIETY, VOL. IV. 1864.

At a meeting of the Society on the 2nd and 14th December, 1864, Rear Admiral Boutakof read a paper on the subject of his last exploration on the Syr-Daria, between Fort Perovski and Baidyr-Tugai (a locality in the Tashkened territory). In 1863 Rear Admiral Boutakof steamed 538 miles up the Syr-Daria, from Fort Perovski. This officer has now explored, determined astronomically, and mapped 1003 miles of that river's course, beginning from its mouth. He expresses his conviction that the river is navigable still higher up, although, for want of fuel, he could not this time proceed further. The general ascending direction of the river from Fort Perovski is towards the south-east as far as the parallel of  $43^{\circ}$  of latitude; thence it is directly to the south. Throughout the whole distance of 538 miles,

from Baildyr-Tugai to fort Perovski, the river flows in a magnificent mass of water between depressed banks of an argilo-salinous and sandy character, for the most part inundated at high water; there was nowhere either a *break* in the banks, or a stone, for the observation of the geologist. The swamps, after the subsiding of the waters, afford excellent pasturage whereon numerous Aouls of Kirghizes settle for the winter. In the midst of these meadow patches there occur here and there like *islands*, sand hillocks differing in height, from 30 to 40 feet, and overgrown with tamarisk, &c. The dry argilo-salinous banks rise from 7 to 10 feet above the level of high water, and are covered with tamarisk bushes with thorn (growing high and thick), and in some places with the "Turanga" and "Djida." Nearer to our own possessions, large tracts are covered with the "Saxaul." Vegetation is most abundant on the islands, many of which are two miles long. Upon these the "Djida" grows 4 fathoms high, and the thickness of the "Turanga" reaches 10 inches in diameter. Almost all the islands are covered with a dense, almost impassable brushwood, where the Kirghizes declare there are tigers, drawn thither in pursuit of wild boars. The breadth of the river is from 150 to 400 fathoms; the depth from 3 to 5 and 6 fathoms; the current ran at a speed of 7 verstes ( $4\frac{2}{3}$  miles) an hour, the average being from  $4\frac{1}{2}$  to 6 verstes (3 or 4 miles); the water was of a dirty yellow colour, but when allowed to settle, was very soft and agreeable to the taste. Admiral Boutakof found no evidences of a settled life throughout the whole of the river's course. Patches of soil, cultivated by the poorest of the Kirghizes, occurred at extremely rare intervals; and these were irrigated by water from canals replenished by hand from the river. The Kirghizes generally sow millet, sometimes barley, water-melons, and musk melons in their fields. There are two principal reasons for the absence of population along the banks of this river: firstly, the absolute want of any guarantee for personal security and for the protection of property and labour in the face of perpetual disturbances in Turkestan, Tashkend and Khokan; and secondly, the greater advantage of settling along the rivulets running from the Kara-tau mountains; these afford better facilities for irrigation than the Syr-Daria, which inundates and washes away its banks, and consequently demands an enormous amount of labour for the construction and maintenance of the necessary

embankments. This splendid water-course, navigable to Fort Djulek (the extreme eastern fort on the Syr-Daria line of frontier) which would be a picturesque feature in any other place, is surrounded by a bleak desert, and is now only occasionally enlivened by migrating hordes of Kirghizes, whereas the remains of the ancient towns of Otrar (where Tamerlane died) and of Tunent (destroyed by Tamerlane) which were seen by Admiral Boutakof, and the traces of a once extensive system of irrigation surrounding the ruins of these places, and occurring also in many other parts, are evidences of a once numerous, industrious, and settled population. The shores of the Syr-Daria, above and below Fort Djulek, present a striking contrast. Above Djulek is a howling desert; below, and particularly commencing from Fort Perovski, all is life and activity along the banks. Corn fields and melon fields occur continually, with populous Aouls of well-appointed tents, animated by the presence of herds of cattle. The Kirghizes assemble by hundreds to dig fresh canals for irrigation. Vast tracts of swamp and reeds, which were impassable in 1848, have been protected by embankments against the overflowing of the river and converted into corn fields which now engage the labour of thousands: and all this is exclusive of the localities within 50 or 100 miles of our Forts, especially the neighbourhood of Fort No. 1, where, in the excellent gardens surrounding the Cossack settlements, grapes are grown, and cotton has been sown not without success. Kirghizes and sometimes Karakalpaks constantly migrate from the Khivan territories to the lands under Russian protection, so that they at length find themselves cramped for space. The Khivan and Khokandian forts which stood on the grounds now occupied by the Russians, were the centres of the most merciless and barbarous persecution. The Russian forts, on the other hand, are now guarantees for security, and serve to promote traffic and the general well-being of the natives.

The advent of the Russians did certainly produce a most beneficial crisis in the condition of the Kirghizes of the Syr-Daria.

Within 8 miles of Baildyr-Tugai, Admiral Boutakof's highest limit of ascent, there are the ruins of a small Khokandian fort, Bair-Kurgan, demolished, according to Kirghiz tradition, about 100 years ago. At a distance of 40 miles higher up, on the left bank, are the remains of the town of Tunkat (rased by Tamerlane). This place is

now called Tskilleh, after a saint of that name whose tomb is close by.

There are more Kirghizes grouped about Tunkat than over the entire extent of country traversed by Admiral Boutakof; and to all appearances these were opulent, being possessed of immense studs of horses and camels, and of droves of horned cattle and sheep. Above that place, *i. e.* nearer to Tashkend, he fell in with two rich migrating Aouls, one encamped by the side of the river.

Descending the Syr towards the river Arys, an open space becomes visible beyond the zone of reeds, at 4 or 5 miles from the river, studded with clayey sand mounds that are covered with a scanty and low brushwood. Some of these mounds are evidently artificial. On a sort of tableland, within 7 miles in a direct line, and almost due north from the mouth of the Arys, are seen the remains of what may have been the citadel of the ancient town of Otrar.

From the mouth of the Arys to the little fort of Utch-Kayuk, abandoned two or three years ago by the Khokandians, and built on a marshy soil, the distance is  $84\frac{2}{3}$  miles. The character of the river here is still the same, the same bends and islands, the same depressed banks, mostly flooded, the same vegetation along the shores and on the islands. The forts Utch-Kayuk, Din-Kurgaon, Yang-Kurgaon, Djulek and Ak-Mechet, (now fort Perovski), Kumysh-Kurgaon, Chin-Kurgaon, and Kash-Kurgaon (the three latter below fort Perovski,) were the rallying points of the Khokandians, for the subjugation of the Kirghizes, and the centres for the collection of tribute and the general merciless oppression of that people. Yang-Kurgaon, raised by the Khokandians in 1857, and Din-Kurgaon, erected in 1860, were the last points of Khokandian resistance against the spread of Russian influence; here also the last attempts were made by the Khokandians to retain under their yoke the Kirghizes who passed over in masses to place themselves under our protection. Yang-Kurgaon fell in 1860 to the Russian arms; Din-Kurgaon in 1861. Utch-Kayuk is the nearest place to the town of Turkestan; it was visible from the river, being situated in a hollow of the foreland of the Kara-tau mountains.

The only affluents of the Syr seen by Admiral Boutakof are the rivers Arys and Sauran-Su, falling into the Syr on its right bank

opposite the An-djar settlement,  $8\frac{2}{3}$  miles below Utch-Kayuk; other rivers emerge from the Kara-tau mountains, namely the Tuitchke whereon Turkestan is situated, the Karaichik, 6 miles lower down, and the Sart-Su; these do not reach the Syr-Daria, but lose themselves in the marshes formed by its inundations.

Below Utch-Kayuk the country at first is inundated, and large wet meadows, or more correctly morasses, extend along both banks of the river, but further on, especially on the right bank, land is firmer.

Nearer Djulek the trees on the banks are higher and thicker than along the whole remaining portion of the river's course. In the immediate vicinity of this Fort, there is a very pretty avenue of tall and thick willows, looked upon by the Kirghizes as a sanctuary (Aulie).

Between Djulek and fort Perovski the banks are generally firm and salinous, but not elevated. The "Saxaul" is very abundant at the Kasakty-Syra, Chagouon and Kushsant settlements, and opposite Burinbai. The islands and the continuing banks are covered with the "djida," "turanga," and occasionally with willows, and the margins are usually clothed with high dense thorn and reeds. Sandy hillocks occur beyond the saline plains, and in many places Kirghiz tombs and the remains of long neglected irrigating canals are met with.

From the 14th July, when the expedition was proceeding upwards and was within 67 miles of Utch-Kayuk, the waters were visibly subsiding, and daily decreased, though the heat continued to be great, up to  $30^{\circ}$  R. in the shade. This was doubtless owing to the exhaustion of the supply of snow which accumulates on the mountains, where the river takes its rise. At fort Perovski the water began to fall only from the 30th of July, and at Fort No. 2 from the 5th of August (N. S).

Notwithstanding that Admiral Boutakof's expedition had to halt at night close to marshy lands, there were no cases of ague, and so far as he was able to judge, the climate on the Syr-Daria, in its upper as in its lower course, was healthy. His astronomical observations disclose great inaccuracies in this portion of the map of Central Asia which is founded on the determinations by the Persian Missionaries of the 18th century.

The communication made by Admiral Boutakof, who has long distinguished himself by many years of labour in this region, was listened to with great attention, and received with great enthusiasm. We could not give here more than the mere outlines of the paper, which he is now preparing for the press, and which will appear with a map of the Syr-Daria. There is no doubt that Admiral Boutakof's work will be an agreeable acquisition for modern geographers.

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*Kashmir, the Western Himalaya and the Afghan Mountains, a geological paper by ALBERT M. VERCHÈRE, Esq., Bengal Medical Service; with a note on the fossils by M. EDOUARD DE VERNUEIL, Membre de l'Académie des Sciences, Paris.*

[Received 11th March, 1865.]

#### INTRODUCTION.

Of all the great chains of mountains on our Planet, the most stupendous is, singularly enough, the least known to the geologist. Many fossils have indeed been collected by travellers in the Himalaya, and a few have been determined; but satisfactory sections and careful descriptions are very scarce, and it has not yet been found practicable to attempt any general grouping and arrangement of the rocks and beds of these mountains. Jacquemont's researches in Kashmir have not, I believe, much advanced our knowledge of the geology of the country. Mr. Vigne was no geologist, and his observations were not sufficiently accurate for scientific purposes; the same remarks apply, more or less, to most visitors who have published what they saw amongst the higher ranges. Captain R. Strachey, R. E. in his papers on the geology of the Himalaya, between the Sutlej and the Kali rivers, gives a map and two sections which are of great interest; they do not, however, refer to the portion of the Himalaya which I have studied, and they leave yet a vast field for more precise investigations. I regret not having been able to consult Capt. H. Strachey's paper

on the physical geography of Little Thibet, and Dr. Thompson's work on the same country; neither have I had the benefit of Mr. Medlicott's Memoir on the southern ranges of the Himalaya, between the rivers Ganges and Ravee, nor any of the other papers which have been written on the Sub-Himalayan ranges.

Of the geology of Kashmir especially, I believe that very little indeed has ever been published, and that not even a geological horizon has been discovered. Mr. Vigne and Dr. A. Fleming reported having found in Kashmir "Nummulitic limestone disturbed and calcined by greenstone;" this was an error of some importance, as it gave a false datum from which to fix the age and relations of the Azoic rocks. Dr. A. Fleming, in his report on the Geological Structure of the Salt Range, published in Selections from Public Correspondence of the Punjab Administration, Vol. II., 1855, has the following passage:—

"From Kashmir, too, Mr. Vigne obtained limestone containing "nummulites. This we have seen in situ on the side of a mountain "at the upper end of the Manus Bal lake, where it is much disturbed "and calcined by greenstone. It probably forms the summit of "many of the higher hills on the northern side of the Kashmir valley, "a district fraught with interest to the geologist and hitherto quite "unexplored."

When I arrived at Srinuggur, Mr. Drew, who had visited Manus Bal, showed me some specimens of the limestone of that locality, and expressed a doubt about the markings seen on the rock being nummulites; he considered their markings to be the result of crystallisation and weathering; but I could not accept this view, and regarded the little marks as indications of organisms. I was unwilling to believe that Dr. A. Fleming could possibly have made a mistake about nummulites, after the experience he had had of their appearances in the Salt Range and the Bunnoo district; and, as Mr. Drew acknowledged that he was not familiar with the nummulitic formation, and the specimens shown me were very bad and ill-preserved, indeed merely faint marks in a coarse limestone, I temporarily admitted Dr. Fleming's view. I was, at the time, unable to visit Manus Bal, or to absent myself a single day from Srinuggur, owing to great sickness amongst the visitors; but I had the good luck to discover a bed of fossiliferous limestone and shales within a few miles of

Srinuggur. These beds were near enough to enable me to ride to them in a few hours, and I soon found that they contained the same forms as were known to occur in the dressed blocks of limestone (obtained from Buddhist ruins) of which the river-walls and river-stairs of Srinuggur are built, and I also found the remains of one of the antique quarries near my favourite locality. Ultimately, the rocks reported to be nummulitic were found to be carboniferous, and the so-called nummulites, rings of Encrinite-stems; the volcanic rocks were also ascertained to be palæozoic in age and not intrusive. (See para. 53, where the Manus Bal limestone is described in detail.)

To my friend, Captain Godwin-Austen of the great Trigonometrical Survey, I owe my best thanks. I had wished that this paper might have been written in conjunction with that gentleman, and it would have been well for the reader, if it had been so; but as Capt. Austen went to Bhotan and I to Bunnoo, such a hope had to be abandoned.

In drawing up the map, I have used for its topography whatever materials I could procure, but I have not had the benefit of many recent discoveries and surveys. The compilation was made from works of very different values. Kashmir, Hazara and the British Trans-Indus districts are, I believe, tolerably accurate; the Salt Range is less so; whilst the Korakoram Chain, the Hindoo Koosh, Kaffirstan, Chitral, Kabul, etc. only lay claim to give a general outline and direction of the ranges, valleys and rivers. About the Hindoo Koosh, I much regret not having been able to avail myself of the maps of Kaffirstan lately published in the office of the Surveyor General of India.

It may appear, on seeing how little of the Afghan mountains is geologically coloured, that there was no necessity of extending the map as far as the Hindoo Koosh, but I hope that the advisability of having sketched in this chain will be acknowledged, after reading the fourth chapter of this memoir.

The geology of the map is partly from my own observations and partly from information obtained from friends and travellers; I have endeavoured to enter nothing which did not appear pretty certain. I have been able to sift satisfactorily a good deal of the information obtained, by means of specimens which were either shown or given to me.

I have added a few sketches of fossils which, I hope, will be found sufficiently well done to enable the organisms to be easily recognized. The forms sketched are those which have appeared to me most characteristic of the beds met with.

The two parts of which this paper consists are nearly separate memoirs. In the first, chapters 1 and 2, a description of the mountains of Kashmir is given in some detail. In the second theoretical views are discussed; but as Kashmir is merely a small portion of the Himalaya, it was found impossible to understand many fossils without taking such general views as referred to the whole mass of the chain; and, further, as the Himalayan chain is supposed by me to be intimately connected with the Afghan mountains, these mountains had also to be considered. In order to be intelligible, it became therefore necessary to write a cursory survey of the Afghan-Himalayan regions; this is done in the 3rd chapter. It is of course very superficial and incomplete; yet I hope that it may not be without some interest. On the data furnished by the first three chapters, the hypotheses advanced in the fourth are based.

I have not entered into many details on the eocene and miocene formations (except incidentally), as it would have lengthened to undue proportion this already too long paper; these formations deserve to be studied by themselves. The same remarks apply to the Jurassic and Saliferian rocks. In chapter 3, however, a few words will be found on the nature and relations of these beds. The principal object of this paper, in its descriptive portion at least, has been a study of the older rocks, viz. Silurian and carboniferous, together with the volcanic and metamorphic rocks.

I trust that the many imperfections and errors which cannot fail to occur in a memoir of this nature, will not be too severely criticised. My excuse is that this paper was prepared at one of the out-posts of the Punjab Frontier, where I had not the usual assistance of a Museum and a Library. Such as it is, I hope that it may not be without interest to some of the members of the Society who are fond of geological researches.

CHAPTER I.—*Felstone and Porphyry.**The mountains South-West, South and West of Cashmir.*

Baramoola is a small city, well known to the tourist in Cashmir and to the pedestrian coming from Murree; it is a haven of rest, for here boats may be hired to take him to Srinagar, the very heart of the valley. From the heights above the town the traveller gets his first view of the celebrated vale, and in the spring of the year it is difficult to imagine any more beautiful landscape than it affords. It is here also that disappointment or enthusiasm commences, according to the traveller's disposition: for to many Cashmir is an overrated land, whilst to the scientific man, to the artist or the antiquarian it is a mine of great wealth.

The town is built at the foot of a hill which has a direction west to east, and is cut in two to give a passage to the river Jheelum. It is approximatively in N. Latitude  $31^{\circ} 13'$  and E. Longitude  $74^{\circ} 23'$ . Its southern view is limited by a small hill, the Atala, and on the west a mountain of 8,467 feet, the Shumalarum, also confines the horizon. Thus, placed in a cradle of hills, on the banks of the Vedusta, it has a picturesque aspect, a damp cold climate, a celebrity for rain and storms, and a great name for earthquakes.

The hills at the foot of which Baramoola is built are the extreme eastern extension of the great Kaj Nag Range, which, proceeding from E. to W. for 20 miles, bifurcates into a huge north-westerly branch (which I shall leave alone for the present, as I know nothing about it), and a southern branch which, proceeding S. S. W., divides again, one arm going west towards Mozofferabad, whilst the other, the Kiren or Kirna range, crosses the river at Ori (or rather the river crosses it) to be continued with the Kandī range in the direction of the Pir Punjal chain.

2. The whole range of hills near Baramoola dips S. by a few degrees E., and in describing the rocks from S. E. to N. W., we shall therefore proceed from the more superficial to the deepest.

On the left bank of the river, we find a clinkstone or felstone of a dark grey colour and slaty texture, and an appearance as if it had been drawn while in a viscid state. It has a sandy feel to the hand; it breaks into long narrow flags having a close resemblance to pieces of

pine wood which have been cut and prepared for burning, and have weathered grey by exposure. It has a well marked stratification, which is cut obliquely to its plane by a slaty cleavage which forms with it an angle of about  $113^{\circ}$ . It has also a series of parallel joints, about 2 or 3 feet apart, and which cut the stratification at right angles but form with the cleavage an angle of  $67^{\circ}$ . The joints are usually lined by a coating of quartzite, and both quartzite and felstone are occasionally stained by iron.

The felstone appears to be entirely composed of elongated and flattened granules of felspar or albite, which has a sub-vitreous lustre when closely examined; it has a dark bluish-grey colour, but weathers ash-grey and even dirty white and some pieces which are very fissile, assume somewhat the silky appearance of amianthus. The colour of the paste appears to be due to augite; this, by decomposition, lets free a certain quantity of iron which causes the surfaces of cleavage and stratification to be covered by a powdery, rusty incrustation. Sparingly disseminated in the mass are seen minute fusiform nodules of dark shining augite; these nodules are never crystalline. Some strata are extremely thin-bedded, like sheets of paper, and fall to pieces very easily, ultimately decomposing into a brownish earth. Other strata present an alternation of very thin laminae of nearly white and dull albite, and a dark grey shining mixture of felspar and augite, so that, when the rock is broken vertically, it appears striped white and grey.

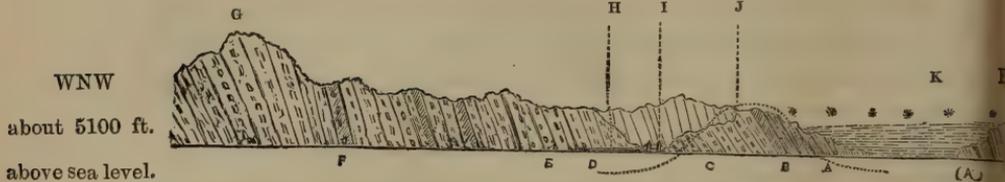
3. The above beds dip S. and a few degrees E., with an angle of  $60^{\circ}$  near the Atala hill, but the angle diminishes as we go towards the N. W., being no more than  $45^{\circ}$ , near the river at Baramoola. For two miles along the left bank of the Jheelum, this felstone was observed with, here and there, a band of amygdaloid interbedded. But I made too superficial an examination of the Atala to enter here into detail. Crossing the river to the right bank, we find that felstone also forms the hills which overhang Baramoola. Just over the city, it is similar to that of Atala, but as we proceed towards the N. W. and therefore see deeper beds, the character of the beds changes considerably. There is a beginning of separation of the minerals of the felstone, the dull white albite forming by itself innumerable penicilli having the shape of extremely elongated spindles which are imbedded in the grey felspathic paste. The rock has still,

however, a well marked stratification which is rendered very conspicuous by the white penicilli being parallel to it. There are also cleavage and joints as before, but a great deal more quartz in the latter.

The next beds, lower down, are much lighter in colour and more compact in structure. The paste is ash-grey, felspathic and dull looking, but instead of the penicilli noted before, we have here regular almond-shaped masses of white saccharine albite, usually about one inch long and two-tenths of an inch across, but often made larger and with the albite in the state of a fine incoherent sand. Then rocks, like the one with penicilli, but bluer in tint and interbedded with amygdaloidal greenstone and felspathic ash, containing oval nodules of augite, extend to the west, as far as the Shumalarum which they appear to entirely compose.

The angle of dip, on the right bank of the river, is again very great, being about  $60^{\circ}$ , and the beds are a good deal faulted. One fault has a direction N. E.—S. W. and the river runs in it at Baramoola. It is continued in a ravine on the right bank of the river, about a mile below the town. The angle of dip is not the same on both sides of the fault, and there has been a slight down-throw on the south. The Jheelum, while in the fault, is narrow but navigable; at the ravine, it turns suddenly to the south, quitting the fault and passing over a band of rock which stretches from W. to E., thus forming a small rapid. From this place to Ori, where the Jheelum enters the Sub-Himalayan tertiary sandstones, the Vedusta follows its course across the much up-tilted beds of felstone, changing its character of a winding, placid, broad and shallow river into that of a boiling, rapid, deep and narrow torrent, and forming, as it were, a succession of small falls and cascades all the way down. The thickness of the felstone near Baramoola is enormous. I can form but a mere appreciation, not having followed the beds sufficiently far to the west; but I am certain that it is much above 5,000 feet.

4. The following section (marked I. on the map) is merely a diagram to enable the reader to understand the position of the beds. It is oblique and not at right angle to the dip.



- A. Dark grey felstone, slaty, stratified and with a cleavage and joints. Fusiform, elongated, minute granules of augite. Many thin-bedded strata, ..... about 400 feet.
- B. Felstone like A, interbedded with strata of felspathic ash containing nodules of augite, ..... 30 "
- C. Rough trachytic clinkstone or felstone, breaking in elongated slabs terminated by oblique, clean joints generally lined with quartzite, ..... 500 "
- D. Bluish grey felspathic paste with innumerable penicilli of white powdery albite,..... 500 "
- E. Pale grey felspathic paste with almond-shaped masses of albite, either powdery or compact and saccharine. Beds of ash interstratified, ..... 400 "
- F. A succession of beds similar to D. and E. interstratified with bands of amygdaloid and of felspathose ash containing oval nodules of augite. This rock appears to form the whole of the Shumalarum, and was seen, as far as I could see, towards the west.
- G. Shumalarum, 8467 ft.
- H. River Jheelum or Vedusta.
- I. Baramoola.
- J. The dotted line is the Atala.
- K. Lacustrine Clay and Boulders.

5. The rocks, which I have endeavoured to describe, are continued along both banks of the Jheelum as far as the fort of Ori, about twenty-five miles south of Baramoola. Following them on the left bank, (Murree Road) we first cross the Atala, and can observe, near the village of Mihrur, very fine narrow slabs of felstone, twelve feet long, used as rafters to support a roof over a holy well or spring: Proceeding S. W. we cross a small marshy valley, and near the village of Ghaut Mullah we meet a succession of spurs directed towards the N. W., and which are the extreme north-western extension of the Pir Punjal Chain. These spurs are also made up completely of felspathic flagstone, identical to that which I have described above, but the dip and strike of the beds are different from that of the beds near Baramoola: the dip is W. with a

very high angle; but the rock is much decomposed, the vegetation rich, and little is seen until we reach Nausherra. Thence, the beds are well exposed, forming lofty cliffs over the path, of a grand and picturesque aspect; they are often quite vertical and seldom form an angle with the horizon of less than  $85^{\circ}$ . But the same force which has made those strata stand on end, has also broken them and wheeled round enormous sections of the beds. Even a superficial examination shows that portions of the hills, some thousands of yards long, caught as it were between two faults and thus set free in their movements, have been made to rotate on themselves, the strike changing its direction from a few to ninety degrees. Thus, near Buniar, the strike is N.—S.; a little further south it is W.—E.; four miles before we get to Ori it is W.  $15^{\circ}$  N.—E.  $15^{\circ}$  S. and the dip is southern and only  $45^{\circ}$ . At Ori the strike is again about N. W.—S. E. and the dip northern and  $80^{\circ}$ . But it is often difficult to see the stratification in these laminated rocks, as cleavages and joints are generally better marked than the stratification. The general strike, however, is from N. a few degrees W., to S. a few degrees E., and the dip is northern.

Between Nausherra and Ori, the felstone presents several appearances. The bulk of the hills is made up of a pale grey and extremely laminated felstone, having much the appearance of slate, and being crossed by numerous veins of opaque quartz. These veins are sometimes so thick that they form bands of quartzite. Near Ori, some beds are seen having the appearance of metamorphic chloritic slates. Others are made up of very thin-bedded felstone of an earthy appearance, and are wonderfully wavy and crimped, whilst the beds above and below them are but gently undulated. It appears probable that these thin-bedded layers were deposited by water during periods of volcanic inaction, and that when the covering felstone contracted in cooling, the aqueous deposit was gathered in zigzag folds. They ought, therefore, to be considered either as an ash arranged by water, or as a laterite derived from the surface of decomposing felstone, and having the same composition as its parent rock.

6. About half way between Buniar and Ori, is a small Buddhist ruin concealed by brambles and wild roses, and built of a dark grey rough trachy-dolerite. This rock was obtained from a thick band

which is well seen close to the ruin. It is divided into somewhat prismatic blocks by joints; it is generally compact, but sometimes scoriaceous, and it appears to have had some influence on the cooling of the felstone above and below it, this being much more compact near the trachy-dolerite, and becoming gradually more laminated and slaty as we get further off. I cannot say whether the trachy-dolerite is intrusive, or interbedded; but it is perfectly conformable to the felstone.

7. At Ori, we find a small valley sunk between high mountains and crossed by a tolerably big ravine and by a torrent flowing from the S. E. to N. W. This torrent divides the hills on the S. W. which are miocene sandstones and shales, from the mountains on the E. and N. E. which are volcanic. The Jheelum describes a semi-circle round the extremity of the Kiren range, the beds of which cross the river to be continued with those of the Kandi or Kanda Range, which are the link between the Kirna Range and the Pir Punjal Chain. The river runs for a little while between the volcanic rocks of the Kirna and the miocene sandstones, but it very soon leaves this bed, and cutting a canal through the tertiary sandstones and clays, bids farewell for ever to rocks of a volcanic origin.

8. I will not enter into a description of the tertiaries in this paper, though we shall have to see much of them incidentally, but as it has been said and written by many persons that the miocene sandstones and clays dip under the volcanic felstone (generally described as metamorphic schists or quartzose mica-slate), I must correct the error, while we are at Ori. Both the volcanic and miocene beds are nearly vertical, but not quite, and dip northerly, and there is therefore an appearance of the miocene dipping under the felstone. On examining the high bank of the Jheelum, however, not far from the fort, I could see the miocene beds bend backwards, thus showing that they

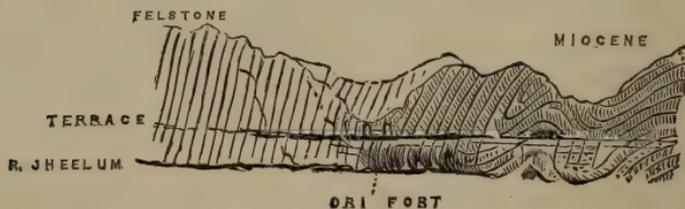


fig. 1.

are superior to the volcanic rocks, but have been dressed up against them by a lateral pressure. The diagram (fig. 1.) shows well the folded

disposition of the miocene and the bending backwards of the beds in contact with the felstone. These beds are partially concealed by a very high river-terrace of conglomerate, but this has been washed off in many places and the rocks are left uncovered.

There is, in the Sub-Himalaya, sufficient evidence of miocene sandstone having been mostly raised by a lateral movement; there appears to have been a reflection, a *refoulement* of the miocene beds towards the S. and the W., as if the enormous masses of the central chains had surged up through a chasm of the earth's crust and forced the sandstone aside, instead of lifting it up. And thus the volcanic rock of my diagram would have pressed against the miocene, and curbed up and bent back the yielding plastic beds of sandstone and clay.

9. Returning now to Buniar, half way between Ori and Baramoola, we cannot fail to admire the remains of a Buddhist temple of considerable size and great beauty. It is built of a white porphyry, and of this porphyry we must now speak in detail.

The stones of the temple were obtained from huge blocks which are strewed on the river terraces on both sides of the Jheelum, in the neighbourhood of Buniar. Some of these blocks are of enormous size: one I noticed is about 20 feet above ground and nearly as thick and broad as it is high. No water-power could have moved such enormous masses, and they have evidently been brought down by glaciers. I have been told that Mr. Vigne supposed them to have been brought by icebergs floating on a huge Kashmir lake, but we need not go so far for their origin, as the Kaj Nag peaks, seven miles to the north, and the Sank or Sallar, eight miles to the south, are mostly composed of this porphyry. A glance at the map will easily demonstrate how glaciers, filling up the narrow valleys of the Harpeykai and the Khar Khol, brought down to the river-terraces blocks of porphyry detached from the summits of Kaj Nag and Sallar (13,446 ft. and 12,517 ft.). I had not time to visit these valleys and look for ancient moraines, but some blocks show striæ and scratches such as glaciers alone can produce. These glaciers no longer exist, but their disappearance is only the result of a change of climate of the Himalaya, which is abundantly proved to have taken place at a very late

geological epoch by the river-terraces, raised lacustrine deposits and other indications of diminished rain-fall.\*

10. Examining the porphyry of the Kaj Nag mountains in hand specimens, we find it composed of the following minerals:—

*a.*—Paste of granular, white, opaque albite, fusing before the blowpipe without much difficulty or =  $4\frac{1}{2}$  of Von Kobell's scale of fusibility.

*b.*—Small transparent crystals of quartz-like rock-crystals.

*c.*—Large crystals of glassy shining albite, with a vitreous lustre and a lamellar cleavage. Sections of the crystals are sometimes as much as five inches long.

*d.*—Plates of white mica; sometimes grey.

*e.*—Dark augite (or Horneblende?) with an Iodine lustre and a dark greenish grey colour. It fuses = 4, without swelling or boiling.

*f.*—Garnets; red, brittle and cracked.

*g.*—Grains of magnetic iron ore; metallic lustre; black.

*h.*—Gold; in invisible scales.

The paste of granular albite is hardly to be seen in the most crystalline specimens of the porphyry; but it increases very much as the several crystals are less abundant and less well defined, forming rocks in which we see, beside it, only a few specks of dark augite and spangles of white mica; even these occasionally disappear, and we have a rock having a saccharine appearance, and entirely composed of minute shining grains of albite. Specimens are found in all the stages of transition, from the highly crystallized porphyry to the saccharine rock.

The quartz is not very abundant in the most perfect porphyry, but it increases in some specimens, rows of small rock crystals appear-

\* The diminished rain-fall is the result of the filling up with diluvial deposits of the great troughs situated between the Himalaya, the Affghan mountains and the mountains of Central India once covered by the sea, and now represented by the valleys of the Ganges and Indus. This filling up of the sea-communication once existing between the Bay of Bengal and the Arabian Sea, converted the Himalaya's climate, then insular, or at least littoral, to an eminently continental one. The tremendous rain-fall at Cherra-Poonjee ( $50\frac{1}{2}$  feet during S. W. Monsoons) enables us to form an idea of what the snow-fall must have been on the high summits of the Himalaya in the days when the Bay of Bengal extended to the foot of the Siwalik hills, and the Arabian Sea bathed the Salt Range.

ing in the map. It becomes also amorphous and forms bands of considerable thickness of opaque quartzite, crossing the rocks in the same manner as similar bands often cross beds of shales or other stratified rocks.

The mica is also scarce in some specimens, small spangles being occasionally imbedded in the substance of the large crystals of albite (c) or sparingly disseminated in the paste. But in other portions of the porphyry it becomes very abundant, forming tufts of plates which resist decomposition better than the other minerals, and stick out of the rock where this has been worn and rounded by exposure. These tufts of mica often form irregular bands.

The augite varies from a few specks to laminar masses of considerable size. It is often found associated with felspar alone, the other minerals having disappeared, and it thus forms a rock composed of amorphous grains of albite and lamellar masses of augite. Before the blowpipe it fuses only in places, small globules of a shining black glass appearing on the assay.

The garnets are sometimes wholly wanting and sometimes very abundant. It is very difficult to extract them from the mass, owing to their brittleness. They are mostly found where the porphyry is well crystallized and the mica abundant.

The large crystals of albite vary in size from half an inch to five inches. They have two cleavages, one nearly at a right angle to the surface of the plate, or forming with it an angle of about  $95^{\circ}$ . The other cuts the first cleavage obliquely with an angle of about  $115^{\circ}$ .\* The form of the crystals is, I fancy, uncommon, and I will describe one of them with its dimensions, in order to give an idea of the proportions of the crystals.

The crystal is always twin or composed of two hexagonal plates (fig. 2) two and half inches in diameter between opposite angles, and 0.4 inch thick. Either four or the six edges of the plate are bevelled by oblique facettes, which form with the plane of the surface an angle of about  $138^{\circ}$ , so that one surface is considerably smaller

\* The angles of these crystals were measured with strips of paper and a graduated half circle; the crystals were also much weathered; the results are therefore mere approximations. If I had had the means of measuring the angles with precision, I would have figured the crystals.

than the other. Two such plates are applied one against the other by their greatest surface, but one of the plates has (apparently) rotated half a turn, so that A of one plate is opposite B of the other.

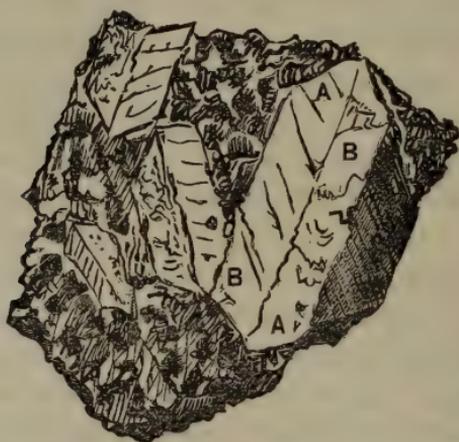


Fig. 2.

This rotation is of course only apparent, but it appears to have taken place from the cleavage of the two plates being opposite, so that when we look at a section of the double crystal (fig. 2), one side presents the shining striped surface of a lamellar cleavage, whilst the other shows the dull rough surface of a fracture across the grain. This opposition of cleavage is probably due to a play of opposite electricity generated during crystallization, but it gives the idea of one of the plates having made half a turn before applying itself against its fellow.

The perfect crystal is rarely seen; it is generally broken across, and the section (fig. 2) is conspicuous on the surface of the rock, so that, at first sight, one may fancy the crystals to be prisms, and a little trouble is necessary to understand the arrangement of the twin plates. This maclé is therefore, to all appearance, a twin crystal of one of the numerous modifications of triclinic albite.

By exposure to the atmosphere, the porphyry crumbles easily and falls to a coarse gravel which is soon converted into a very white sand. While the rock is still hard and sound, the large crystals

of albite sometimes become loosened in their matrices, and, falling out, leave angular cavities on the face of the rock. The rock, when fresh and well crystallized, is however very hard: some varieties appear to crumble much more quickly and completely than others.

II.—The grains of magnetic iron ore and the gold I have not seen in the porphyry,\* but they are found in the sands which, I will now endeavour to prove, have been formed by the decomposition of these volcanic rocks.

Gold is washed in most of the rivers which traverse the miocene sandstones and conglomerates of the sub-Himalaya, and is always found associated with grains of magnetic iron ore. Let us examine one of the districts where the washings are, I believe, most abundant, the banks of the Soane river, in the districts of Jheelum and Rawul Pindee, especially near the villages of Pindeh Geb, Kothair and Mukud. Let us therefore go to Rawul Pindee and travel towards the S. W. along the road to Kalabagh. We find that this dreary road, about 120 miles long, crosses obliquely from the N. N. E. to the S. S. W. the great plateau of miocene sandstone, conglomerate and clay (Sect. G.).

There is a thick bed of miocene sandstone and conglomerate, above 2,000 feet thick, which might be called the upper miocene formation of the Sub-Himalaya (contemporary of the Sewalik hills and containing the same Mammalian fossils), whilst the sandstone and shales of Murree and adjacent hills, about 5,000 feet thick and without fossils, might be regarded as the inferior miocene. These two divisions of the miocene are not exactly one on the top of the other, but rather the upper bed thinning towards the north, covers in the southern edge of the lower bed in an intricately

\* A similar granitoid porphyry exists in Portugal, in the hills near Cintra about five leagues from Lisbon. It is there very variable in appearance and consistency, and is generally made up of large grains of felspar and of quartz, and of large plates of mica. It contains grains of magnetic iron ore, but I am not aware whether it contains the large twin crystals of felspars seen in the Kaj Nag porphyry. The Portugal rock is generally described by travellers as granite, but is considered by geologists as decidedly volcanic. It presents the character of crumbling easily after a certain amount of exposure.



Fig. 3.

manner, as represented in the accompanying diagram (fig. 3) : 1, Upper Miocene with Mammalian Bones ; 2, Lower Miocene without fossils (excepting a few roots and stems and imprints of leaves) ; 3, Porphyry and Felstone, &c.

The upper bed is therefore not seen near Murree, whilst the lower bed is equally absent from the great plateau of Rawul Pindee, where the fossiliferous sandstone is always seen to rest directly on the Nummulitic formation, wherever this breaks through the miocene. The bed we have to deal with here is, therefore, the upper miocene only. It is much folded and faulted, forming stray folds and many faults at both extremities of the bed, and rolling in broad undulations in the centre of the plateau. Now, if we examine the much up-tilted beds near Futteh Jung, Nusrulla, or else close to the Salt Range near Kalabagh, we find them composed of a grey or greenish calcareous sandstone, of conglomerate and of sandy indurated clays containing nodules of kunkur. These beds look like inclined and parallel walls sticking out of the alluvium, and separated one from the other by open spaces or intervals ; and one may at first sight fancy that the several strata have been wrenched apart at the time they were upheaved. But if we examine the beds where they are nearly horizontal, as in the neighbourhood of the Soane river near Kothair or Jubbie, we find that they consist of a hardly cohesive sand, very white and composed of minute grains of albite and quartz, with black grains of augite and spangles of mica. I have been in the habit, in taking notes, to call this sand, Pepper and Salt sand, and I shall here make use of this term, as it is a convenient one. Interstratified with this sand we find the beds of grey or greenish sandstone, of conglomerate and of sandy clay noted at Futteh Jung ; and it becomes evident that at the places where we first observed the beds, and where they are much tilted up,

the pepper and salt sand has been washed out from between the harder beds, whilst in the horizontal strata, the sand has been protected by one of the strata of harder rock which acted as a roof over the sand underneath.

Now this pepper and salt sand is the one washed for gold. The washings are done during and after the rains, as the swollen waters of the torrents bring down to the beds of the rivers a large quantity of fresh sand. It is washed in the usual manner, and gives a residue of a black sand which is composed of shining grains of magnetic iron ore and grains of augite. A little more washing in a smaller vessel removes the augite and a great part of the iron; and the gold, which is rarely visible with the naked eye, is picked up by mercury.

If we examine the pepper and salt sand in situ, we shall very soon become convinced that it is nothing but the porphyry of the Himalaya ground down to powder, for we find in it numerous pieces of the porphyry not quite crushed to sand. I have found some of these pieces half an inch long and composed of a hard fragment of albite supporting specks of augite. Pieces of the large felspathic crystals I have seen also, and the smaller crystals of quartz are frequent and hardly altered and rubbed. The sandstone consists mostly of undecomposed albite and augite. It is not easy to describe in words the great similarity between the porphyry and the white sand, but their complete identity strikes one at once when we study the beds. Dr. Fleming made therefore a good guess when he wrote the following passage: "We have been quite unable to trace the source whence the gold has been derived, and are not aware that amongst the quartzites and quartzose mica slates (felstone is meant,) which are much developed in the Punjal Range, near the Baramoola Pass into Kashmir, and stretch west into the northern Hazara mountains, the metal has ever been detected in situ. From similar rocks there can be little doubt that the auriferous sands have been derived."\*

And again he writes: "In the neighbourhood of the Salt Range the scales of gold are small and almost invisible, but we have heard from natives, that, in Hazara, grains of gold are sometimes found of a size such as to admit of their being picked out of the sand. If

\* Report on Geological Structure of Salt Range; Selections, P. Govt. Vol. II. 1855, page 342.

this be true, we may infer that the auriferous source is somewhere to the north, and that by tracing the gold stream, so to speak, we might arrive at a point where the drifted materials become coarser, and where the gold, from its high specific gravity, has been deposited in larger quantity.”\*

That the miocene deposit of the Sub-Himalaya has been derived from the mountains situated N. or N. E. of it, is evident from the boulders contained in the conglomerates of the formation, these boulders being mostly volcanic rocks, such as we have seen in the mountains near the Baramoola, and such as we shall see in other parts of Kashmir. We will see, by and bye, that these volcanic rocks extend to the west, along the northern boundary of the Peshawur valley, as far at least as Jelalabad, and to the east as far, at any rate, as 80° east long., and probably much farther, though it appears from Captain R. Strachey’s memoir on the geology of part of the Himalaya mountains,† that the volcanic rocks in the eastern portion of the Himalaya are more intrusive than they are in the western extremity of the chain.

If it is indeed true that grains of gold of some size are picked out of the sand in Hazara, some valuable diggings might yet be found in the valleys situated between the spurs of the Kaj Nag range or its extension to the west. But I cannot help thinking that, with a population everywhere anxious to wash gold even in very poor washings, auriferous sands of any economical value would have been worked long since, especially as the sands formed by the decomposition of a porphyry, similar to that of the Kaj Nag chain, and situated on the eastern frontier of Kashmir are searched for garnets only.

The magnetic iron ore is tolerably abundant in the pepper and salt sand, and is at present wasted by the gold-washers of Kothair and Mukud: but it has not been always so. In traversing the great miocene plateau of Rawul Pindee, I noticed for many miles along the road, between Pindeh Geb and Jubbie, small pieces of black slag, often in some quantity and evidently very old, as many pieces were seen where ravines had cut the ground, buried a foot

\* Ditto ditto, page 344.

† On the Geology of part of the Himalaya Mountains and Tibet, by Captain R. Strachey, Bengal Engineers, F. G. S. Proceedings of the Geological Society of London, 1851.

and half below the surface. Knowing nothing then of the magnetic iron sand, I could not conceive whence the slags came, but on seeing the large quantity of iron ore which is washed out of the sand by the gold-diggers, I was forced to conclude that a time had been when the iron powder was saved and smelted. It is not such a poor undertaking as it might appear to wash iron from sand, especially as the gold alone would pay the men 3 or 4 annas a day, and a very little arrangement would save the iron. It contains about 70 per cent. of metal of the very finest quality and the very best to make steel. It resembles Swedish iron, and it is the same as the Kangra iron which has been proved to be of excellent quality by experiments in England. It is very dear, selling at £14 a ton. It is probable that the smelting of this iron sand was discontinued from the want of fuel, which is now very scarce on the plateau. That fuel was once more abundant, is sufficiently proved by the amount of travertin seen in many places where no springs exist now-a-days; and these fossil springs, if I may call the travertin by that name, tell us of a time when a higher jungle on the plateau and forests on the hills arrested a good deal of moisture, and wrung from the humid monsoons a portion of the rains which are now poured on the Himalaya. It would be, I imagine, easy for the local government to find out whether the magnetic iron ore is still smelted in some localities in the district, or when the smelting was discontinued, and to resuscitate the trade, the iron ore being brought to Mukud from the neighbouring villages, and there smelted with charcoal brought down in boats from the Akora Kuttuck hills or from Hazara. Excellent limestone is abundant near the banks of the Indus ten or twelve miles above Mukud. It is also abundant in the conglomerate on which Mukud is built.

The smelting of this iron sand would not, of course, give profits or yield a quantity of metal worth mentioning in comparison to the results of European industry, but it might be a valuable enterprise for natives possessing some little capital, and might much ameliorate the miserable condition of the gold-washers.

12.—Returning now to Buniar and the Kag Naj range, I must insist on the very changeable appearance of the porphyry. We have seen that it consists of a granular mass, with large crystals of albite, small crystals of quartz, crystals of garnet, plates of mica and lamellæ

of augite, and that any of these crystalline minerals or all of them may disappear, leaving a rock entirely composed of a saccharoid paste of albite. At other times the quartz becomes very abundant, and thick bands of white quartzite traverse the mass. Again, the augite, which is sometimes wholly wanting and at others in very minute specks only, may increase and at last predominate and form dark rocks with a semi-metallic lustre, the augite being generally collected in masses of aggregate plates having the lustre of iodine. It very often happens that the minerals are arranged in bands or layers as in gneiss, and this apparent foliation also varies much, and often it does not exist at all, whilst in other instances it is extremely well marked, thus gradually forming a passage to the clinkstone, described in the beginning of this paper.

13.—I have not visited the high summits of the Kaj Nag: indeed, I have only seen a few spurs of this enormous centre of mountains; but, from the road between Nausherra and Ori, one can see on the other side of the river, towards the tops of the hills, immense masses of the white porphyry glaring in the sun through the underwood which covers these mountains; and Captain H. Godwin-Austen, G. T. S., who assisted in the survey of this district, informed me that the white porphyry of the Buddhist ruin at Buniar forms the summits and all the central system of the Kaj Nag range. From a coloured sketch kindly made for me by this officer we are enabled to see that the porphyry forms the whole of the main chain of the Kaj Nag, a portion of the huge North-Western branch, and extends along the western or Mozufferabad branch towards Hazara. The rock passes gradually from the granitoid porphyry I have described to less and less crystallized rocks, until it becomes the pencillated white and blue felstone which we have seen at Baramoola, and finally the earthy, slate-like felstone of the Atala mount.\*

The summit of the Sank or Sallar, on the left bank of the Jheelum, I have also painted as volcanic porphyry, from my observing that the valley of the Apaikay is strewed with blocks of porphyry to a

\* Captain Austen described the felstone as a hard slate, but as he said that this slate was identical with the "hard slate of the lofty cliffs over the road near Nausherra," it is evident that what was taken for slate, was an earthy slate-like felstone. At the time Captain G. Austen observed these rocks, he had not yet begun to study geology.

considerable height, and disposed in such a manner that they cannot have been brought from any other locality but the summits above. When I visited the Apaikey valley, the summits on both sides were covered with a thick mantle of snow, but the very shape of the peak, a smoothly rounded boss, was suggestive of a hill composed of materials which wear quickly and round easily under the influence of atmospheric vicissitudes.

14.—We must now endeavour to ascertain the extent of country covered by volcanic rocks similar to those I have described, and I am again indebted to Captain H. G. Austen for the following information: "The so-called granite, or, as you say more properly, volcanic porphyry, of the Kaj Nag is quite unlike the granite of the Deosais or Ladak, which is pure granite or syenite. This Kaj Nag rock is seen again in the mountains bounding the south-east end of the valley (of Kashmir) and in Kistwar; and the whole length of the Chota Dhar range, bounding Badrawar to the south, is of it; I have seen it nowhere else. It is so strikingly peculiar that I should certainly have noticed it, had I come across it in other parts of Kashmir."

How far the porphyry of Kistwar and Badrawar extends to the east, I have no means of judging;\* but we have seen that the Kaj Nag extends towards the west into the upper part of Hazara; and I have had described to me some "granite" seen a few miles north of Mauserah, near the entrance into the Kaghan valley, which appears to be a volcanic porphyry similar to that which we have seen at Buniar.† But it extends still further west: Dr. Costello informs me that a great deal of "granite" and quartz occurs in and near the Umbeyla pass, lately occupied by the troops under General Sir Neville

\* The "granitic" belt between the Sutlej and the Kali rivers, long.  $77^{\circ}$  to  $80^{\circ} 15'$ , appears to be a continuation of the porphyry of Kaj Nag, Kistwar and Badrawar. In Sirmoor, Garhwal and Kumaon it forms the centres of mountainous systems such as Chor, Dudatoli, Binsar, &c. Capt. R. Strachey describes it as "often porphyritic and much subject to decay." It passes into "mica-schist showing a distinctly laminated structure," (felstone?) and also into greenstone.

† Also "a place on the road (to Mausera) as it passes along the eastern edge of the Pukti valley gets its name of *Chitti wat* (white stone) from several large blocks and hillocks of white felspathic rock containing large crystals, the same as that of the blocks on the ridge of Buri a few miles to the S. W., and like them visible "from a great distance."—*Journal of the Agricultural and Horticultural Society of India, Vol. XIV. Part I.*

Chamberlain. The General himself, in one of his dispatches, describes some of the hills as "granite," putting a note of interrogation after the word, and thus showing that the granitoid rock he noticed was sufficiently peculiar in its appearance to make it doubtful whether it was really a granite. From specimens of the mountains near the Pass, kindly given to me by Dr. Costello, I have no doubt that the so-called granite is one of the varieties of porphyry described in paragraph 12. It passes into a felstone composed of very elongated and large spindles of opaque, dirty white, and somewhat granular felspar and bluish semi-translucent glassy felspar, and in the spare felspathic paste which cements the spindles together, a few irregular grains are seen of a mineral having a metallic golden lustre, and which is probably Diallage or Bronzite. The rock has a great resemblance to, and is indeed identical with, the most compact sort of felstone seen at Baramoola. Bands of quartzite, of which I have seen very beautiful specimens as clear as Wenham lake ice, are also extensively developed, as well as enormous masses of compact gypsum and tabular selenite.

Dr. Bellew, in his "Report on the Yusufzaies," describes a variety of volcanic rocks occurring in the ranges which separate British Yusufzaïe from Chumla, Buneyr and Swat: "Feldspar grit" and "various combinations of mica and felspar," "porphyry in a variety of forms," "trap-rock in great variety," quartz, mica and clay-slate, hornblende-rock, felspar-rock and amygdaloid; "hard trap" (greenstone?) "loose, friable and crumbling" ditto. (ash?) He also describes granite and gneiss; but he adds that the gneiss is quarried for mill-stones, and, if these mill-stones, (which is very likely) are similar to the mill-stones of Jellalabad, they are a coarse gneissoid felstone, and not a gneiss. The granite again is a whitish rock, and we find it connected with and surrounded by, rocks undoubtedly volcanic. I have no hesitation therefore in regarding it as a granitoid porphyry, similar to that of the Kaj Nag. A great deal of slate and "*primitive limestone*" is also mentioned in these mountains.

Dr. Bellew concludes that these hills are "all of primitive and metamorphic rocks;" but the list of rocks he gives, proves conclusively that they are of volcanic origin.

These volcanic beds in Yusufzaïe are capped, in some places, by beds of

limestone, and these again by sandstone. No fossils have yet been discovered in either the limestone or the sandstone, and the age of these strata must therefore remain unknown for the present. Near Jellalabad beds of gneissoid felstone appear. This rock is quarried to make hand-mills which are brought down by the Povindahs and sold in Peshawur and the Derajat. These hand-mills are made of a coarse trachyte which has begun to effect a partial separation of minerals, and these minerals are arranged in streaks of white, granular felspar, greyish-blue felspar, with here and there a grain of augite. It is, therefore, again one of the varieties of felstone seen at Baramoola, and probably the same gneissoid variety quarried in Yusufzaie.

15.—By reference to the map we observe that the Pir Punjal chain is the first great parallel of the Himalaya, between the long.  $73^{\circ} 30'$  and  $76^{\circ}$  E. It is a great chain, forming a belt of high mountains between the miocene districts of Jummoo, Rajaori, Poonch and Ori and the Kashmir valley, and at both ends of this great chain an immense accumulation of porphyries and other volcanic rocks, rising to tremendous heights, and covering some thousand square miles of country, are placed like two bastions at the extremities of a centric wall. What rocks then compose the connecting chain, the Pir Punjal? The reader will easily conceive how vexed I am that I was prevented visiting this range, more especially as the information I obtained from travellers is most conflicting and unsatisfactory. Mr. L. Drew, who has traversed the chain three or four times, was especially struck with the enormous development of a great slate bar of unknown age. We shall see in the next chapter, how very thick and extensive courses of slate are interstratified with beds of trachyte, ash and agglomerate, in the mountains bounding the Kashmir valley to the North. These slates are completely devoid of fossils, but as I hope to be able to fix the age of the volcanic rocks with which they are interbedded and contemporaneous, we had better reserve the discussion of their age until after the examination of the fossiliferous strata of Kashmir.

But the slates form only a band or bar in the Pir Punjal chain, and not the whole of it. I believe, that the remainder of the rocks of this range are mostly volcanic ash, felstone and agglomerates. A friend of mine and a very trustworthy observer, in the following passage

from a letter to me, is describing, I think, volcanic rocks, especially agglomerates and ash full of lapilli and volcanic conglomerates. "It (the lacustrine deposit of the valley of Kashmir) rests unconformably on trapean rocks, quartzite, quartz conglomerate, very hard and forming a compact mass." And again, further to the S. W. on the road through the Pir Punjal Pass, he says: "The rocks are principally mica-slate, with *thick beds of a hard conglomerate having a very fine dark blue matrix; this, in some places, was a mass of water-worn pebbles; but in most of it these are scattered through the mass, and are often in that case angular and small.* Up to the Pir Punjal Pass the dip is N. with a high angle; having crossed the ridge N. E. this continues all the way to Barangulla, giving these altered sandstones, slates and conglomerates an enormous thickness."\* The excellent observer who wrote the above remarks did not think, it appears, that the rocks were mostly volcanic in origin, but I cannot help imagining that his description applies, in great part, to stratified ejecta of volcanic eruptions, and the passage I have put in Italics is, I think, a very fair description of ash with lapilli. Again, I must also remark that the felstone of Baramoola has always been described by travellers, and by geologists also, as mica-slate, though it contains no mica and is nearly wholly made of felspar; what has been taken for mica, being minute spindles of glassy albite. It certainly has a slaty cleavage, and the most earthy varieties have a close resemblance to metamorphic slate, and it is probably this fact which has misled most people as to the nature of the rock. It is not therefore impossible that some of the "mica-slate," mentioned above, is in reality earthy felstone.

16. The position of the Pir Punjal chain is rather peculiar, abutting as it does at both ends against enormous centres of volcanic rocks, and being separated by a great fault (the valley of Kashmir) from mountains also composed of the same rocks. In the enormous accumulation of amygdaloidal ash, agglomerate and conglomerate which we shall see, by and bye, on the other side of the valley, there is abundant proof of the existence of open volcanoes in this part of the Himalaya, at the time the porphyry was in a fluid or viscid state. The extreme

\* I do not give the name of the person who kindly gave me the information quoted, as I do not agree with him on the origin of these rocks, and believe that he missed appreciating their true value, though his description is accurate.

regularity and evenness of the stratification of these cinder beds renders it highly probable that the showers of ejecta fell in a shallow sea in which the volcanoes formed islands. It appears to me, that we cannot refuse to admit that the porphyry was the base of the volcanoes, and indeed the matter which failed to escape through the vent in the earth's crust, whilst the felstone or clinkstone and varieties of trachytic rocks into which the porphyry always passes, are lavas which have flowed under the pressure of the sea. If these views are admitted, we have a series of volcanoes beginning at the Kaj Nag, and forming an arc along the north-east boundary of the valley of Kashmir, down again to the mountains of Badrawar: of this arc of volcanoes the Pir Punjal chain is the chord. Can we wonder, huge though the chain is, at its being in a great measure formed by ejecta of volcanoes received in a sea gulf and there arranged in conformable layers? The slate, as we shall see in the next chapter, was formed during the intervals of volcanic activity, and it is not improbable that the continual shower of ashes and hot stones into a shallow bay kept the water at a temperature too high for the development of animal or vegetable life.

Since writing the above paragraph, Capt. G. Austen has informed me that beds of unmistakably volcanic rocks, such as amygdaloid and coarse greenstone, are interbedded with the slate and other rocks of the Pir Punjal. This is precisely what occurs in the hills north of the valley of Kashmir, we may therefore regard the Pir Punjal as a mass of volcanic ejecta interbedded with slate which was deposited during the periods of volcanic tranquillity.

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## CHAPTER II.—*The Mountains North and North-East of Kashmir.*

17. By referring to the map, we observe that the Kashmir valley is an elongated trough with its longer axis directed S. E.—N. W. The Jheelum has a similar general direction, as far as the Woolar Lake, and the smaller stream which drains the north-western end of the valley flows from the N. W. to the S. E. To the north-east of this axis, we notice long spurs of hills which descend to the water-

edge of the Woolar Lake, the Manus Bal and the Dál and to the lacustrine plains of Pampur, Avantipoor, Bij-Behara and Islamabad. These spurs are the extreme south-western ends of a labyrinth of mountains which forms a barrier, nearly forty miles across as the crow flies, between the flat plain of the Kashmir valley and the chain of mountains which separates Kashmir proper from Drass, Sooroo and Ladak. If we consider the Himalaya as a series of parallel chains and valleys, we should have the Pir Punjal chain as one of the parallels; traversing the valley of Kashmir and the labyrinth of mountains to the north-east of it, we meet another great parallel chain, which has unfortunately no general name. It has been called by Col. Cunningham the Western Himalaya, but the name is evidently objectionable, as we want the term "Western," to designate the whole of the Himalaya between the longitudes east  $73^{\circ}$  and  $79^{\circ}$ , or between the Indus and the Sutlej. It has also been called the Central chain of the Himalaya by several authors, but the great quantity of snow which covers its peaks is merely the result of its being so placed, that it collects and condenses nearly all the remaining moisture contained in the south-western winds, and sends these winds perfectly dry to the Kailas and Karakoram ranges. The beautiful series of snowy summits presented by this chain is therefore no claim to its being the central chain of the Himalaya. I am afraid no other rule, but that of the division of drainage, can be considered safe in estimating which of the many parallel chains of a same system of mountains is the central one; and if we conform to this rule, the Karakoram range is to be regarded as the central chain of the Himalaya. It is therefore preferable to name the chain under consideration by the name of one of its great peaks, and as the Kun Nun or Ser and Mer Peaks (23,407 feet) are well known and very conspicuous in the western portion of the Himalaya, I shall make use of the term "Ser and Mer chain" to designate the great parallel range which separates the basin of the River Jheelum from that of the Indus.

Between the Pir Punjal and the Ser and Mer chains, we have not only the valley of Kashmir, but a number of independent and, as it were, isolated centres of mountains which, as I have said before, form a complicated labyrinth of hills and valleys to the north and north-

east of the Jheelum. If we travel, on the map, from the N. W. to the S. E. of the valley of Kashmir, following the banks of the Jheelum, we shall notice a series of mountains of moderate height, encroaching into the valley, and separated one from the other by broad lateral valleys more or less filled with lacustrine deposits. The first mountain we meet is on the eastern side of the Woolar lake, and is called the Safapoor (10,309). Its foot is bathed by a small but exquisitely picturesque lake, (Pl. 6) the Manus Bal. The next is close to Srinagar and is the Zebanwan (8813). Ten miles to the south-east, the Wastarwan, near Avantipoor, is the next summit; then, after crossing the valley of Trahal, we meet the hill of Kamlawan (8601), over the village of Murhama, and the Sheri Bal close to the Kamlawan. Crossing the broad valley of the Lidar River, we find the Hapatikri, a mountain which sends a spur to the S. W. to form the small hill of Islamabad at the foot of which the town of that name is built. Crossing the valley of the Arpat river, we meet with the Dhar (8146) and the Nawkan (9207). We have therefore, from the eastern shore of the Woolar lake to the extreme south-east of the Kashmir valley, a catenated chain of mountains composed of isolated summits, whilst their relations are covered by the diluvial and lacustrine deposits which fill the Kashmir valley, and the lateral valleys which open into it. This chain is therefore presented to us as a series of summits and not as a regular chain.\* Its direction is that of the general parallelism of the Himalaya, viz. from N. W. to S. E. Ten miles, as the crow flies, to the northeast of this chain there is another similar one, that is to say a series of summits, apparently somewhat detached one from the other, but being in a line with the parallelism of the Himalaya. These mountains are from the S. E. to the N. W.—the Liwapatoor, the Wokalbul (14,310) the Girdwali (14,060), Batgool (14,423), Boorwaz (13,087), Handil (13,273) Saij Aha (11,334). West of the Saij Aha, this catenated

\* I need hardly say that the catenated appearance of the chains described in the text is in great part due to erosion, and that this great erosion is only what was to be expected, if we remember that the whole rain-fall of the southern slope of the Ser and Mer chain has to find its way to the valley of Kashmir across these catenated chains, and that the Ser and Mer chains receive a tremendous snow-fall. I use the word "catenated," in the same sense as it is used in Anatomy, to designate the arrangement of the lymphatic glands of the neck, viz. like the beads of a necklace or rosary.

chain becomes blended with the first one I have indicated. Ten miles again to the north-east of the series of peaks just enumerated, is another chain of detached peaks or centres of mountains, arranged along a line parallel to the two others and to the general direction of the Himalaya. From the S. E. to the N. W. we have the following summits or centres of mountains: the Rajdain (15,389), the Gwasbrari (17,839) the Harbagwan (16,055), the Basmal (15,652), the Kotwul (14,271), the Haramook (16,903) and the numerous peaks which, with their complicated spurs, separate the valley of Kashmir from Gurais and Tillail.

Between all these catenated chains, connecting spurs or branches are to be seen spreading in all directions, and it is extremely difficult to give the direction of the resulting masses of mountains. But the geology of these mountains will help us a good deal to understand their topographical grouping. As we see these mountains on the map, we should be disposed to consider them as long spurs of the Mer and Ser chain descending towards the S. W.; but we shall see that all, or at least most of these summits, are composed in their centre of rocks which have once been in a fluid or viscid condition, that is of porphyry, greenstone, basalt and amygdaloid; that these melted rocks are covered by enormously thick layers of ash, agglomerate and slate interbedded, and that on the top of these beds of ejecta fossiliferous strata rest quite conformably. It becomes therefore evident, that the summits represent separate and isolated centres of volcanic action, no doubt much displaced by the last upheaval of the Himalaya, but yet preserving their relations to the beds of ejecta which were collected around their feet and on their slopes. We have therefore a linear arrangement of volcanoes, or at any rate of volcanic fused matter, (for some of the collections of melted minerals may not have reached the surface and never had a vent), this linear arrangement forming three parallel lines, and these lines being parallel to the general N. W.—S. E. direction of the Himalaya. I believe that similar lines of volcanoes or collections of volcanic matter are to be found between several of the great parallel chains of the Himalaya, but whether they are thus general or not, the ones in Kashmir are sufficient to prove that during the Palæozoic epoch, the volcanoes of the Himalaya had an arrangement more or less linear, and that the

great lines of fracture on which these volcanoes were situated, had the same direction as that of the Himalaya of our time.

18. Beginning with the southernmost line of summits, I will now describe in some detail the hills which compose it. I shall begin with that nearest to Srinagar, viz. the Zebanwan.

The Zebanwan is a mountain of 8813 feet at its highest point, with a general direction from E. to W. (Map B). Its eastern portion is nearly due E.—W., and is  $2\frac{1}{4}$  miles in length. It then turns to the S. W., at the same time throwing out long spurs to the N. W. to embrace the eastern shore of the Dal. The Zebanwan keeps its N. E.—S. W. direction for  $3\frac{1}{4}$  miles, when it bifurcates into two branches, a southern one, small and short, and a W. N. W. one,  $2\frac{1}{2}$  miles long. It is at the end of this W. N. W. branch that the Tukt-i-Suliman rises, a very conspicuous little hill, seen from nearly every part of the valley. Still further to the W. N. W.,  $2\frac{1}{2}$  miles from the Tukt, the hillock of Hurri Parbut rises out of the lacustrine alluvial. It is evident that the Tukt-i-Suliman and the Hurri Parbut are only continuations of the W. N. W. spur of the Zebanwan, and appear as detached hillocks on account of the thickness of the lacustrine deposit. (Sect. A).

The following detailed section of Hurri Parbut, the Tukt-i-Suliman and the W. N. W. spur of the Zebanwan is at a right angle to the axis of these hills. It will give, I hope, a good idea of rocks which we shall meet again and again, and which I will, therefore, endeavour to describe now with some precision, as they are nowhere better seen or more conveniently studied.

Section of Hurri Parbut, Tukt-i-Suliman and W. N. W. spur of the Zebanwan. (Sections A, B, &c.).

Direction of chain : S.  $65^\circ$  E.—N.  $65^\circ$  W. General strike of beds S. E.—N. W. General dip of beds, north-easterly. The Section follows the direction of the range and consequently cuts the dip at an angle of about  $65^\circ$  instead of  $90^\circ$ . (See Sect. : A). (Section II. of General Map). See also Map B.

*Hurri Parbut.* This hill is a succession of hard layers of trachy-dolerite and soft layers of other rocks. The trachy-dolerite is rough, compact, very hard and dark. I have never seen it scoriaceous. It is sparingly amygdaloidal, containing sometimes a few large geodes filled with white quartz. These beds are nearly vertical, with a dip east-north-easterly, forming with the horizon an angle seldom under  $75^\circ$ . The most westerly beds are nearly vertical, whilst the most easterly layers are more sloping. There are seven or

eight thick beds of this trachy-dolerite separated one from the other by the following rocks: (a) A slaty basalt, hard when fresh, but very soon falling into foliated debris. It reminds one somewhat of the earthy variety of the felstone of Baramoola. It is grey in colour. (b) an ash of a dirty-looking felspathic paste, full of rounded or oval nodules of dull augite or hornblende. These nodules are probably amygdaloidal in origin, being due to a bubbling of a hot paste of ash and water. It desintegrates very quickly into a yellow earth or a grey gritty soil on which grass grows well, soon concealing the rock below.

These beds of slaty basalt and ash are well stratified, and fill up all the spaces left between the layers of trachy-dolerite; this last rock forms prominent ridges or saddles on which the several works of the fort are built.

A marshy alluvial plain intervenes between the Hurri Parbut and the Tukt-i-Suliman.

*Tukt-i-Suliman.* The western extremity of this hill (as it appears above the lacustrine deposit) is a little knoll which has received the name of Rustun Ghurree.

1. Rustun Gurree: Compact greenstone either greenish or bluish; hard; fracture conchoidal. Either no amygdala or a few large ones, about the size of a pigeon's egg, often irregularly shaped, composed of white opaque quartz arranged in concentric layers and never crystallized.\* Strike S. E.—N. W.; Dip N. E. = 50°. This is a hard rock and forms a prominent boss of a barren character. It is quarried for building purposes, but is too hard to be dressed, and as it breaks in angular pieces, it is altogether a very unsatisfactory building material. This bed has a thickness of about ..... 60 ft.

2. A dirty yellowish-grey felspathic ash, full of geodes of dark augite. It decays fast, the nodules of augite, after partially decomposing and colouring the whole mass ochre-yellow, drop out of their niduses and leave a spongy mass of yellow earth somewhat resembling pumice, but not in its hardness. It is used as a good clay for pottery. It is much better developed on the northern than on the south-eastern side of the hill. In one section it is no more than ..... 10 ft.

3. Resembling greenstone but much more amygdaloid. It is hardly seen on the southern aspect of the hill, where it is covered by vegetable earth and a cemetery; but it is well seen on the lake side near the water gate, ... 20 ft.

4. Tukt-i-Suliman: A mass of amygdaloidal greenstone, sometimes compact, as at the base of the Rustun Gurree, but more generally showing dark specks of augite or hornblende in the mass. The amygdala of white quartz invade it, either as large and scarce geodes disposed here and there

\* These amygdala of white quartz occasionally fall out of their matrices and are to be seen in numbers, half-buried in the soft silty mud of the lake near the village of Drogehand. Should this mud one day dry up into a rock, a false amygdaloid will be produced, all the more difficult to distinguish from fused amygdaloid, as the mud of the lake is entirely formed of the debris of volcanic rocks.

irregularly in the rock, or as smaller geodes mixed among long cylindrical and twisted branches of quartz running through the mass. (See figs. 1, 1a. plat. X.) I must confess, I had some difficulty in understanding these branches; they look precisely like the arms of a canal or like small rhizomes, and they sometimes have the form of worm-burrows; they begin with thick branches or trunks about the size of the finger and throw out smaller twigs; they are often 6 or 8 inches long, and are cut obliquely by both stratification and cleavage. I have come to the conclusion, after examining a great many of these cylinders, that they are gas-vents, similar to the amygdala in origin, the imprisoned gas, in its efforts to reach the surface, having had sufficient strength to force a long passage through the viscid paste.\* Dip 55° to 60° ..... about 600 ft.

5. Amygdaloidal greenstone, graduating to trachyte; with innumerable small geodes, rounded and pressed together. The greenstone becomes rough and gritty and passes into a trachyte, it is much less amygdaloidal; and on the other hand, where the rock is excessively amygdaloidal, the paste is a dark brownish black rock, which is cleaved into well defined slabs, and breaks easily into prismatic fragments. This bed forms a depression between harder layers. The stratification is easily seen by the several courses of the rock superposed one on the other; but of course it is not seen in the thickness of each course. .... about 200 ft.

6. Pale bluish greenstone, hard, compact, with conchoidal fracture; it is closely spotted with irregular dots of hornblende. At the base of each compact layer, there is a margin 1 or 1½ foot thick and very amygdaloidal, the geodes being filled with quartz. It is a very hard stratum ... about 150 ft.

7. Closely set amygdaloid. The paste is a greenish felspar, sometimes very compact and then dark, and cleaved into slabs half an inch thick; sometimes light in shade and with the amygdala rather irregular and nearly touching one another. In many specimens, the felspathic paste shows a division of the felspar into a bluish or greenish mass and patches of white felspar; but there is no crystallization. Dip 70° nearly due E. The felspathic paste decays pretty quickly and thus this bed forms a depression on the hill side..... 50 ft.

8. This is the stratum on which the celebrated Buddhist ruin is built; it is the highest summit of the Tukt-i-Suliman (6263 ft.) It is composed of very hard, dark greenstone, with amygdala of white quartz, occurring sparingly. Beds of lighter coloured greenstone, with specks and nodules of angite are interstratified. A great many well defined long cylinders of quartz, either white or black or smoky, such as I have described as gas vents, are seen here. This stratum is a hard saddle or ridge; nearly vertical, and dipping easterly. .... 60 ft.

\* I have since read that Dr. MacCulloch observed in Little Cambay, one of the Western Islands of Scotland, amygdaloid containing elongated cavities similar, I believe, to those which are here described.

So far, the rocks have been purely igneous. We now meet an alternate succession of igneous rocks produced by the decomposition and arrangement under water of volcanic minerals. Ash, agglomerate and other strata of volcanic ejecta become also much more abundant.

9. A dark blue slate, in places clayey, in others calcareous, and effervescing slowly and feebly with acids. It decays soon and forms a depression. It contains no trace of organisms..... 15 ft.

10. A lumpy brown rock composed of a coarse felspathic paste which weathers chocolate-brown and contains a great number of lapilli, mostly black and basaltic-looking. It shows thin, lenticular beds of pale grey felspathic ash containing innumerable geodes, filled, some with quartz, some with dark augite (?) This stratum is not very hard, and rounds by weathering, so that it forms a smooth round boss and not a sharp saddle. It is about ... 30 ft.

11. This bed is interesting and presents a very peculiar appearance.

The rock is a pale grey trachyte in which crystals of dull white albite have imperfectly formed and arranged themselves in tufts of imperfect crystals forming more or less a star or section, (see fig. plate X.) When the rock is polished, (such as is seen in the pavement of Srinagar where it is polished by people walking over it\*) the starry disposition of the crystals is evident enough, though in the fresh broken specimen it is rather confused. The rock is a passage between a trachyte and a felspathic porphyry. I have never seen or read a description of this variety of volcanic rock, and I therefore propose to call it "Soolimanite." On the north-western flank of the hill, this bed of Soolimanite is better seen than on the other side, and there presents some layers which show well the nature of the rock. Some of these layers, rather darker than those we have seen on the other side of the hill, contain the starry crystals well developed in the centre of the beds only, whilst above and below, that is near the lowest and uppermost parts of the beds, the

\* The stone is not abundant, and very few pieces of it are seen in the pavement of Srinagar. I have seen two however, one in the vegetable market near the great Musjid, and the other between the first bridge and the gate of the Shere Ganie on the left bank of the Jheelum.

Fig. 4.

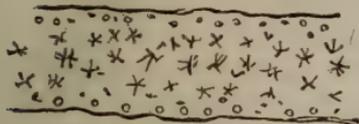


Fig. 5.

crystals disappear and are replaced by amygdala filled with quartz (fig. 4.) Other beds again of compact trachyte show neither starry crystals nor amygdala in their centres, but have their deepest layers invaded by large amygdala, and their uppermost portion full of small geodes, having besides a scoriaceous aspect (fig. 5).

In the middle of this bed of Soolimanite, some of the cylindrical tubes of quartz described before as gas-vents are well developed, branching in all directions through the rock.—Dip E.  $70^\circ$  ..... about 30 feet.

12. Slate of various colours, laminated and very false-bedded, often squeezed and twisted. It has been folded, the lower part being nearly vertical with a dip westerly, whilst the upper part dips east  $65^\circ$ . The centre of the fold is much contorted and gathered in zig-zags, and in these contorted parts a great many gas-vents (branching cylinders of quartz) are well seen; some as large as the finger, others of the usual size, viz. a crow's quill. .... 200 ft.

13. A band of Soolimanite like 11. The slate of No. 12, has evidently been metamorphosed by the action of heat emitted by the band of Soolimanite which covers it. There must have been a considerable period of inaction between the two out-pours of Soolimanite to enable the slate to become collected, and it is evident that the slate was yet in the state of a silty mud at the time of the second eruption and was set bubbling by the heat of the Soolimanite.

I may here remark that I am satisfied that many of the layers of laterite, cellular slate and ash, which we shall see in this section, are nothing but true sedimentary deposits metamorphosed and rendered amygdaloidal by the bubbling or boiling of the waters which covered them. I had thought at one time, to try and distinguish the beds of ash and volcanic mud which were probably formed as I have just explained; but I found the work too uncertain and requiring too much time to be worth prosecuting. But no doubt can be entertained that, besides the slate and laterite, many of the beds of the mountains of Kashmir which appear to be volcanic ash or dust, are in reality metamorphosed sedimentary layers.

- The Soolimanite has a thickness of ..... 15 ft.
14. The band of Soolimanite gradually passes into a felspathic ash, often friable, but often also hard and compact and full of oval nodules of dark augite, varying in magnitude from the size of a pea to that of a pin's head. Occasionally the ash passes, along the strike, into a hard compact quartzite. The whole bed appears irregular and lenticular, and has been probably formed by ejecta falling into shallow pools of water ..... 15 ft.
15. A calcareous rock which is not seen on the hill side, but gives out, on the brow of the hill, a good deal of nodular muddy carbonate of lime (kunkur). Here and there a brown ferruginous rotten ash (or metamorphosed calcareous shale?) crops through the grass on the top of the hill. It effervesces feebly with acid, and is probably the rock which gives out the kunkur. This layer, which is probably squeezed out of its place near the foot of the hill by the gradual curving of the strike of the harder rocks, is, at the top of the mount, at least ..... 20 ft.
16. A thin band of amygdaloidal greenstone ..... 12 ft.
17. Slate, grey. On the western side of the bed it dips W. N. W.  $65^{\circ}$ . In the centre it is much folded; on the eastern side it dips E. S. E.  $75^{\circ}$ . This angle, however, diminishing quickly to  $65^{\circ}$  ..... 20 ft.
18. Greenstone alternately coarse and fine ..... 20 ft.
19. Slaty basalt, dark bluish black, fracture conchoidal. It dips E. a few degrees S.  $70^{\circ}$  ..... 30 ft.
20. A crumbling, brown, lumpy metamorphic mud, slightly amygdaloidal. It decays rapidly into a dirty yellow coarse gravel. It is interbedded with bands of agglomerate, the lapilli being mostly basalt ..... 50 ft.
21. Sandstone, hard, rough, quartzose and micaceous; apparently much altered by heat. No organisms ..... 3 ft.
22. Coarse quartzose grit, very hard and rough. It appears to be composed up of angular grains of quartz, variously coloured, cemented together by a siliceous paste. It may be a siliceous deposit in which crystallization of the purer quartz has begun to take place ..... 15 ft.
23. Sandstone like 21. Dip. S. E. .... 10 ft.
24. Blue compact slate, becoming gradually first coarser and more like a shale, and then more silty or like yellow and grey clay-slate. The stratification is best seen by the coloured markings which indicate it to be only  $25^{\circ}$  and E. The bed has probably been squeezed out of its place ..... 150 ft.
25. Coarse yellow sandstone with a calcareous cement. Cleavage well marked. No organisms..... 20 ft.
26. Slate, thin bedded and falling into angular fragments. It is mostly deep blue with bands or ribbands of yellow and grey. The dip is more regular than that of the slates seen before. It is nearly due E. with an angle of  $40^{\circ}$  ..... 200 ft.

27. Slate, fissile. It differs from the preceding by decaying much more quickly by exposure, the whole bed being covered by small débris. It dips W. on its western side, and E. on the eastern, whilst the centre of the fold is zigzagged ..... 30 ft.

28. Slate, compact and dark blue ..... 8 ft.

29. Slaty shale, grey and dark, dipping W. a few degrees N. at an angle of 55°. It is continued (underneath) by coarser shales which form an anticlinal (not easily seen on account of débris and of the decayed state of the shale). On the other side of the anticlinal the dip is nearly due E. 60°. The extent of outcrops of this layer (not its thickness) is about..... 5 to 600 ft.

30. Metamorphosed slate, fissile and greyish blue; much jointed; the joints are yawning, sometimes a foot apart; they strike W. E. vertically. The stratification dips E. S. E. with an angle of 50°, but that is much falsified by the stratum inwrapping the end of the spur. This bed presents in its middle, thin layers as follows:

a. Soft, yellow quartzose sandstone, nearly friable, 8 inches. b. Dirty quartzite, 8 inches. bb. Do. with veins of pure white opaque quartz, 1 foot. c. A hard, brown, baked quartzose with spreading veins of quartz, 6 inches. Total 3 feet. The whole outcrop of the bed (not its thickness) is about 130 ft.

Here ends the Tukt-i-Suliman, and between this hill and the foot of the W. N. W. spur of the Zebanwan passes the road from Srinagar to the Nishat Bagh. (Sect. A).

*The W. N. W. Spur of the Zebanwan.* Ascending this spur in the continuation of the section, we have the following beds:—

1. Slate more or less laminated, with large yawning joints striking W—E. The stratification is well shown by the colouring of the slate; it dips W. 45°; inwrapping the end of the spur.

It may be here remarked, that the beds of slate, ash and fossiliferous rocks nearly always present this inwrapping arrangement at the end of spurs and when they cross a spur; it appears that these beds had plasticity enough to bend all round when upheaved by inferior rocks. A fine example of this inwrapping arrangement is seen in the limestone which terminates the spur of the Zebanwan over the village of Zeeawan: the limestone, in endeavouring to arrange itself around the band of volcanic rock which upheaved it, has split into slices from 5 to 15 feet thick, diverging like an open fan. (Sect. C).

To come back to our section, the slate has a tendency to break into prismatic pieces, and the joint-surfaces are coated with a yellowish or

dirty white quartz. This bed is evidently a continuation of the last bed of the Tukt-i-Suliman (30 of section A), and the road passes over a synclinal, which would be very evident, were it not for the inwrapping arrangement of the slate at both extremities of the bed. As we go up the hill, we observe that the bed forms a small eminence of its own, being separated by a fault from the western beds which have a general south-easterly dip. It extends for about a thousand yards along the southern aspect of the hill, wheeling round and, as it were, lining the foot of the spur, its dip becoming gradually more southerly until it is S. W.

2. Following our section, we find, after the fault, the same alternate disposition of felspathic ash with nodules of augite, of dark slate more or less laminated, baked and metamorphosed, and of volcanic agglomerate full of dark coloured lapilli. It would be tedious and unprofitable to give a minute description of each bed, especially as the enumeration would be a long one, each bed being seldom more than 10 feet in thickness. No greenstone was seen for more than half a mile; the ashes are always tolerably compact when not in a decomposed state, and always invaded by innumerable nodules of augite. They are always well stratified, and it appears therefore evident that the whole of the ejecta fell into water, by which they were arranged in well defined strata. The amygdaloidal condition of nearly all the rocks, whether ash or slate, seems to indicate that the water was raised to a high temperature during the volcanic eruptions; and the want of animal remains in the slate beds and amongst the agglomerates is in accordance with this hypothesis.

It goes on, as I said before, for above half a mile, alternating ash and slate, with occasionally a dirty-brownish bed of rotten and calcareous ash decomposing very fast and throwing out, on its surface and also between its joints, a large quantity of kunkur. The strike of the beds turns gradually to true N. S. and the dip is E., the angle with the horizon being between  $60^{\circ}$  and  $70^{\circ}$ . Beds of laterite now begin to appear, of a yellowish grey colour and resembling indurated clay. They are a little harder than slate, sparingly amygdaloidal, and the geodes are very small and filled with quartz. They break into small cuboid fragments. These laterites are interstratified with beds of dark slate, and lying over them we get the following strata:—

*x.* A band of greenish-grey trachyte with small rounded geodes of chalk-white albite. It weathers somewhat reddish on its outside and wears in rounded masses. It reminds one very much of some of the felstone of Bara-moola. Strike N. 15° W.—S. 15° E. Dip Easterly 40°. But this stratum varies very much along its strike, becoming in places a ferruginous, rotten, augitic amygdaloid; in others a sandstone made of big rounded grains of quartz, of hornblende and of other volcanic minerals, with a calcareous cement which effervesces powerfully with acids. This sandstone forms slabs 1 to 1½ inch thick, and superposed one over the other like bricks in a wall. Again a little further on, it is a fine, very compact, smooth laterite, passing gradually into a more sandy variety containing very minute spangles of white mica hardly visible in the day time, but which shine well by candle light, and also a few small rounded nodules of a pale green semi-lucent mineral. The variations of this bed along the strike seem to indicate a very shallow shelving shore or a pool of water, the bottom of which had been frequently disturbed by the appearance of lavas or other heated matter. The bed is about 15 feet thick at the outcrop.

*xi.* Then the slate, blue and compact, comes again, with occasional thin beds of sandstone or dark-stone: a coarse grained highly ferruginous amygdaloid, a sort of peperino, forms a bed 15 feet thick, and on the top of this, here and there, are patches of grey laterite. The slate and the sandstone alternate repeatedly in beds of more than five feet each, and this goes on for a thickness of about 160 feet.

*xii.* A ridge of coarse, brown, slightly micaceous sandstone, in superposed slabs like a built wall, now makes its appearance. It strikes S. W.—N. E. and dips easterly 45°. This strike S. W.—N. E., meeting the strike of the preceding layers *x* and *xi* which is N. 15° W.—S. 15° E., leaves an open angle or yawning on the northern flank of the hill, and this is filled up by laminated slate, much broken and of various colours, a good deal of it being yellow. It is the yielding of this soft slate which has allowed the hard and unyielding sandstone to take a direction to the S. W. instead of to the S.

The thickness of this sandstone ridge is about 45 feet, and that of the slate, which fills up the gap or yawning on the flank of the hill, about 40 feet.

*xiii.* Slate, hard but much cleaved; about 80 feet.

*xiv.* A ridge of very compact and massive baked clay, having a conchoidal fracture and large distant joints. It is yellowish grey in colour, with bands of lighter yellow: one would take it for a light-coloured basalt, if it were not for its trifling hardness, which is about that of slate. It appears to be a clay made up of silty mud, derived from basaltic and other volcanic rocks and baked after formation. Perhaps it would be best named "Massive Laterite." The joints and the surface are covered with a rich brown iridescent oxide of iron or a black crust of the same material. This rock is nearly vertical, and is near a fault of considerable extent which cuts the hill right across,

and this proximity to a large fault might perhaps account for the metamorphosed appearance of the clay.

FAULT.

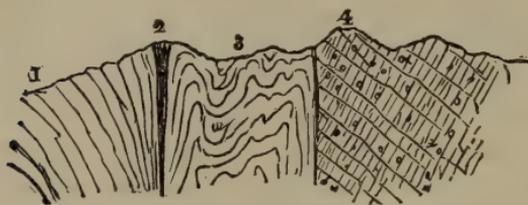


Fig. 6.

1. Slate.
2. Massive Laterite or Baked Clay.
3. Slate, Ash and Laterite in the fault.
4. Amygdaloidal Greenstone.

The fault is about 500 feet wide, and is filled with zig-zagged slate, ash and laterite. A very great deal of kunkur is found all over the ground. This fault goes right across the hill, from near the ruin of Pari Mahal to the small spur over the village of Pandrettan.

East of the fault, the rocks are very different; they are rocks similar to those we saw at the foot of the Tukt-i-Suliman; viz. greenstone and amygdaloid, and there has been therefore a downthrow on the west of the fault. The strike is very different on both sides of the fault. We have seen that on the west side it is S. W.—N. E. with an eastern dip; the greenstone and amygdaloid strike S. E.—N. W., dipping to the N. E.

There is no occasion to describe these greenstones and amygdaloids again, as I have done so before at the foot of the Tukt-i-Suliman. But we must notice here a very great quantity of what I have called gas-vents; the amygdaloidal greenstone is in some places completely perforated by these vents which are sometimes filled with quartz, sometimes with augite, and sometimes left empty. (See figs. 1. 1a, Pl. X.)

20. Crossing the broad ravine above the village of Pandrettan, a ravine in which once flourished a Buddhist city of which the ruined walls are still to be traced, we notice a spur composed of dark and brittle basalt, much jointed but not columnar. It is interstratified with a volcanic ash, similar to that seen in the Rustun Gurree. The end of the spur presents a fine example of beds of ash and laterite inwrapping or infolding subjacent beds: the spur is narrow and the layers of ash and laterite are bent down on each side of it, just as a layer of paste laid across a ruler would by its weight bend on each side of the ruler. The dip of the beds is N. E., and consequently the strike is obliquely across the spur which has a W. south-western direction, and when we look up the hill, facing to the N. E., we can then see the beds of ash and laterite cropping out one above the other, like steps,

and forming arches along the strike. This curvature of course falsifies the dip on both flanks of the hill, the dip becoming northern on the south eastern flank of the spur, and south east on the other flank.

The lowest portion of the spur forms a little mound on which may be seen the remains of a gigantic Buddhist figure. The figure is that of a woman, but it is now prostrate and headless. It is a huge block of limestone. There are many other Buddhist remains at Pandrettan, all built of that rock: amongst others, a small temple in a tank is well worthy of a visit.

From Pandrettan to Panchhooka, we have a succession of thick beds of dark basalt, cleaved and jointed but never columnar, and greenstone and amygdaloid, with a few beds of compact ash containing oval nodules of augite. The basalt is the only rock which has not been described before. It is best seen in a little spur which descends to the Jheelum, hardly half a mile east of the Buddhist figure on the little knoll. It has sometimes a very black and conchoidal fracture, and at other times a pale pitch and bluish colour. It breaks into prismatic blocks which are quarried at the place where the spur hangs over the river. It does not appear to be amygdaloidal, but the greenstone into which it passes is sparingly so, the geodes being large and filled with quartz. It is difficult to ascertain the stratification or superposition, owing to the well marked cleavages and joints, but by observing the beds of compact ash occasionally met with, it is found to be easterly at a very high angle with the horizon. All the way from the stone quarry, at Alwajin, to that portion of the village of Panchhooka, designated on the map as "Large Cheenar Trees," there is a succession of these beds, but the angle of dip diminishes gradually as we travel eastwards and is only  $45^{\circ}$  at Panchhooka. There we find the following beds:—

A slaty basalt, dark and heavy, dipping to the E. a few degrees S. at an angle of  $45^{\circ}$  with the horizon. It has a cleavage dipping due W. with an angle of  $45^{\circ}$ , and vertical joints striking S. W.—N. E. It is succeeded by a coarse trap, a sort of trachyte showing a certain amount of crystallization, the rock having a granitoid or rather gneissoid appearance. The augite and the glassy felspar are the only minerals tolerably crystalline, the remainder being a paste which is sometimes nearly white, or yellow and rough; sometimes greenish-grey and conchoidal in fracture, or blue, indigo-blue and

French grey. There is much in these strata to remind one of the starry trachyte or Soolimanite of the Tukt-i-Suliman, but the starry arrangement of elongated crystals of albite is never perfectly seen.

A layer of amygdaloid covers in the trachyte.

From Pandrettan to Panchhooka, we have been examining the beds of the southern spur of the Zebanwan. The W. N. W. spur may be considered to end or rather to begin over Pandrettan, and from thence eastwards we cross the digitations of the southern spur. A glance at the horizontal section (Map B) will render any further explanation unnecessary.

Here ends our section through Hurri Parbut, the Tukt-i-Suliman and the W. N. W. portion of the Zebanwan.

21. We will now examine the south-south-eastern flank of the Zebanwan, following a section from near Panchhooka towards the E. N. E. (See Map B.) (Section III. of General Map or Map A.)

We meet first a long slender spur proceeding from the main range of the Zebanwan to the S. S. E., and as this spur is very interesting, I have called it the Zeeawan spur from the name of a village situated close to its extremity. (Sect. A, B and C.).

\* The Zeeawan spur is composed, high up the hill, of the same basalt, amygdaloid and greenstone which we have seen in the preceding spur, but towards its end it is made up of enormously thick beds of volcanic agglomerate. This agglomerate is composed of a cement having the shining appearance of a slag, but not in its vesicular arrangement. It contains lapilli of nearly all the rocks which we have seen before, viz. greenstone, basalt, amygdaloid, slate of various sorts, and pieces of both felspathic and augitic ash. These lapilli are quite angular and crammed together so close that in some places the cement can hardly be seen. This cement appears to have at first coated the fragments with a thin layer of a dark shining paste, and then glued them together with a coarser material; or it is very possible that this coating is a superficial melting of the lapilli, and that the cement is a lava. However this may be, this agglomerate forms the greater portion of the spur. A confused stratification is discernible, dipping to the E. S. E. at a higher angle, and cut at right angles by well marked joints; thus huge blocks are separated from the mass and

strew the ground at the foot of the spur. Towards its end, the spur bifurcates into two digitations, the most westerly being entirely made up of agglomerate, whilst the most easterly presents the following section:—

Section of the end of the Zeeawan spur above the village of Zeeawan. (See Sections B. and C.)

1. Volcanic agglomerate with a shining, dark, semi-vitreous cement. It is interstratified with bands of amygdaloid and thin layers of peperino. 15 ft.
2. Quartzite, white, opaque, stratified; it breaks into cuboid fragments, owing to numerous well-marked joints. It is sometimes yellowish, but usually quite white. It is a conspicuous layer and deserves to be remembered, as it always occurs between the volcanic rocks and the beds of limestone to be hereafter described.\* 15 ft.
3. Compact basalt, of a dark colour and breaking in prismatic pieces. It is often scoriaceous on the surface of layers..... 20 ft.
4. Compact amygdaloidal greenstone. .... 3 ft.
5. Greyish-blue basalt; heavy; much fissured. .... 5 ft.
6. Coarse yellow sand, with numerous water-worn pebbles of the basalt No. 5 imbedded in the sand. The pebbles are lenticular in shape, such as are seen on the shores of lakes and sluggish rivers, and unlike those rounded by torrents. .... 6 ft.
7. Sandstone, grey and bluish, but weathering to a fawn-colour. It contains a few water-worn pebbles similar to those seen in the preceding layer. 3 ft.
8. Slate, greyish-blue; fissured and foliated. .... 5 ft.
9. Sandstone of rolled grains of quartz. .... 3 ft.
10. Slate, as before. .... 3 ft.
11. Compact and dark rock, much jointed and breaking in flat square pieces. Either a baked clay or a laterite. It is all broken to pieces on the surface of the bed. .... 5 ft.
12. A conglomerate of water-worn pebbles of trap united by a calcareous cement. The pebbles are not lenticular, but rounded..... 2 ft.
13. Dark shales containing débris of fossils not determinable. ... 10 ft.
14. Limestone; dark greyish-blue; coarsely crystalline; in places very impure, argillaceous and shaly. It is a mass of fossils. .... 5 ft.

\* Having now reached the fossiliferous strata, I shall not, in charity to the reader, give the section of the spurs of the Tukt-i-Suliman and Zeeawan which face the little lake or *Dal*. But the map (see Map B) will enable any one wishing to know the geology of these spurs, to satisfy his curiosity. I have indeed to apologize for the minuteness of the section of the Tukt-i-Suliman, &c. But in a country new to the geologist, a section, I think, cannot be too minutely detailed.

15. Dark brown calcareo-ferruginous shales, exfoliating in thin plates and undergoing quick decay. It weathers nearly black. Extremely rich in fossils. .... 10 ft.
16. Limestone. .... 10 ft.
17. Dark brown calcareo-ferruginous shale..... 15 ft.
18. Limestone. .... 10 ft.
19. Sandy shales, very dark nearly black; do not effervesce with acids; very rich in fossils. .... 10 ft.
20. Limestone; less coarse than preceding; very fossiliferous. . 15 ft.
21. Limestone; hard and arenaceous; separated by thin layers of shale which weather dark brown and appear in relief on the section of the bed.... 5 ft.
- Any further bed which may exist is concealed under Eboulis.

22. When I first met with this bed of limestone, I was particularly delighted, as I had seen no limestone in Kashmir, except the huge carved blocks of the Buddhist ruins near Srinagar and at Pandrettan. I was told that the fine bluish-grey limestone of these ruins was no longer to be found in the country, and that nobody could guess whence the stone had been obtained. Even some of the Surveyors of the Kashmir Series, G. T. S. corroborated this opinion, which appears to be the received one amongst the natives. I could see at a glance that here I had the very stone, and in examining the bed I came across the remains of an old quarry. I subsequently found some much larger Buddhist quarries of limestone, as we shall see by and bye.

Misled by Mr. Vigne and Dr. A. Fleming, who, as I have said, stated that they obtained nummulites from the Kashmir valley, I began to look diligently for these foraminifers. I found indeed a few rounded bodies which might be taken either for nummulites or rings of crinoid stems. I did not at first hit on a very good portion of the bed for fossils; those I found were extremely weathered, and I could only pay flying visits to Zeeawan. But I tried once more to discover nummulites, when lo! I came across a *Productus*! The following genera were found to be abundant: *Productus*, *Athyris*, *Orthis*, *Strophomena* or *Leptæna*, and *Spirifers* amongst the *Brachiopods*. Very few *lamellibranchiates* and *gasteropods* were seen, but an immense number of *Bryozoa*, especially two or three genera of *Fenestellides*—viz. *Acanthocladia* and *Fenestella* and

innumerable individuals of what has been called *Vincularia multangularis* (Portlock), but which some say is not a *Vincularia* at all. Some of the fossils are familiar to every body: the *Productus semi-reticulatus* (Martin), *P. costatus* (Sow.), the *Athyris Roissyi* (L'Eveillé). Other fossils are interesting on account of their rarity, and first amongst these is the claw of a crustacean, the pincers of which are two and a half inches in length. Though the pincers are neither toothed internally nor flattened into organs of natation, we may, I think, refer the fossil provisionally to the genus *Eurypterus*, if it is not even a true *Limulus*. (See Pl. V. fig. 4.)

23. We have therefore, resting on the volcanic rocks, beds of carboniferous limestone. These beds are of great thickness, and they change their characters very considerably as we follow them upwards. I have divided them into three great divisions, and I have called these by the names of the localities where they were found to be well developed. The lowest bed, which we have just seen, I have called the Zeeawan bed, from the village of Zeeawan. The next above will be called the Weean bed, from the village of Weean near which it is well developed; and the uppermost division I have named the Kothair bed,\* from the name of a small district at the foot of the mountains where this upper bed is well seen. I have preferred adopting these names to the plan of using the designations of Lower, Middle and Upper, as further observations may render it desirable to sub-divide any division into two or more sections, in which case the terms lower, middle and upper would become inconvenient. In the present state of our knowledge of the geology of Kashmir and the N. W. Punjab, we may nevertheless remember with advantage, that the Zeeawan is the lowest, the Weean the middle, and the Kothair the upper bed of the mountain limestone.

24. To come back to our section near Zeeawan: we must first notice the inwrapping disposition of the beds around the end of the spur. The general strike of the volcanic rocks is N. N. E.—S. S. W.

\* So few fossils were found in the Kothair bed, that it is not possible to place it, with any certainty, in the carboniferous; the same reason prevents its being placed in the Permian or Triassic. The place of this bed as the uppermost carboniferous is therefore only temporary. See the remark after the list of fossils found in the Kothair bed, Chapter II., para. 50.

and the dip E. S. E. High up the spur, this dip forms a considerable angle with the horizon, but it diminishes gradually as we descend towards the plain; at the bed of quartzite it is about  $45^{\circ}$ , and at the limestone it is generally  $40^{\circ}$ . But these rocks, that is from the quartzite upwards, appear to have been upheaved by a narrow band of hard rock catching them in the centre and pressing them upwards in that central point, whilst the sides of the beds were unsupported. Instead of yielding softly and shaping themselves into a carapace-like coating, as slate and ash would have done, the limestone and the shales have separated into thick bands or slices, and these bands have spread themselves out like a fan. At the small end of the fan there has been a considerable crushing of the beds one against the other, and enormous blocks, indeed whole pieces, of the limestone courses have been squeezed out of place; whilst, at the circumference of the fan, the beds have been parted from one another, and in some places we can see the layers of limestone separated by open intervals two or three feet wide. (See horizontal section, Sec. C.)

25. I will now try to define the character of the Zeeawan bed of carboniferous limestone:—Its lithological characters are, that it is a rough, coarse and semicrystalline limestone of a dark bluish-grey colour, weathering a rich grey. If we break it, we find it made of innumerable irregular grains of a darker limestone united by a lighter cement more or less crystalline. It is full of debris of fossils; indeed I am not quite sure that the darker grains are not the debris of the organisms or excrements of animals. It is foetid. Portions of it are arenaceous or rather shaly, and these, when exposed to the air, decompose partially, becoming soft and crumbling. The stone is soft to work and cuts with great ease, except where there are too many large fossils. It contains an immense number of minute crinoid-stems converted into spar: it breaks obliquely to the surface and gives flashes of light at certain angles. It is interstratified with courses of rich-brown calcareous shale, often of a bright rust-colour, and generally much decomposed and with bands of a black, not calcareous, sandy shale: it is also full of fossils, these being apparently converted into oxide of iron. Finally, it contains limited short lenticular layers of a much paler limestone, in thin-bedded and false-bedded patches having somewhat the appearance of a fine mortar or cement.

The characteristic fossils of the bed are the following:—

- Productus Costatus* (Sowerby).  
 „ *Semireticulatus* (Martin).  
 „ *Cora* (D'Orbigny).  
 „ *Humboldtii* (D'Orbigny).  
 „ { *Flemingii* (D'Orbigny).  
 „ { *Longispinus* (Verneuil).  
*Athyris*, Sp. ——— Pl. II. fig. 1 & 1a. *A. Subtilita* (Hall)?  
 „ *Roissyi*? (Verneuil) Pl. II. fig. 3 & 3a.  
 „ Sp. Nora (*A. Buddista*, Verchère) Pl. II. 2, 2a 2b.  
*Spirifer* (*Sp. Verchèrii* (Verneuil) Pl. I. fig. 1, 1a & 1b.  
*Spiriferina octoplicata*? ——— Sowerby, Pl. I. fig. 2, &c.  
*Orthis Crenistria*, Phill. ———  
*Strophomena Analoga*, Phill.? Pl. II. fig. 4.  
*Fenestella Sykesii* (Koninck).  
 „ *Megastoma* (Koninck).  
 „ Sp. ——— Pl. V. fig. 1.  
*Vincularia Multangularis* (Portl.)  
*Acanthocladia*, Sp. ——— Pl. V. fig. 4.

We shall have therefore no difficulty in identifying this bed wherever we meet it, as the Bryozoa make a great show and immediately attract attention. The coarse granular limestone is unlike that of the other beds we shall see hereafter; the rich brown shales are also peculiar to the Zeeawan bed, and even the position close over the glaring white quartzite would assist us, if necessary.

*Contributions to Indian Malacology, No. VII. List of species of Unio and Anodonta described as occurring in India, Ceylon and Burma.*—By WILLIAM T. BLANFORD, A. R. S. M., F. G. S.

[Received 5th September, 1866.]

There are few genera in the whole range of natural history more puzzling than *Unio* and *Anodonta*. Every naturalist who has attended to them has been struck by the great variation of which the different species are susceptible, though it is to be regretted that this knowledge does not appear to have had much influence in restraining some naturalists from recording as distinct species isolated specimens which reached them from distant countries, and which only differed from other specimens in characters of very doubtful specific value.

Although the *Unionidæ* of the Indian waters are far behind those of some countries, and especially of America, in the amount of variation which they exhibit, amply sufficient is shewn to render them very difficult to classify. And as the question of variation is one of the most important, especially at the present day, in the whole range of zoological science, those animals which, in the wild state, exhibit the greatest amount of variation, are peculiarly worthy of study.

In endeavouring to classify the Indian shells, one great difficulty that I have found, has been the determination of described types. Descriptions of Indian *Unionidæ* are scattered through many works, not easily procurable in India. There are, probably, yet a few to which I have not had access, but as I have been able to compile a list, comprising, I believe, a very large majority of the published forms, I think that I shall be aiding any one who, in India, may be engaged in the same study, by printing the list, with references to the original descriptions and to figures, whenever such exist, and by adding such remarks as appear to be necessary.

I also hope to be able to publish figures of a considerable proportion of the species named; in some cases, copies of the original illustrations; in others, drawings of authentic specimens. I shall feel greatly indebted to any one who will aid me in this endeavour by furnishing me with typical forms, or with any specimens from distant parts of the country. In all such cases, a small series of the varieties and different ages is desirable.

The present list, therefore, is merely an instalment of what I hope may be an illustrated monograph of Indian *Unionidæ*.

It is not my intention at present to enter at all fully into the question of the limitation of specific forms. I would merely point out, that some of the described species are certainly within the ordinary limits of variation of others described as distinct. Thus out of one tank in Calcutta, I have taken specimens unquestionably belonging to *U. Corrianus*, Lea, others which were nearer to *U. lamellatus*, Lea, and young specimens representing *U. bilineatus*, Lea, whilst other forms again appeared to appertain to *U. anodontina*, Lam., (or, at least to the species figured as such in Küster's monograph) which by Lea is classed as a variety of *U. marginalis*, Lam. Yet all these forms were unquestionably identical, being united by numerous intermediate varieties, all living together in the same small pond.

Lea's figures in the Journal of the American Philosophical Society, and the Transactions of the Academy of Natural Sciences of Philadelphia, are so good and characteristic, that the difficulties which might otherwise exist in identifying forms discriminated by such minute and variable characters are obviated. Benson's species, of which only descriptions exist, are far more difficult to identify, and Gould's, which are but briefly described, still more so. Küster's monograph, in Martini and Chemnitz's Conchylien Cabinet, contains figures of but few Indian and Burmese Unios, and of those, several are incorrectly named.

For convenience sake, the species of *Unio* inhabiting India proper, Ceylon, Assam, and Burma will be separately enumerated. The species referred to *Anodonta* are so few that subdivision is unnecessary, especially as none occur in India or Ceylon. No typical form of the genus is known to exist in the Indian or Burmese area.

The following works are referred to in the ensuing pages by the abbreviations appended in each case.

*Müll.*—O. F. Müller, *Historia Vermium*, 1774 (not procurable in Calcutta).

*Chemn. Conch. Cab.*—Martini and Chemnitz *systematisches Conchylien Cabinet*. About 1780? (not procurable in Calcutta).

*Gmel.*—Caroli a Linne *Systemata naturæ*. Tom. I, Pars. VI, 1789.

*Lam.*—Lamarck, *Histoire des Animaux sans vertèbres*, Vol. VI. 1819.

*Gleanings in Science*, Vol. I., Calcutta, 1829.

*Küster, Mart. and Chem.*—Systematisches Conchylien Cabinet von Martini und Chemnitz, 2nd edition, by Dr. H. C. Küster and others. Vol. IX. Part 2, commencing in 1843 : unfinished.

*Ann. and Mag. Nat. Hist.*—The Annals and Magazine of Natural History, London, 3rd series, Vol. X. 1862.

*Trans. Am. Phil. Soc.*—Transactions of the American Philosophical Society held at Philadelphia, new series, Vol. IV. 1834 ; Vol. V. 1837 ; Vol. VI. 1839 ; Vol. VIII. 1843.

*Jour. Acad. Nat. Sci. Phil.*—Journal of the Academy of Natural Sciences of Philadelphia, Vol. IV. 1858-60 ; Vol. V. 1862-63.

*J. A. S. B.*—Journal of the Asiatic Society of Bengal, Vol. III. 1834 ; Vol. IV. 1835 ; Vol. V. 1836.

*Proc. Bost. Soc. Nat. Hist.*—Proceedings of the Boston Society of Natural History, Vol. I. 1843-44, (not accessible in Calcutta).

*Gould, Ot. Conch.*—Augustus A. Gould, Otia Conchologica, descriptions of shells and mollusks from 1839 to 1862, Boston, 1862.

*S. Hanley, Supp. to Wood's Ind. Test.*—Supplement to Wood's Index testaceologicus, 1855 (not accessible in Calcutta).

*Genus UNIO, Retzius.*

I.—INDIA.

No. 1.—UNIO CORRUGATUS, Müll. sp. Rivers of Coromandel.

*Mya corrugata*, Müll., p. 214, No. 398.

*Unio corrugata*, [a.] Lam., VI., 78, No. 34.

*U. corrugatus*, Küster, Mart. and Chem., p. 289, pl. 97, figs. 3, 4.

There is the greatest conceivable confusion about this species and the next one, and it is far from clear what Müller's type was. I cannot obtain access to his work in Calcutta, but Küster copies the description thus :—

*Testa rhombea, viridescens, tenera, pellucida ; (umbonibus corrugatis ; ) valvulæ intus striis radiantibus subtilissimis notantur.*

The figures are, I suppose, those of Chemnitz's types ; they are two in number, one representing the exterior of a subequilateral, nearly elliptical shell, measuring 36 mm. by 24 in its two diameters, and the other the interior of a far more inequilateral shell, also subelliptical, rather smaller than the first, and having every appearance of being a

thick form, with strong lateral teeth. The first shell is subalate posteriorly, and the posterior margin is very bluntly biangulate, the anterior margin is rounded at the end, but the slope thence to the umbo is almost a right line; the second shell is perfectly rounded both before and behind. The shell of which the interior is figured corresponds so ill with Müller's description, being neither rhombic nor thin, that it may certainly be neglected. The figure moreover is ill-executed.

Lamarck's description is a little different from Müller's: "*Unio testá ovato-rhombeá, tenui, viridi, umbonibus rugosis, rugis undulato-flexuosis sublongitudinalibus.* Of the variety *a* he adds *testa viridis, pubis cariná lævigatá.* His variety *b* is said to be the next species, *U. rugosus.*

The type shell in Mons. de la Serre's cabinet in Paris, which, by the politeness of M. Chenu, the Curator, I was enabled to examine in 1862, is a thin broadly ovate form with small teeth, and a well marked posterior wing. It measures 40 mm. from anterior to posterior margin, and 33 from the umbo to the ventral margin, the latter diameter being thus much greater in proportion to the former than in Küster's type. The valves are inequilateral and much broader behind than before, the anterior margin rounded, sloping away below to the ventral side; posterior margin bluntly biangulate, the two angles rather wide apart. The form is common in Southern India and Ceylon, and appears to have been generally accepted as the type.

Both Lamarck's and Chemnitz's types are quite distinct from Benson's *U. favidens*, which has been confounded with them.

No. 2.—*UNIO RUGOSUS*, Gmelin. Rivers of Coromandel.

*Mya corrugata magna*, Chemn. Conch. Cab. X. 346, Pl. 170, f. 1659.

*M. rugosa*, Gmel. p. 3222, No. 32.

*Unio corrugata*, [b.], Lam. VI., 78, No. 34.

*Unio rugosus*, Küster, Mart. and Chem. p. 290, Pl. 97, f. 5.

Both this and the preceding species probably inhabit the Cauvery or neighbouring streams. Küster's figure represents an elliptical sub-equilateral shell, with strong angulate sulcation at the umbones, extending to within no great distance of the ventral margin. Gmelin's original description is the following:—

*M. testá ovali rugosá, extrinsecus virescente, intus margaritaceá : cardinis dente primario crenulato, laterali longitudinali, alterius duplicato.*

No. 3.—UNIO MARGINALIS, Lam. Bengal.

Lam. VI. 79, No. 41.

Küster, Mart. and Chem. p. 239, Pl. 80, f. 4.

This species is probably the most widely distributed of all the Indian forms. It is extremely variable, and I am inclined to believe that many of the species to be hereafter enumerated are merely varieties of it. I have examined the type and compared a shell from Pegu with it, which will be figured. It agrees very well. Küster's figure represents a variety with unusually prominent umbones, and rather longer from the hinge to the ventral margin than usual.

*U. marginalis* is by no means confined to India. It abounds, as I have already mentioned, in Pegu. One of Lamarck's forms came from Ceylon, and Küster appears much disposed to unite to it a species from the Nile in Egypt. Lamarck's type was said to inhabit rice-fields in Bengal.

No. 4.—UNIO ANODONTINUS, Lam. Bengal.

*U. anodontina*, Lam. VI. 80, No. 47.

*U. anodontinus*, Küster, Mart. and Chemn. p. 240, Pl. 80, f. 5.

Lea has classed this shell as identical with *U. marginalis*, Lam. If Küster's figures in the Conchylien Cabinet can be trusted, the two shells differ more than any one of Lea's three species, *bilineatus*, *lamellatus*, and *Bengalensis* do from each other, or from *marginalis*. Most of the Bengal specimens of *marginalis*, however, are intermediate between the two forms figured by Küster as *marginalis* and *anodontinus*.

The locality given by Lamarck for this species is Virginia. I unfortunately omitted to examine the specimen when I had the opportunity of doing so. There is, I believe, no question but that the shell was really from India.

No. 5.—UNIO FAVIDENS, Bens. Ganges valley and Burhampooter valley, Assam.

Benson, Gleanings in Science, I, Pl. 8, f. 1.

„ Ann. Mag. Nat. Hist. 1862, 3rd Ser. X. 188.

This species has been frequently confounded with *U. corrugatus*,

Lam. It differs totally from all the shells referred to that species, and all its numerous varieties are easily distinguished both from Lamarck's and Chemnitz's types of *corrugatus*. *U. favidens* is more inequilateral, it is a thicker shell with much stronger and broader cardinal teeth. The type, too, is more angulate, both anteriorly and posteriorly. The following varieties of *U. favidens*, with their localities, are described by Mr. Benson in the Ann. and Mag. Nat. Hist. Vol. X, pp. 188, 189.

*Unio favidens*, type. Bhitoura on the Ganges between Cawnpore and Allahabad.

- 1 var. *marcens*,.....Burhampooter river, Assam.
- 2 ,, *trigona*, .....Nujeeabad in the north-west of Rohilkund.
- 3 ,, *Deltæ*, ..... Jellinghy river, Bengal.
- 4 ,, *Chrysis*, ... ..Dojora river, Kareily Ghat near Bareilly.
- 5 ,, *viridula*, .....“Jheel” between Humeerpore and Someerpore, Bundelkund.
- 6 ,, *densa*, .....Ganges river above Chunar.

No. 6.—UNIO CÆRULEUS, Lea.—Hoogly river, 100 miles above Calcutta.

Lea, Trans. Am. Phil. Soc. IV, 95, Pl. 13, f. 25.

Benson, J. A. S. B. IV. 450.

Küster, Mart. and Chem. p. 228, Pl. 77, fig. 4.

The two figures agree perfectly. The type is a very thin shell, with fine lamellar teeth. Specimens exist in the Asiatic Society's Museum, brought from Bhagulpoor. The form is widely distributed in N. India; I have even a variety from Sind.

No. 7.—UNIO BILINEATUS, Lea. Hoogly river with the last.

Symphonota bilineata, Lea, Trans. Am. Phil. Soc., IV, 98, pl. 11, f. 19.

„ Benson, J. A. S. B. IV. 452.

Benson, (Ann. Mag. Nat. Hist. Ser. 3, Vol. X., pp. 187, 195) shews that this is merely the very young form of *U. marginalis*, Lam. He is unquestionably correct. The “two delicate lines passing from the beaks to the posterior region” are, like many other umbonal markings, characteristic of young shells, and disappear gradually with age. The remains of them, much blunted, are often to be detected on adults.

## No. 8.—UNIO OLIVARIUS, Lea. Ganges valley.

Lea, Trans. Ann. Phil. Soc. IV, 108, pl. 16, f. 38.

Benson, J. A. S. B. IV. 453.

Küster, Mart. and Chem., p. 244, pl. 82, f. 2.

The locality given by Lea is Burrill river, India. Küster, who appears to be indebted for all his Indian species described by Lea to Dr. von dem Busch, gives Burrill river, Indiana (!), North America, as the locality. Mr. Benson says—"It is widely distributed in the Gangetic region, and is most abundant in the Rohilkund streams." The variety figured by Küster differs from Lea's type in being more inequilateral, much shorter anteriorly, and more obtuse posteriorly, and of a light green colour instead of pale olive. Indeed, it is by no means clear that the specimen figured is not a variety of *U. cæruleus*. I do not know if there be such a river as the Burrill, but the locality for the original type is very probably the neighbourhood of the Burail Range, north of Cachar, as the shell was received by Lea from a Dr. Burrough who collected extensively in Assam, and who supplied the original specimens, from which *Hylobates Hoolock* was described, to Dr. Harland.\* This is not far from the localities whence the closely allied *U. Nuttallianus*, Lea, and *U. involutus*, Benson, were obtained.

## No. 9.—UNIO CORRIANUS, Lea. Calcutta.

Lea, Trans. Am. Phil. Soc. V. 65, pl. 9, fig. 25.

Küster, Mart. and Chem., p. 229, pl. 77, fig. 5.

Two completely distinct shells are figured by the two authorities above referred to. Lea's original type is a young form of one of the common varieties of *marginalis*, approaching *U. anodontina* of Lamarck; Küster's, on the contrary, is a form allied to *U. cæruleus*, but thicker, and with broader hinge teeth than that species, so that it is more diverse from *U. marginalis* than even *cæruleus* is! Küster's specimen was derived from Dr. von dem Busch, who, in this and other instances, appears to have utterly confounded different forms.

\* See Transactions of the American Philosophical Society, Vol. IV. p 52. It is a disgrace to the science of England as represented in British India, and a lasting memorial of the disregard of natural history which has always been a characteristic of the British Government of India, that so remarkable an animal as the Hoolock should have been first recognised by an American naturalist at so late a date as 1834. Had India belonged to France, the United States or Russia, the study of its fauna would not have been left to the unaided efforts of private individuals.

No. 10.—*UNIO BENGALENSIS*, Lea. Bengal.

Lea, Trans. Am. Phil. Soc. VI. 3, pl. 2, f. 3.

Küster, Mart. and Chem., p. 228, pl. 77, f. 2, 3.

In this case again, two totally distinct shells are figured, and again the authority for Küster's appears to be Dr. von dem Busch, whose collection furnished the specimen figured in Martini and Chemnitz. Lea's type is a very peculiar variety of *U. marginalis*, very much "longer" (that is wider when measured from the umbones to the ventral margin) in proportion to the breadth than usual. I have not met with it. It was obtained by Lea from Dr. Burrough who purchased it in Calcutta, and believed that it inhabited the Ganges. It has better claims to distinction than most of Lea's "species."\*

Küster's type is a much thicker, more tumid shell, with far stronger teeth and impressed cicatrices, much more inequivalve and different in almost every character. I cannot recognise it as any form with which I am acquainted, and I much doubt its being Indian at all. At all events it is nearer to *U. corrugatus* than to *U. marginalis*.

No. 11.—*UNIO LAMELLATUS*, Lea. Bengal.

Lea, Trans. Am. Phil. Soc. VI. 19, pl. 6, f. 16.

This is another variety of the *U. marginalis* type, perfectly intermediate between the two last named, and approaching the type more nearly than either. Lea's shells were probably immature. In the younger shells of *marginalis*, the hinge teeth are more lamellar than in the adults, and the principal character of this "species" and of the two preceding is the lamellar teeth.

I have not met with the exact type of this shell, but it doubtless inhabits the neighbourhood of Calcutta. Specimens resembling it in every way except in being rather less long (in the dorso-ventral diameter) in proportion to their breadth are common.

No. 12.—*UNIO RAJAHENSIS*, Lea. Rajah's Tank, Calcutta.

Lea, Trans. Am. Phil. Soc. VIII., 239, pl. 23, fig. 53.

The above is the locality quoted. I am unable to discover what

\* In a letter to my brother, Mr. Benson suggested a doubt as to whether this species were Indian. Taking into consideration the circumstance that nearly all the shells in the Calcutta bazar are foreign, this suggestion appears highly probable.

tank is referred to. The shells inhabiting the Seven Tanks shew a considerable difference. The shell is a small, subrotundate, thick form, approaching some of the varieties of *U. favidens*, Bens., and has much the appearance of being stunted and distorted, a very common occurrence in tanks, and especially in those of Calcutta, probably in consequence of their being slightly brackish at times. Two specimens, agreeing well with Lea's figures, exist in the Asiatic Society's Museum. A very similar shell inhabits the Nerbudda.

No. 13.—*UNIO SHURTLEFFIANUS*, Lea. Sina River, India.

Lea, Jour. Acad. Nat. Sci. Phil. III., 302, pl. 27, f. 17.

The Sina river runs past Ahmednugger in the Deccan. It is an affluent of the Bheema, one of the principal feeders of the Kistna. This shell has somewhat the form of *Unio cœruleus*, but is thicker. Unfortunately the volume containing the description of this shell does not appear to exist in Calcutta, so I cannot tell whether specimens, which I possess from the neighbourhood, belong to the type form or not. In such extremely variable shells as *Unio* this is a matter of considerable importance.

No. 14.—*UNIO MERODABENSIS* v. d. Busch, Province of Merodab in Bengal. (!)

v. d. Busch. MS. in Küster, Mart. and Chem., p. 233, pl. 78, fig. 4.

I give the locality of this ridiculously named species as it is quoted in Küster. The locality is doubtless Moradabad in Rohilcund. Küster gives as a synonym ? *U. flavus*, Benson, and adds the remark: "Whether this species be Benson's described *U. flavus*, I cannot ascertain, as I have not access to Benson's work. The name would be ill-selected, as the shell is by no means yellow."

Of course Benson's species thus referred to is *U. favidens*, of which the present appears to be a variety, very close to Mr. Benson's *var. trigona*. The name *Merodabensis* is so utter a barbarism, that it will be satisfactory to be rid of it. For the little series of blunders attending the description of this type, Dr. v. d. Busch again appears to be responsible.

No. 15.—*UNIO SIKKIMENSIS*, Lea. Sikkim.

Lea, Jour. Acad. Nat. Sci. Phil. 2nd Ser. IV. 251, pl. 39, f. 131.

I have some doubt about the locality assigned to this species. It

approaches the S. Indian forms of the *corrugatus* type (Lamarck's) in outline, and is barely distinguishable from two shells in the Asiatic Society's collection, which are labelled from Ceylon. It is a stouter shell than the Lamarckian *corrugatus*.\*

No. 16.—UNIO NAGPOORENSIS, Lea. Ambajiri tank, Nagpoor.

Lea, Jour. Acad. Nat. Sci. Phil. Ser. 2, IV. 270, pl. 45, f. 150.

This species is barely separable from some varieties of *Unio favidens*, Bs. It is, however, a rounder, thinner shell, forming a link, both in character and locality, between that species and *Unio corrugatus*.

No. 17.—UNIO WYNEGUNGAENSIS, Lea. Wynegunga river, east of Nagpoor.

Lea, Jour. Acad. Nat. Sci. Phil. 2nd Ser. IV, 271, pl. 45, f. 151.

Except in greater thickness, and stouter hinge teeth, there appears no distinction of the slightest importance between this "species" and the last. The type abounds in the Godavery and its feeders, and is, as usual, variable. The locality given by Lea is Wynegunga river, East of Nagpoor in the Deccan, Bengal, which is equivalent to talking of Philadelphia in New England, Virginia. However it is hardly fair to expect American naturalists to have accurate information on Indian geography, when an English naturalist of repute confounds the Khasi hills in N. E. India with the Nilgiris in the S. W., and when a second, in a work solely devoted to Indian zoology, perhaps the most important work on any branch of Indian Natural History, exclusive of botany, ever published in England, confounds Saharunpoor with Serampoor on the Hooghly. After this, the discovery made by the *Times* newspaper, a few years ago, that a spur of the Himalayas is visible from Calcutta is not so surprising. A distinguished French naturalist, five or six years since, placed Kattiarwar in Cochin China, but it is only fair to add that this was before the French expedition to the latter country, and that French naturalists have already done not a little towards making us better acquainted with the Molluscan fauna of that little known region.

\* Since writing the above, I have learned that the locality is correct. The shell was collected by Dr. Bacon.

No. 18.—UNIO THECA., Bens. River Cane near Banda, Bundelcund. Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 186.

I have not seen this form. It belongs, according to Mr. Benson, to the *Corrianus* type of *Unio marginalis*.

No. 19.—UNIO MACILENTUS, Bens. Choia Nuddy, near Bijnore, Rohilcund.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 187.

A rather thin species resembling *cæruleus*, but with stout hinge teeth, resembling those of *U. favidens*. I am unacquainted with the type, but a very similar form is common in the Damuda and its tributaries in Bengal.

No. 20.—UNIO TRIEMBOLUS, Bens. R. Ramgunga, near Moradabad. Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 190.

A thick shell with large hinge teeth. A massive species which inhabits the Nerbudda, and the shells of which are found fossil associated with the bones of extinct mammalia in the gravels of the river valley, may be a variety of this species. I have never seen the type.

No. 21.—UNIO PLAGIOSOMA, Bens. River Cane near Banda, Bundelcund.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 191.

No. 22.—UNIO LÆVIROSTRIS, Bens. Near Chunar, in streams and tanks.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 191.

No. 23.—UNIO PINAX, Bens. Gungun stream, near Moradabad, Rohilcund.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 192.

The three abovenamed species appear all to be allies of *U. favidens*. They probably pass into each other.

No. 24.—UNIO LEIOMA, Bens. Deccan? near Bombay.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X. 192.

The locality of this shell is uncertain. I have no species from Western India which agrees with the description.

No. 25.—*UNIO OCCATUS*, Lea. Bengal.

Lea, Jour. Acad. Nat. Sci. Phil. 2nd Ser. V. 398, Pl. 50, fig. 304.

A compressed form, with strong teeth, fairly intermediate between *cæruleus* and *favidens*, and allied to *U. macilentus*, Bs. and *U. plagiosoma*, Bs. but more compressed than either. It especially requires comparison with *U. macilentus*, of which it may be a compressed form.

No. 26.—*UNIO GERBIDONI*, Eydoux. Coromandel.

Said by Lea to be the same as *Unio cæruleus*.

No. 27.—*UNIO BONNEAUDI*, Eyd. South India.

No. 28.—*UNIO GAUDICHAUDI*, Eyd. Bengal.

No. 29.—*UNIO KERAUDRENI*, Eyd. Chandernagore.

I am indebted for all my information as to the above four species to Mr. Benson. I have not access at present to the work in which they are described.

In Küster's monograph of *Unio* in Martini and Chemnitz another species is described from the "East Indies," *U. Exanthematicus*, Küster, p. 243, pl. 81, fig. 2. The authority, however, for the locality is Dr. v. d. Busch, whose general accuracy, after the instances given above, may be open to doubt; the "East Indies" in a Natural History sense, not many years since, denoted any country between Africa and Kamschatka, and the peculiar pustulated surface of the shell, from which the name is derived, is unknown in any Indian species. I think it is probably not a native of the Indian Peninsula.

*U. discus*, Lea, *Trans. Am. Phil. Soc. IV*, 74, Pl. 18, f. 57, was at first stated to be from India, on, however, palpably insufficient grounds, the original specimen having been purchased from a dealer amongst a lot of shells from India. The shell is so distinct from any known Indian species, that I had concluded that the locality was assigned to it in error, before I found that in a subsequent volume of the *Trans. Am. Phil. Soc.*, Vol. VIII., p. 234, note, Lea mentions his having ascertained that the locality was the River Moctezuma in Central America.

Mr. Benson mentions (*Ann. and Mag. Nat. Hist.* 1862, X., 195,) his having received from the Malabar Coast a shell which he refers to *U. consobrinus*, Lea.

*Unio spuria* is said by Lamarck to be from Southern Asia. Mr. Benson states (Ann. and Mag. Nat. Hist. 1862, X., 189,) that the young of *U. favidens* approaches the figure given by Wood of *Mya spuria*, which is, I suppose, the same species. It is not clear that Lamarck's type was Indian. Mr. Benson also (l. c. p. 189) refers to *Mya radiata*, Chem. as being from Malabar. *Mya radiata*, Gmelin is by Lamarck, Lea and Küster, said to be American, and even in Küster I can find no allusion to Chemnitz's species.

It is only right to add too that some of what Woodward most justly terms "the worthless fabrications of Rafinesque" (Man. Mol. p. 136, note,) came from India. No scientific purpose can be served by recalling the names from the oblivion in which they are happily buried.

## II.—ASSAM.

### No. 30.—UNIO INVOLUTUS, Benson. Assam.

S. Hanley, Supp. to Wood's Ind. Test.

I only know of this and the succeeding three species from reference being made to them by Mr. Benson in the Ann. and Mag. Nat. Hist. for 1862, 3rd Ser. X., 186. The work in which they were originally described is not procurable in Calcutta. *U. involutus* is said to be thin and tumid and to represent *U. olivarius*, Lea, in Assam.

### No. 31.—UNIO CORBIS, Bens. Assam.

S. Hanley, Supp. to Wood's Ind. Test.

### No. 32.—UNIO RADULA, Bens. Assam.

S. Hanley, Supp. to Wood's Ind. Test.

### No. 33.—UNIO SCOBINA, Bens.

S. Hanley, Supp. to Wood's Ind. Test.

*U. fluctiger*, Lea (teste Benson) Jour. Acad. Nat. Sci. Phil. 2nd Ser. IV, 250, pl. 39, f. 130.

„ Küster, Mart. and Chem., p. 237, pl. 80, fig. 1.

Mr. Benson (in Ann. and Mag. Nat. Hist. 1862, X., 186) states that *U. fluctiger*, Lea, is a synonym of *U. Scobina*. Küster's figure of *fluctiger* differs from Lea's type, and the shell is stated to be from S. America. As, however, Küster's specimen was from Dr. v. d. Busch's cabinet, very little reliance can be placed upon the assigned locality, especially as Lea, who did not know whence the shell came, suggested that it was, possibly, South American.

Küster's type is narrower anteriorly and has rather different, coarser plication posteriorly, than Lea's. It may be a different shell.

No. 34.—UNIO NUTTALLIANUS, Lea. Assam, teste Benson.

Lea, Jour. Acad. Nat. Sci. Phil. III., 310, pl. 30, f. 25.

The locality is simply stated to be India by Lea. Benson, Ann. and Mag. Nat. Hist. 1862, X, 194, states that he has received specimens from Assam. The volume containing the description of this shell is not procurable in Calcutta.

No. 35.—UNIO JENKINSIANUS, Bens. Burhampooter River, Assam.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X., 185.

An ally of *U. marginalis*, distinguished by "the very tumid form, the sloping posterior end, absence of a wing, the short ligament, and the nature and position of the teeth." (Bens. l. c.) In the Asiatic Society's collection there is a shell from Bhagulpoor perhaps referable as a variety to this species.

No. 36.—UNIO PACHYSOMA, Bens. Burhampooter River, Assam.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X., 186.

"An inflated form of the *cæruleus* type." (Bens. l. c.) Mr. Benson also states that he has received a distorted variety from Calcutta. A peculiar tumid form which is not uncommon in Calcutta tanks is doubtless referred to. It agrees generally with the description given. This form therefore adds one more to the Bengal list.

No. 37.—UNIO SMARAGDITES, Bens. Burhampooter River, Assam.

Benson, Ann. and Mag. Nat. Hist. 1862, 3rd Ser. X., 190.

A shell allied to *U. favidens*.

Besides these forms a variety of *U. favidens*, Bens. (*var. marcens*) has already been quoted as occurring in Assam. Mr. Benson also records the receipt of a variety of *U. cæruleus* (J. A. S. B. VI. 750) and of a small variety of *U. marginalis* (Ann. and Mag. Nat. Hist. 3rd Ser. X. 186) from that region.

### III.—CEYLON.

No. 38.—UNIO LAYARDI, Lea. Ceylon.

Lea, Jour. Acad. Nat. Sci. Phil. 2nd Ser. IV., 243, pl. 36, f. 122.

This is a shell of the *marginalis* type with a convex dorsal margin, and generally rounded outline. It appears to be a fairly distinguishable form, though very close to *Bengalensis* and *lamellatus*.

## No. 39.—UNIO THWAITESII, Lea. Ceylon.

Lea, Jour. Acad. Nat. Sci. Phil. 2nd Ser. IV., 246, pl. 37, f. 125.

This shell only differs from the last in having a rather straighter hinge line, and being slightly more inequilateral. If such differences are to rank as specific, half a dozen "species" might be manufactured out of any tank in Calcutta. The separation of these two forms is perfectly unjustifiable in a genus like *Unio*.

The above are the only species that I can trace specially described from Ceylon. Lamarck's variety *b.* of *Unio marginalis* described as *var. testâ minore, brevior*, and 75 millimetres broad was also from Ceylon (Lam. VI. 79). Sir Emerson Tennent, in his work on Ceylon, enumerates only *U. corrugatus* besides *U. marginalis*. He, however, adds that Mr. Cuming possessed six species from the island, which had been sent to Mr. Lea. *U. Thwaitesii* and *U. Layardi* are doubtless two of these, as they were from Mr. Cuming's cabinet, but no mention is made of the others by Mr. Lea.

## IV.—BURMA.

## No. 40.—UNIO TAVOYENSIS, Gould. Tavoy.

Gould, Proc. Bost. Soc. Nat. Hist. I., 140.

„ Ot. Conch. p. 190.

Küster, Mart. and Chem., p. 166, pl. 48, f. 2.

"Closely allied to *U. corrugata*, Lam. which is less rounded and less corrugated" (Gould, l. c.) More nearly allied to Lamarck's than to Chemnitz's type of *U. corrugatus*. Küster's figure agrees well with Gould's description, but represents a young shell, not mature. The specimen figured was from the collection of Dr. Sturm (and not from that of Dr. v. d. Busch).

## No. 41.—UNIO CRISPATUS, Gould. Tavoy.

*U. crispata*, Gould, Proc. Bost. Soc. Nat. Hist. I., 141.

„ „ Ot. Conch. p. 191.

## No. 42.—UNIO FOLIACEUS, Gould. Tavoy.

*U. foliacea*, Gould, Proc. Bost. Soc. Nat. Hist. I., 141.

„ „ Ot. Conch. p. 191.

An ally (variety?) of *U. marginalis*, Lam. "Closely allied to *U. Bengalensis* and *Corrianus*, Lea." (Gould, l. c.)

No. 43.—*UNIO EXOLESCENS*, Gould. Tavoy.

Gould, Proc. Bost. Soc. Nat. Hist. I., 141.

„ Ot. Conch, p. 191.

Apparently, from the description, another ally or variety of the *U. marginalis* type.

No. 44.—*UNIO GENEROSUS*, Gould. Tavoy.

Gould, Proc. Bost. Soc. Nat. Hist. II., 220.

„ Ot. Conch, p. 201.

I believe I possess this species. Specimens were sent to me by Mr. Theobald from Pegu, which agree with the description fairly, except that they are smaller than the type.

No. 45.—*UNIO LUTEUS*, Lea. Newville, Tavoy.

Lea, Jour. Acad. Nat. Sci. Phil. III., 302, pl. 27, 17.

I have not access to the description or figure of this species.

No. 46.—*UNIO CRISPISULCATUS*, Bens. Bangong R. near Thayet Myo, Pegu.

Benson, Ann. and Mag. Nat. Hist., 1862, 3rd Ser. X., 193.

I am indebted to Mr. Theobald for specimens of this shell. It appears doubtful whether it be more than a variety of *U. crispatus*, Gould, to which Mr. Benson does not refer in his description, and with which he was possibly unacquainted. Gould's description is very brief, and gives the idea of a more coarsely sculptured shell (“*rugis angulatis radiantibus undique crispata*”) besides being somewhat shorter (from the dorsal to the ventral margin) in proportion to its breadth, but these are not necessarily specific distinctions.

No. 47.—*UNIO PUGIO*, Bens. Ava and Pegu.

Benson, Ann. and Mag. Nat. Hist., 1862, 3rd Ser. X., 193.

A solitary valve was sent to Mr. Benson by Mr. Theobald, who gave the locality as Ava. I subsequently found the same form in the Myanong district of Pegu, and Mr. Theobald has since obtained larger varieties, I believe from Prome. It is a well marked type, extremely inequilateral, and with a peculiar acuminate form posteriorly.

As already observed, the type form of *Unio marginalis*, Lam. abounds in Pegu. I found unusually fine specimens in large swamps about Henzada and Myanong in the Irawady valley. The type gradually passes by insensible gradations into a much less transverse

form, almost subquadrate. The posterior portions of the valves were often covered by the remarkable fresh water Bryozoon *Histopia* of Carter, apparently a new species.

I have other species from Pegu, but I am unable at present to compare them with the numerous named forms described by Lea from Siam, many of which probably extend to Burma.

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Genus ANODONTA, Brugiere.

No. 1.—ANODONTA SOLENIFORMIS, Bens. Assam.

Benson. J. A. S. B. V., 750.

The type specimen is in the Asiatic Society's Museum (now the Imperial Museum). There is also an *A. soleniformis*, D'Orbigny, but Mr. Benson's name is the oldest, as it was published in 1836.

Mr. Lea has described a species from Siam, evidently very closely allied to this, as *Mycetopus emarginatus*, Lea. (Jour. Acad. Nat. Sci. Phil. 2nd Ser. V., 398, pl. 50, f. 305). As the animal has not been observed, it may be doubtful if it is really a *Mycetopus*. At the same time the character of both the Siam and Assam shells are so distinct from those of any true Anodonta, that perhaps the best provisional classification is that adopted by Mr. Lea. Specimens of *A. soleniformis* with the animal living are a peculiar desideratum.

No. 2.—ANODONTA SALWENIANA, Gould. Salween R., Burma.

Gould, Proc. Bost. Soc. Nat. Hist. I., 158.

„ Ot. Conch. p. 193.

A very peculiar broad shell, belonging to *Monocondylæa*. (See next species.) I have never seen this form.

No. 3.—ANODONTA INOSULARIS, Gould. Salween R., Burma.

Gould, Proc. Bost. Soc. Nat. Hist. I. 158.

„ Ot. Conch. p. 193.

Subsequently in the same volume, p. 161, Dr. Gould suggested that this species might be the type of a new genus which he named *Pseudodon*. This name is by Adams quoted as a synonym of *Anodonta*, but the type species is not quoted under that genus, nor, so far as I can detect, under any other. In *Otia Conchologica*, Gould, in describing the genus, adds in brackets "perhaps equivalent to *Monocondylæa*, D'Orb." So far as the shell is concerned, this is undoubtedly the

correct position of these species, if the hinge teeth are trustworthy indicators of generic affinity. H. and A. Adams, in the Gen. Rec. Moll., include under *Monocondylæa*, *M. Vondenbuschiana*, Lea, from Java,\* described by Lea as a *Margaritana* (*Baphia* of Adams) and several species of the genus have been described from Siam and Cochin China by French and American naturalists.

I have received from Mr. Theobald fine specimens obtained in Pegu which correspond admirably with *Margaritana Vondenbuschiana*, Lea, and unquestionably belong, I think, to that species; and also shells which appear to belong to a variety of *Anodonta inoscularis*, agreeing with the type in size, shape and every character of importance; and not only are the two forms unmistakably congeneric, but I even think it probable that specimens might be met with to unite them specifically, as they differ in no essential character, except the very different degree of development of the cardinal tooth, which in *Vondenbuschiana* is scarcely raised, while in the specimens which I refer to *inoscularis* it is sometimes nearly a quarter of an inch high.

There are in the Asiatic Society's collection, also, two forms which appear to me certainly varieties of *M. Vondenbuschiana*. One of them, however, agrees more closely with the figure of *M. Cumingii*, Lea (Jour. Acad. Nat. Sci. Phil. 2nd Ser. IV, 235, pl. 33, f. 114) a Malacca shell, which only differs from *Vondenbuschiana* in unimportant minutiae.

*M. Vondenbuschiana* is described and figured by Lea in Trans. Am. Phil. Soc. VIII, 222, pl. 18, f. 39, and also in Küster.

Were there nothing but the form of the hinge teeth to connect the South American species of *Monocondylæa* with the Burmese and Javanese *Pseudodon* and *Margaritana*, especially having regard to the very diverse form of the shell, I should suspect them to be in reality distinct types. But there is one little peculiarity which appears to tend to unite them. At the termination of the portion of the hinge line in which, by close inspection, flattened obsolete representations of the lateral teeth may be seen, there is a very peculiar expansion of the end of the ligament which covers a small sinus in the inner surface of both valves. This is very well shewn in Lea's figure of *Margaritana*

\* Yet they state, "All the species of this genus known are from the rivers of South America."

*Vondenbuschiana*, and also in both Adams's figures of different species of *Monocondylæa* from S. America. The same occurs in *Anodon* and in the type species of *Margaritana* of Schumacher,\* (*M. margaritifera*, L.). I have not had an opportunity of examining the animals of the Burmese species of *Monocondylæa*, and therefore cannot say if the gills are free or not.

Besides the above forms, a minute species of *Anodon* is stated by Mr. Benson to inhabit ponds in Bundelcund, J. A. S. B., V. 750.

P. S. No. 2a.—*UNIO SPURIUS*, Gm. Tranquebar.

*Mya spuria*, Gm. vol. I, Pt. VI, p. 3222, No. 16.

*Unio spuria*, Lam. VI, 80, No. 45.

*Mya spuria*, Wood, Ind. Test. p. 12, pl. 2, No. 35.

Since writing the note on this species at p. 146, I have found that it was described originally as from India. Gmelin refers to Schroeter Einl. in Conch. II, 617, No. 9, pl. 7, f. 5, so perhaps the name may have been given by Schroeter, though that by no means follows from the reference. The description is very brief: "*M. testâ rhombæâ viridi, natibus glabris*" and the shell is said to be like *corrugatus*, but nearly twice the size and perfectly smooth in front of the beaks ("*praeter vulvæ regionem tota glabra*," Gm. l. c.). Wood's figures are all poor. The shell can scarcely be a young form I think, if considerably larger than *corrugatus*.

*Mya radiata*,† I find, is attributed to Malabar by Gmelin, (p. 3220,) from whom Wood appears to have only copied his localities. The species is, I think, correctly attributed to Chemnitz by Mr. Benson, although other authors give Gmelin as their authority. Gmelin's description runs thus—" *M. testa æquivalvi pellucida tenuissime transversim striata viridi flavicante livido radiata; valvis altero latere latissimis, altero angustissimis.*" I know of no form of Indian *Unio* to which this description would be applicable, and I cannot help suspecting that the writers who have applied the name to an American species may very possibly be right. Wood's figure, also, does not recall any Indian

\* It is by no means clear that *Margaritana* and *Monocondylæa* are more than subgenera, or even artificial sections of *Anodonta*. *M. Vondenbuschiana* is intermediate between the second and last in characters of the shell, and there is no known essential distinction in the animal.

† The Linnæan genus *Mya*, like most Linnæan genera, was an artificial group to some extent. Besides *Mya* as now understood, it comprised *Unio* and several other genera.

species; for it is evident from the above description that the radiating lines shewn do not refer to striae but to coloured markings. Mr. Benson's shell from Malabar was striated.

Good collections of the Unios of both Coromandel and Malabar are greatly needed to determine all these doubtful species.

MONOCONDYLÆA CREBRISTRIATA, Anthony. Pegu.

American Journal of Conchology, I., 205, pl. 18.

MONOCONDYLÆA PEGUENSIS, Anthony. Pegu.

Am. Jour. Conch. I., 205, pl. 18.

I am indebted to Mr. Theobald for the above quotations. The shells are the two *Monocondylæa* above referred to, the first being that referred by me, though with some doubt, to *Anodonta* (*Pseudodon*) *inoscularis*, Gould, the second to *Monocondylæa Vondenbuschiana*, Lea. So long as it is the practice of naturalists living in foreign countries, and, necessarily, imperfectly acquainted with the fauna of distant regions, to give a "specific" name to every animal or fragment of an animal which reaches them, lists of synonyms must multiply; and as everybody will contend for the distinctness of his "species," false notions as to the nature and value of specific distinctions must prevail. Thus, in the same paper, one of the numerous varieties of *Melania variabilis*, Benson, is called *M. gloriosa*, Anthony. Now it is worthy of remark that Mr. Benson, who has examined far more of the Mollusca of Burma than Mr. Anthony can possibly have seen, has not for years described a single *Melania* from that country as new, and has only described two species of *Unio*, although he had specimens of all Mr. Anthony's supposed new species. I can only add that it would be easy for me to describe, from the materials I possess, 20 or 30 forms of *Unio* (and nearly as many more of *Melania*) with as good claims to distinction as one-half at least of those already published from India and Burma; but were I to do so, I cannot help thinking that, while burdening science with additional names, I should have added nothing to the knowledge of the fresh water mollusca of India. Amongst fresh water shells I am convinced that forms pass into each other far more than amongst land shells, that "species," in the usual definition of the word, have no existence, that all the characters relied upon for distinguishing "species" of *Unionidæ* in especial, the form and thickness of the hinge teeth, form

of the shell, prominence of the umbones, shape of the muscular impressions, colour of the nacre, characters of the epidermis, &c. vary *ad infinitum*—in short that species must be described like genera and grouped around types, not distinguished by characters.

I see from a notice in the Paris *Journal de Conchyliologie* that, in the same volume of the American Journal of Conchology, Mr. Conrad proposed a new genus *Trigonodon* for *Monocondylæa crebristriata* of Anthony, from which, as I have stated above, *Anodonta inoscularis*, Gould, is at the best but dubiously separable specifically. But the last named shell is the type of Gould's genus *Pseudodon*, and Gould himself suggested the identity of that genus with D'Orbigny's *Monocondylæa*.\* Unless Mr. Conrad has procured the animals of the Pegu forms, and shewn them to be distinct from those of South America, (and I scarcely think he can have done so,) I cannot believe that any useful object is attained by inventing these generic appellations. Even if *Trigonodon* be not *Pseudodon* over again, (Mr. Conrad appears to have already furnished one synonym before for *Pseudodon*, viz. *Monodontina*,) there has been no distinction of any generic value shewn between the shells of Burmese and Malay species of *Monocondylæa* and those of S. America; and bearing in mind that there are some genera of more restricted distribution than those belonging to the *Unionidæ*, e. g. the Tapir, and amongst Mollusks, *Cyclophorus* and *Megalomastoma*, common to the two regions, it would, I think, be more scientific to examine the animals of the Burmese shells allied to *Monocondylæa*, before founding new genera to comprise them.

There is of course the possibility that Mr. Theobald may have been misinformed as to the respective names of the two species, and that the type of *Trigonodon* is the form I have referred to *Monocondylæa Vondenbuschiana*. I can only add that the specimens of the same shell from the same locality sent to me by Mr. Theobald, do not differ more from Küster's figure of V. d. Busch's original specimen of *M. Vondenbuschiana* in Martini and Chemnitz, than that figure does from Lea's.

UNIO PEGUENSIS, Anthony.

American Journal of Conchology, Vol. I.

I cannot learn what species has been thus named. I hope to be able to refer to the volume before long and to return to the subject.

\* Ot. Conch., p. 194.

Two Indian species of *Unio* in the Musée d' Histoire Naturelle at Paris have received MS. names from Valenciennes. I am unable to ascertain at present if these names have been published or not.

Corrigenda in Contributions to Indian Malacology, No. VI., in this volume :

|        |                    |              |                                 |                                        |
|--------|--------------------|--------------|---------------------------------|----------------------------------------|
| P. 31, | line 2,            | from bottom, | for Kimery                      | read Kimety.                           |
| 32,    | " 7,               | " top,       | " <i>Fordoni</i>                | " <i>Gordoni</i> .                     |
| " "    | 8,                 | " bottom,    | " Hattiar                       | " Kattiar.                             |
| 34,    | " 2,               | " " "        | " inwardly                      | " conoidly.                            |
| 35,    | " 15,              | " top,       | " <i>subgesta</i>               | " <i>subjecta</i> .                    |
| 37,    | " 12,              | " bottom,    | supply "it"                     | after <i>nulla</i> .                   |
| " "    | 9,                 | " " "        | omit the word South.            |                                        |
| 38,    | " 10,              | " top,       | " oblong ovate, <i>Achatina</i> | read oblong ovate<br><i>Achatinæ</i> . |
| " "    | 17,                | " " "        | " <i>Basilens</i>               | " <i>Basileus</i> .                    |
| " "    | 12,                | " bottom,    | " <i>Alycæus</i>                | " <i>Alycæus</i> .                     |
| " "    | 8,                 | " " "        | " <i>Recliz</i>                 | " <i>Recluz</i> .                      |
| 39,    | lines 21, 16 & 11, | from bottom, | for <i>Basilens</i>             | " <i>Basileus</i> .                    |
| " "    | line 17,           | from bottom, | for Wynand                      | " Wynaud.                              |
| " "    | " 14,              | " " "        | " Paulghat cherry               | " Paulghatcherry                       |
| " "    | " 5,               | " " "        | " of that <i>N. auris</i>       | " of <i>N. auris</i> .                 |
| " "    | " 2,               | " " "        | " base by                       | " barely.                              |
| 41,    | " 11,              | " top,       | " slightly                      | " slightly.                            |

In the previous number V. of the Contributions, an important error occurs N. CONULA, n. s. for N. CONULUS (J. A. S. B. XXXIV, 73, 1865).

In the same page, Phoung ditto, Arakan, should be Phoung Do, and three pages further, p. 76, line 12, a semicolon is omitted, altering the sense. The passage should read "a vertical lamina in front, and a second, slightly oblique, just behind; the first giving out" &c. instead of "just behind the first." The only other erratum of importance is in page 81, line 20, where "re-entering lamellar parietal" should be "re-entering parietal lamella."

## SCIENTIFIC INTELLIGENCE.

The following is from Mr. Blyth :—

I have already elucidated\* sundry species of *Ægialites* (or Ring Plover) and may now further add that I have since made out the *Charadrius pusillus* of Horsfield to be the same as *Æ. ruficapillus*, Gould, figured in his *Birds of Australia* : Horsfield's specimen being in winter dress, and his name of course standing for the species.

The Indian *Neophron* (281) will have to rank as *N. ginginianus*, Latham. The *Spilornis* of Ceylon and of all S. India is the same as *S. Elgini*, Tytler, and will bear my prior name *Spilogaster* (J. A. S. XXI. 351) being distinct from the Malayan *S. bacha*, with which Professor Schlegel identifies it. *Falco babylonicus* is the *F. peregrinoides* apud G. R. Gray, as suggested in p. 282. The Cat noticed as *Felis macrocelis* in p. 283 seems, after all, to be of a different and smaller race than one received from Asám also in the Zoological Gardens. It has now been more than three years in the garden, and has only a slight fulvous tendency even yet, while the other is much more fulvescent, and is also of heavier build. I think that the larger only has the very elongated canine teeth. Neither seems to be the true *Diardii* (vel *macrocelis*) of Sumatra and Borneo ; and I suspect that the larger and more fulvous animal (which the Society's Museum has from Sikhim) should rank as *F. nebulosa*, C. H. Smith, figured in Griffith's English edition of the *Règne animal*. There is also great variation in the *F. aurata*, Tem. (*murmensis*, Hodgson, and the young *F. Temminckii*, Vigors.) A rufous specimen in the India Museum has strongly developed body-markings, akin in type to those of the *macrocelis* group ; others (alike from Sikhim, Malacca and Sumatra,) are deep rufous without trace of body-markings ; and thirdly, there is the blackish race, which is designated *F. nigrescens*, Hodgson, in the second edition of the British Museum Catalogue of Mr. Hodgson's collections. These Cats would seem, in fact, to be in process of specialization, which is carried on a further stage in the *F. Swinhoei* of Formosa, as compared with the other races akin to *F. Diardii*. Lastly, *F. Charltoni* may be a race not strongly specialized apart from *F. marmorata*.

\* Asiatic Society's Journal, vol. XXXIV. p. 280.

The whole of these constitute a group of E. and S. E. Asiatic Cats *per se*, which have not the peculiar clubbed tail of *F. uncia*, with which Dr. Gray associates them. To the species of birds to be expunged from Jerdon's Indian series (p. 282), may be added *Otocoris penicillata*, for which *O. longirostris* of Kashmir, Kooloo, &c., has hitherto been mistaken. *O. penicillata* of W. Asia is smaller, with much longer ear-tufts, and the black of the cheeks is continuous with that of the breast. Have I told you that *Carpophaga cuprea*, Jerdon, is well distinguished from *C. insignis*, Hodgson, having the neck and lower parts much more ashy, while both differ from *C. badia*, (Raffles), of Sumatra? Of *C. pusilla*, nobis, I have seen more specimens from S. India, where perhaps it co-exists with the large *C. ænea*; and both *cuprea* and *pusilla* are very likely to inhabit the mountains of Ceylon. *Grauculus Layardi*, nobis, (*papuensis* apud Sykes,) of S. India and Ceylon, is very distinct from *G. macei* of Bengal, &c., much smaller, with the wings strongly banded underneath. The Malayan *G. javensis* is a miniature of *G. macei*, of the same small size as *G. Layardi*. As many as four races have been confounded under *Pycnonotus jocosus*, (L.) a name which must be retained for that of China, which I have not seen. The Bengal bird will stand as *emeria* of Shaw (*pyrrhotis*, Hodgson). The Tenasserim and Penang race is *monticolus*, M'Clelland. That of S. India will be named by Gould, and it has no white markings on the rectrices. In the Zoological Gardens are apparently two new species of Pheasant. One is a female, of a duplicate race to *nycthemerus*, being of the true silver Pheasant type. The other is a male; very like *lineatus* of Burma; but the markings of the upper parts more resemble those of *nycthemerus*; it has no white along the ridge of the tail, and no white streaks on the flanks. Some think it a hybrid; but, if so, it can only be between *lineatus* and *nycthemerus*. The tail, however, is shaped exactly as in the former, whereas it should be considerably more lengthened, if the bird had *nycthemerus* for one parent; and its legs also should in that case be larger, and shew some trace of the crimson colour of those of *nycthemerus*. I am, therefore, disposed to consider it as a true wild race of Kallij, probably from some more eastern part of the Indo-Chinese peninsula.

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PART II.—PHYSICAL SCIENCE.

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No. III.—1866.  
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*Kashmir, the Western Himalaya and the Afghan Mountains, a geological paper by ALBERT M. VERCHÈRE, Esq., Bengal Medical Service; with a note on the fossils by M. EDOUARD DE VERNEUIL, Membre de l'Académie des Sciences, Paris.*

(Continued from page 133.)

Leaving with regret the Zeeawan spur, we will continue our examination of the Zebanwan mountain along its southern aspect. (See Map B.) (Section III. on General Map.)

We first cross a considerable mass of volcanic rocks, well stratified, and which we will not stop to describe, as they are similar to the felspathic ashes, black slates and the amygdaloid seen before. They present, however, a few layers of a coarsely crystalline limestone, without fossils and interbedded with layers of ash; some of this limestone is quite black and remarkably well crystallized in small crystals of jet-black spar. It would be a valuable ornamental marble, if found in some quantity. I have only seen it in thin and small patches, accompanying an amygdaloidal dust-stone of fine texture, but much decayed and nearly as black as the limestone. These patches of black rock are well seen on the slope of the long spurs which descend towards the S. E., from the highest summits of the Zebanwan. These volcanic rocks dip easterly, and their inclination is not more than  $20^{\circ}$  to  $25^{\circ}$ .

Having crossed a ravine, we arrive at the spurs over Zowoor, where we find the following beds along one section, from W. S. W. to E. N. E. We begin with No. 4 of the Section: the Nos. 1, 2 and 3 refer to the volcanic rocks and black limestone just described.

- |   |                                                                                                                                                 |         |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| { | 1. .... Amygdaloidal greenstone, dips E. S. E.                                                                                                  |         |
|   | 2. .... Ash interbedded with thin beds of highly crystalline azoic limestone.                                                                   |         |
|   | 3. .... Ash interbedded with black crystalline limestone in thin patches.                                                                       |         |
|   | 4. Amygdaloid; dip E. S. E. 20°.                                                                                                                |         |
|   | 5. Quartzite, white and stratified. It becomes gradually sandy and coloured blue, yellow or grey in places, .....                               | 15 ft.  |
|   | 6. Crystalline limestone with the debris of fossils, undeterminable, .....                                                                      | 5 ft.   |
|   | 7. Lenticular beds of coarse granular limestone, full of <i>Athyris</i> sp. ? (see Pl. II. fig. 1 and 1a) and <i>Productus Flemingi</i> , ..... | 1 foot. |
|   | 8. Limestone; grey, weathering brown, presenting abundant sections of <i>Orthoceras</i> and a few <i>Fenestellides</i> , .....                  | 10 ft.  |
|   | 9. Coarse limestone; <i>Fenestellides</i> , <i>Producti</i> , &c. passes into.                                                                  |         |
|   | 10. Calcareo-ferruginous, brown shales with some fossils: 9 and 10, about .....                                                                 | 40 ft.  |

These beds 6, 7, 8, 9 and 10 are therefore the same beds as there seen at Zeeawan, or they are in other words, Zeeawan limestone. They all dip E.S.E. 20°.

- |                                                         |       |
|---------------------------------------------------------|-------|
| 11. Limestone, thin bedded and shaly: no fossils, ..... | 5 ft. |
|---------------------------------------------------------|-------|

A fault occurs here, and the following beds are seen on the eastern side of it.

- |                                                                                                                                                                                                                                                                                                     |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 12. Limestone of the Zeeawan bed brought up again. It presents the same succession as above, viz. an <i>Orthoceras</i> bed, a <i>Fenestellide</i> bed, and a brown shale bed; the <i>Fenestellide</i> beds are, however, less abundant, and the lenticular <i>Athyris</i> ones were not seen, ..... | 40 ft. |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|

27. Resting on this limestone, we find other beds of limestone having a very different aspect. In fact we have the beginning of the Weean bed of carboniferous limestone. The fauna changes considerably: no *Producti* are found, no *Fenestellides*, no great flat *Orthidæ*, but instead a very great number of small bivalves, much broken and comminuted, and here and there in lenticular beds, where fossils of one or two species have been heaped together, some small *Brachio-poda* of the genera *Spiriferina* and *Terebratula*; some large mussel-shaped bivalves which are probably *Anthracosia* or some other near sub-genus of *Cardinia*; some large and sometimes extremely gibbose *Aviculo-pectens*; some *Pectens* four inches across; *Goniatites* and an innumerable variety of *Encrinite* stems of all sizes. The appearance of the rock will be noticed as we get on with our section.

13. A light blue limestone, argillaceous and compact, weathering rugose like frosted glass, but without losing its fine, lustreless, clay-like, pale blue colour. It contains many remains of fossils in a bad state of preservation, ... 30 ft.

A fault from N. N. W.—S. S. E.; downthrow S. W. The fault is met near the end of the spur by another running W. S. W.—E. N. E. The end of the spur, detached, as it were, by these two faults, strikes S. E.—N. W. and dips N. E. 20°. The rock of this detached bed is a shaly limestone; the fossils are small and ill-preserved; they occur in patches, one or two feet of the bed presenting a great number of remains, whilst hardly a trace of organisms is to be seen for some yards. It is about 50 feet thick, ..... 50 ft.

Another fault from N. N. W.—S. S. E.; downthrow S. W. The effect of this fault has been to bring up again the bed of Zeeawan limestone, and we therefore have the following bed to the N. E. of the fault.

14. A coarse micaceous marly slate, without fossils, and passing gradually upwards into sandy shales of a dark brown colour and containing *Producti*, *Orthidæ* and *Spirifers* in a very bad state of preservation. These dark shales are identical in appearance and in some of their fossils with the brown shales of the Zeeawan bed, but the *Bryozoa*, so extensively developed in other localities, appear to be totally absent, and some small bivalves, which are found in the Weean bed and have not been seen in the Zeeawan bed, were discovered here.\* These differences however may be easily accounted for by a difference of depth of the sea at the time the Zeeawan limestone and shale were deposited. The sandy and coarse micaceous slates seem to indicate a shallow sea with a drifting current on a shelving coast, a physical arrangement which may be a tolerable habitat for the large *Brachiopoda*, but unsuitable to the delicate *Bryozoa*.

This Zeeawan bed is succeeded by a shaly limestone, similar to that which is seen before the fault, that is to say Weean limestone. It has a well marked cleavage, due probably to its argillaceous impurities, and this cleavage is not unfrequently more conspicuous than the stratification.

The end of the spur is, like the preceding spur, cut off by a transverse fault W. S. W.—E. N. E. and the detached end dips E. N. E. 20°, whilst the body of the spur, above the transverse fault, dips E. S. E. 20°, the cleavage noted above dips N. W. 70°.

The thickness of these two beds together is about 100 feet; they form the whole of the spur above the village of Koonmoo, ..... 100 ft.

28. Above Koonmoo, in the angle formed by the divergence of the two arms of the spur, is a spring with a Zyarat called Shöküm.

\* A similar mixture of Zeeawan and Weean fossils is found in some parts of the Rotta Roh in the Punjab. See Chapter III. para. 60.

The rocks which are above this spring form a little knoll very insignificant geographically, but interesting for its fossils. These are often converted into hæmatite, sometimes crystalline, sometimes powdery. The rock of the bed is mostly a hard, cherty, pinkish limestone, and in this are lenticular beds of a soft, granular, pale french-grey limestone, with innumerable minute black dots which are the crystallized stems of a very slender crinoid. These minute rings are sometimes a round plate and sometimes a five radiated star. The rock is sometimes coloured pink by iron, and then the crinoid-rings are dark red instead of black. It is fœtid and it contains the large *Anthracosia* (Pl VI. fig. 3,) and the *Aviculo-pectens* mentioned before, and also the little shell Pl. VIII. fig. 5. This spur contains also a very compact, dark, nearly black limestone, with a very fine grain, but with only a few fossils and encrinite-rings. It is a similar bed which has furnished the blocks of which the beautiful black marble pillars of the Shalimar Bagh are made of. It takes a fine polish, and is evidently very durable. It is probable that this bed of black limestone crosses over to the valley of the Ayrâh river, and has been quarried there for these pillars.\*

The remainder of the little spur is made up of calcareous, micaceous sandstone without fossils (?). The thickness of the beds forming this spur, is about ..... 60 ft.

Then we have again beds of limestone, shaly and sandy, much cracked and fissured, and with only the debris of fossils. The harder portion of the rock is blue, and is traversed by innumerable white lines cutting one another in all directions. It dips E. S. E. 20°.

It is succeeded by a bed of blue argillaceous limestone, weathering rugose, and traversed by thin streaks of yellow, ochrous limestone, and containing fossils in abundance, amongst others a plaited *Spiriferina* which appears common in some layers, whilst it is rare in others. Crinoid stems are also very abundant, occurring as it were in patches.

The above mentioned bed is covered in by a grey micaceous sandstone, weathering pale brown and containing the fragments of fossils, but no *Spiriferina*.

The total thickness of the three last beds mentioned is above ... 150 ft.

Crossing the dry bed of a torrent and a great deal of rubbish which apparently covers a fault, the sixth spur is reached, and presents the following layers :

\* These pillars are generally described by travellers as black porphyry, a mistake which a very little attention would have prevented, as the sections of fossils are to be seen on the polished surface of the columns.

- a. The bed with the spur brought up again after the fault, ..... 20 ft.
- b. The micaceous sandstone, thin and false-bedded, with well marked cleavage, ..... 16 ft.
- c. Fœtid pale brown, calcareous sandstone, viz. false-bedded; no fossils; dips. E. S. E. 30° ..... 1½ ft.
- d. Shales; no fossils,..... 1 foot.
- e. Limestone, compact and dark grey, and weathering brown. It is much shivered, and is divided by innumerable white lines crossing each other. No fossils except what appear to be worm-burrows filled with sandy ochre, 15 ft.
- f. Very argillaceous limestone of a pale blue colour, with patches of a dirty yellow or pale brown colour, ..... 3 ft.

29. I consider that these beds are the top of the Weean division of the carboniferous limestone of the Himalaya, as the following beds show a very great difference in their fauna, which is nearly entirely confined to gasteropods and corals, the gasteropods presenting a great variety of shape and size. The corals of the *Cyathophyllidæ* are abundant and of considerable dimensions. The crinoid stems, some of them minute and starred, continue to be seen everywhere. The beds characterized by gasteropods and corals form the Kothair bed, which we shall see better developed elsewhere.

Continuing our section, we have therefore, resting on the argillaceous limestone, the following layers :

- g. Limestone, fine grained, blue, compact and argillaceous, with patches of dirty yellow. It contains many fragments of fossils, nearly entirely gasteropods. Some of these are two inches in length. Starry rings of crinoid stems abundant. The limestone becomes gradually of a richer blue colour, some portions being indeed light blue; it weathers rugose like frosted glass. The upper part contains no gasteropods, but fossil roots and rootlets the size of the finger. It is about 25 feet thick, ..... 25 ft.

This is all we see here of the Kothair bed, as a fault running N. S. brings up again the Weean bed; but this patch of the Kothair is interesting, as showing its relation to the Weean bed, a relation which I have not been able to trace so well anywhere else. The Weean and Kothair beds are quite conformable.

On the other side of the fault we find :

- a. A limestone, bluish-grey and compact; weathering sandy and dull grey. It is divided in layers by several sandy partings. It contains only a few encrinite stems and dotted white patches which are probably decomposed fossils. It is shivered and traversed by innumerable white lines, ..... 20 ft.

b. Brown fœtid limestone, full of a transverse species of a plaited *Spiriferina* and a globular *Terebratula*. It is probably a lenticular bed, and takes the place of the *Spirifer* bed noted above, ..... 3 ft.

c. Limestone like *a*.

The end of this spur is cut by a transverse fault in the same manner as we have seen in the preceding spurs. The cut off beds are much disturbed, being vertical at the tops of the ridge, and dipping N. E. at high angles along the slope.

Beyond this is I have not examined this fine section of the limestone of Kashmir. I was never allowed to visit it again, as I was suddenly ordered away from Srinuggur, my professional services being required elsewhere. Had I had time, I intended to follow the section across the range into Nawan and down to the bottom of the Harrah Valley.

30. From the brow of the last spur which I have visited, a fine view is obtained of the next spur, which is remarkable for a great twist of the strata which compose it. The limestone is extremely white and resembles chalk-cliffs at a distance. We shall, however, see this white limestone at Manus Bal, and find that it is probably a portion of the Weean bed altered by heat. We shall find it similarly altered at Islamabad.

The whole mass of hills of Nawan appears to be limestone. The summits of Boorwaz and Batgool appear behind the range, presenting high rugged peaks of porphyry. To our right, the limestone forms a small chain which advances for some miles into the Pampur valley, and behind this chain a long line of mountains, also entirely composed of limestone, runs N.—S. to join the Wastarwan. (See maps B. and C.)

31. The little chain which descends into the Pampur valley terminates over the village of Weean. At its extremity, the Weean limestone, or middle bed of carboniferous limestone of Kashmir, is well developed, and we will now proceed to examine this locality. It is, to me, the classical ground of the Weean limestone, as the Zeeawan spur is that of the Zeeawan Bed.

*Section of the hills above the village of Weean in the Pampur valley.*  
 (See fig. 7.)

The little hillocks above the villages of Weean and Kohew, are separated from the main hill by a fault running W.—E. The beds have moreover been folded on themselves and dip due W. (at Weean), with an angle of 55°, whilst in the main hill the dip is to the N. E. with an angle between 20° and 30°. This does not, however, prevent the section of the little hill near Weean being a very good one for study. We shall proceed from E. to W.

1. Impure arenaceous limestone with fine spangles of mica. It is very shaly in the centre of the bed and there very much decayed. It changes its aspect repeatedly, adding here more sand and mica, there more clay, ..... 100 ft.
2. Limestone, argillaceous; in blue and yellow patches,..... 4 ft.
3. Blue limestone, weathering brown and rough. It is arenaceous near its upper part. It contains a very few fragments of fossils, ..... 20 ft.
4. Finely crystalline limestone; nearly saccharine; grey and rough,..... 15 ft.
5. Like 3,..... 8 ft.
6. Limestone in blue and dirty yellow patches; fossils much broken, ..... 12 ft.
7. Flesh colour limestone; hard, cherty and magnesian, ..... 4 ft.
8. Sandstone, micaceous, grey, calcareous and muddy. It decays faster than the other beds and forms a depression on the hill-side, ..... 2 ft.
9. Limestone, patchy blue and brown. The hardest and roughest portions are full of the debris of fossils, ..... 25 ft.
10. Sandstone, soft and wearing off quickly, forming a depression 20 ft.
11. Limestone, hard and grey; it is brecciated and weathers mammilated, ..... 30 ft.
12. Marly and sandy limestone, compact and hard, dark grey and weathering into a granular surface, having the appearance of a sandstone. The debris of fossils, ..... 40 ft.
13. Fawn-coloured limestone, very muddy; it weathers ochrous and decays fast, forming a depression on the hill side, ..... 15 ft.
14. A wall of very hard, crystalline, dark greyish-blue limestone with

patches coloured brown. It weathers a dirty dark yellow, and becomes extremely rough and pitted by exposure. The organisms it contains are quite indistinguishable, ..... 3 ft.

15. Fawn-coloured limestone like 13, ..... 20 ft.

16. A wall of very hard and compact limestone, grey and very arenaceous. Where it is tolerably free of sand, it is bluer and contains the debris of fossils, ..... 15 ft.

17. Sandstone, pale and calcareous, with bands of crystalline carbonate of lime. It decays fast and forms a depression, ..... 10 ft.

18. A well marked wall of dark greyish-blue limestone, very rough and pitted; it is arenaceous and in places cherty, ..... 5 ft.

19. Sandstone, micaceous, very false-bedded and very muddy. It effervesces with acid along the scum-markings of the false bedding only, ... 15 ft.

20. A very arenaceous and argillaceous limestone, extremely variable in its appearance, but being generally of a pale clayey yellow. It is formed of extremely thin layers of two distinct rocks, one being a yellow marl, and the other a bluish grey arenaceous limestone, and these thin layers are also very false-bedded. When we make a vertical section of a hand specimen, we have a striped rock; and in a horizontal one, a succession of regularly rounded patches of bluish grey and sickly yellow. This alternation of very thin and very false-bedded layers of rocks of two different colours is the cause of the patchy appearance of many beds of the Weean group. But it is rarely so well defined as in this present layer. In other places, the bluish limestone forms irregularly-rounded balls or nodules cemented together by the yellow marl, or the marl forms lumps imbedded in the limestone. Then again micaceous sand forms, here and there, small false-bedded layers or bands in the rock: and lenticular beds of a hard, brittle, pale yellowish, limestone, full of the fragments of bivalves and of small crinoid stems, are also found. But all these varieties of rock constitute a thick course of impure limestone, 60 ft.

---

Total ... 425 ft.

We have now arrived at the little ravine which indicates the centre of the fold of the beds; on its other side the same beds are repeated in an inverse manner as far as the bed 16 of the above section; the remaining beds have been denuded from the western branch of the fold. This fold deserves notice, as showing well how completely beds may be reversed in their position. It is probable that the beds nearest to the ravine are the deepest or oldest, whilst the bed which we have numbered No. 1, in the section, is the most superficial. If the hill had been denuded to half its present height above the village, the beds

Fig. 7.

Sketch Section of the hills above Wecan and Kohew, bearing N.; to illustrate the descriptive Section of these mountains. (Not drawn to scale.)

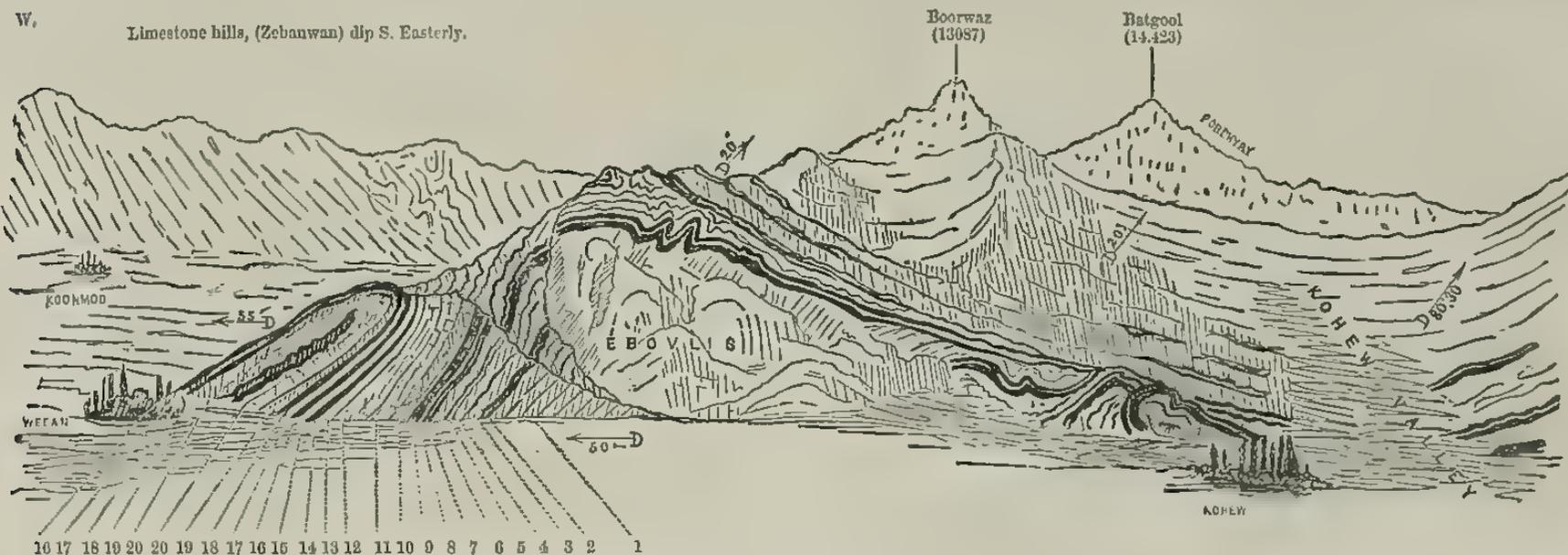
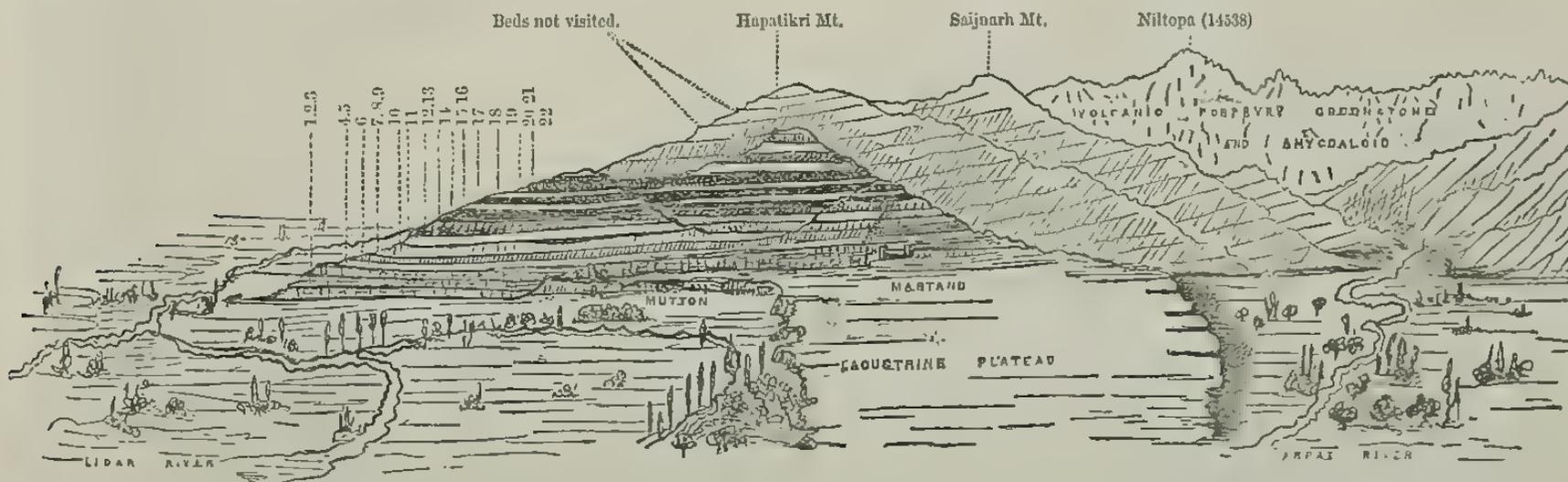


Fig. 8.

Sketch-Section of the Hapatikri and Saijnarh Mountains, bearing N. E. as seen from the top of the Ishlamabad Hill. (Not drawn to scale.)





would appear to succeed one another with considerable regularity from W. to E., and one bed, No. 1, would appear the deepest; but the top of the hill having been preserved, the beds can be seen plainly bending and folding themselves in two. There is a circumstance which renders it extremely easy to follow the beds along the hill-side and it is this, that the layers 16, 17 and 18 form a sort of broad ribbon at their outcrop; 16 and 18 being composed of dark grey walls of limestone which, from their hardness, are prominent 2 or 3 feet over the general surface of the slope, whilst 17, the layer between them, is a pale sandstone, decaying fast and forming a sunken furrow between the two walls. This broad ribbon, about 30 feet wide, can be followed with the eye for miles. The layers 7, 8 and 9 also form a ribbon, but less well marked than the other, being paler and not so sharp. Now, these two ribbons are of the greatest assistance in following the twists and foldings of the beds. We have seen that the ribbon 16, 17 and 18 ascends the eastern branch of the fold over Weean and curves over at the top of the hill, where its beds are perfectly horizontal, and then descends along the western branch. We see the two ribbons forming near the village of Kohew an anticlinal similar to that of Weean, but not quite so sharp, and the description of the ribbon also shows us plainly that the beds of the Weean hillocks are reversed. There is a great fault between the main hill and these two little hillocks of Weean and Kohew; on the north of the fault, the beds dip to the N. E. at a high angle, and all the soft and marly layers have decayed and tumbled down in *éboulis*,\* but the hard ribbon has remained, and can be traced along the hill showing the outcrop of the beds. All the way up to Nawan we can see the beds of limestone dipping N. E. and we can infer the existence of many faults across the range from the reappearance of the ribbon on the top of each small spur which descends in the Kohew valley. We see these pieces of ribbon plunge under the soil of this small valley to emerge on the other side (fig. 7), giving us the strike of the beds of that long chain of limestone hills which connects Nawan with the Wastarwan Mountain; but although I have

\* The French word is so convenient and expressive, that I do not hesitate to use it, as no English word expresses equally well the broken materials of beds which have slipped.

not visited that long chain of hills, and have not travelled up the Kohew valley, I was enabled in following these ribbons, to see that it is composed of the variety of limestone which I have called the Weean Bed.

We shall observe these ribbons wherever the Weean limestone is well developed; they are to be seen in the section I have given, between Zeeawan and Koonmoo, on the southern aspect of the Zebanwan. I did not mention them there, because they make but little show near these localities; but we shall see them well marked near Mutton, in the eastern portion of the valley of Kashmir.

32. I will now try to characterise the Weean Bed of carboniferous limestone.

It is a very arenaceous and argillaceous limestone, the sand being either in thin grey bands, or mixed with the general paste of the rock. A sandy, marly clay, yellow, dirty-yellow, pale brown or brown, forms thin and very false-bedded films in the rock, so that this is striped when bisected vertically, and patchy bluish and yellow when divided horizontally. The hardest beds are brittle, flesh-coloured and generally full of bright red minute crystals of hæmatite, and the fossils are here replaced by a powdery or semi-crystalline hæmatite which, however imperfectly, preserves their outlines. The harder rock is never blue, and the blue variety of rock is sufficiently muddy to have a soft, velvety, lustreless appearance like a fine clay, and not the clean brittle fracture of a pure and hard limestone. It has in places all the appearance of a very dirty dark-grey mud dried up, and it is then full of fossils and extremely foetid. It contains lenticular beds of a very pale, nearly friable limestone, containing black specks which are the rings of stems of very minute crinoids, and this variety of soft limestone is the habitat of large bivalves. One single bed of limestone may be mistaken for Zeeawan limestone, bluish-grey, coarse hard and semi-crystalline, but it contains innumerable *Foraminiferæ* transformed into yellow ochre; very large *Pectens*, and an incredible quantity of fragmentary *Crinoidea*. Indeed, it is the great number of those small rings of crinoid stems, always crystallized, which causes the rock to resemble the limestone of the Zeeawan Bed.

Everything in the Weean bed tells of a shallow sea formation. The rocks in some localities, to be described hereafter, have been much altered by heat or other forces soon after their formation. We shall see them thus altered at Manus Bal and at Islamabad, and also at the Kafir Kote in the Punjab district of Bunnoo. It appears that considerable disturbances occurred while the Weean Bed was still in a soft state. But this subject will be examined more carefully in another paragraph of this paper.

The fossils differ a great deal from those of the Zeeawan Bed. In most layers they are mere debris hardly to be recognized. When they do occur, they are always crowded together in limited beds. The *Spiriferinæ* and *Terebratulæ* appear to have lived in shallow lagoons, in creeks in the sand, in pools on a flat marshy shore, and the large bivalves on sandbanks and shallows. The following fossils appear to be characteristic of the Weean Bed, as they are not found either in the Zeeawan Bed below or the Kothair bed above.

*Spiriferina Stracheyii* (Salter)?

„ *Stracheyii* (Salter)? var. *altior*, (Verch.).

*Solenopsis imbricata*? (Koninck).

*Solenopsis* sp. ——— Pl. VI. fig. 1.

*Cucullæa*? sp. ——— Pl. VI. fig. 4.

*Anthracosia*? (King)—*Cardinia*, sp. Pl. VI. fig. 3.

„ ? — *Cardinia ovalis*? (Martin) Pl. VI. fig. 3.

*Axinus*, sp. n., allied to *A. obscurus*.

*Aviculo-Pecten dissimilis* (Fleming).

„ „ sp. n. — (*A. circularis*, Verchère,) Plat. VII.  
[fig. 1, 1a, & 1b.]

„ „ sp. ———? Pl. VI. fig. 6, 6a, 6b.

„ „ sp. ———? Pl. VI. fig. 7, 7a.

„ „ sp. ———? Pl. VI. fig. 7, 7a, 7b.

„ „ sp. n. — (*A. Testudo*, Verch.) Pl. VII. fig. 3, 3a.

„ „ sp. n.? (*A. Gibbosus*, Verch.) Pl. VII. fig. 4, 4a.

*Goniatites*, sp. ——— like *G. Henslowii* (Sowerby).

*Entomostracæ*—*Cypridinæ*?

*Foraminiferæ*.

*Crinoidea*; *Cyathocrinites* and *Pentremites*.

A small bivalve, giving on section the appearance of a pair of spectacles is also found, but I never could detect the shell entire, although it is often the only fossil to be discovered.

33. But to the positive evidence afforded by these fossils, we must add the negative evidence: I mean we must remember that this is a bed of carboniferous limestone, and that notwithstanding we have no examples of the genera *Productus*, *Orthis*, *Euomphalus*, *Bellerophon*, and *Orthoceratites*, and that there are no large *Spiriferæ* or *Fenestellides*. Neither have we the *Gasteropods* and *Cyathophyllides* which characterise the uppermost or Kothair bed, more by their number and variety, than by any species well defined by me. I am anxious to insist on the absence in the Weean group of these fossils, which are generally regarded as eminently carboniferous, because it has been found difficult to determine the age of rocks belonging to the Weean bed, when seen apart from the Zeeawan Bed; thus the limestone of Manus Bal, which belongs to the Weean group, has been twice reported to be nummulitic.

34. The next mountain to examine is the Wastarwan. It is a fine hill, its summits rising above Avantipoor, a small city on the Jheelum celebrated for its Buddhist ruins. An inspection of the map will be better than any description I can give of the position and relations of this mountain. It is a centre of elevation, with spurs descending in all directions, like the spokes of a wheel. I never ascended it, but I travelled along its northern and its western sides, and the following is a description of what I saw.

*Section from Reechpoora towards the E. as far as longitude 73° 5'. across the northern spurs of the Wastarwan: (See Map C.)*

The spur which descends to near Reechpoora is entirely composed of Zeeawan limestone with the characteristic fossils. The bed forms a sharp anticlinal of which the two arms slope or dip N. E. and S. W. respectively, striking N. W. to S. E. The beds of limestone inwrap the end of the spur, the layers seen above the little Buddhist ruin dipping nearly due N. The anticlinal is so sharp that the courses of rock have separated, and caves, now converted into holy quarters for a few fakirs, are to be observed on both sides of the anticlinal.

35. Proceeding eastwards, after crossing the bed of a stream, we

observe near Banda, a small Zyarut up the ravine above Ladoo, some very fine beds of limestone of which the following is the section.

Proceeding from the bottom of the ravine up the side of the spur we find.

1. Slates, so much decayed and broken that it is impossible to see their dip and strike. They are identical with those which we have seen interbedded with volcanic ash and agglomerate in the Tukt-i-Suliman and the Zebanwan, and they are very extensively developed in the Wastarwan. They are, as we have seen, more or less metamorphosed, often slightly amygdaloidal and always devoid of organisms, ..... very thick.

2. Augitic ash, very amygdaloidal, the geodes being filled sometimes with dark augite, sometimes with bluish-white opalescent quartz. It strikes N. W. by W. and dips north-easterly. About ..... 25 ft.

3. Trachyte, sparingly amygdaloidal; coloured brown outside by iron, ..... 10 ft.

4. Metamorphosed slate, foliated, jointed, disintegrating, ..... 20 ft.

5. Compact basalt, ..... 4 inches.

The debris of volcanic rocks form a breccia over the basalt; but this bed is very irregular and lenticular. The basalt is replaced in some places along the strike by a dull, light-olive-coloured laterite or baked clay, about one foot thick.

6. Quartzite, sometimes pure, opaque, white; often translucent, bluish or smoky; never crystalline. It gradually invades the laterite mentioned above, and forms ribands of dull olive and pure white quartz, ..... 2 & 3 ft.

7. Zeeawan limestone with usual fossils; dips N. 15°, ..... 40 ft.

8. Zeeawan brown shales, ..... 10 ft.

9. Fine blue clay-slate; calcareous and breaking in large thin slates. It contains no fossils, ..... 10 ft.

Extensive old quarries remain here, showing how fine and free a limestone the Zeeawan bed can give, when quarried in portions of rock which are not weathered. The quarries are far from exhausted, or rather the amount removed is insignificant compared to what remains; blocks of any size and very sound could now be procured easily from the old quarries. It is a great pity that the Maharajah's government do not work this and other quarries for the limestone they want, instead of destroying the interesting Buddhist ruins which cover the valley, especially as the style of architecture now in favour in Kashmir is perfectly hideous.

Traversing a ravine we meet the spur which descends towards the village of Mandikpal, and the following section is met with :

1. Amygdaloidal greenstone.
2. Amygdaloid.
3. Quartzite.
4. Rotten Augitic ash.

Some of the ground is covered with the debris of the ash, so that its relation to the next bed is not seen.

5. Limestone, argillaceous, pale bluish-grey, weathering fawn-coloured : afterwards patchy blue and brownish. It is thin-bedded and breaks in slabs about one to one and a half inch thick. It contains an abundance of *Goniatites* of 2 or 3 species. The bed is about ..... 30 ft.

The dip of these several layers of rock is N. N. E. 25°.

This is the only locality where I have seen Weean limestone resting immediately on volcanic rocks.

From Mandikpal, our section goes through a succession of limestone ridges which, from the appearance of the ribbons described at the hillocks over Weean and Kohew (para. 31), are conjectured to be Weean limestone, but I had not time to visit them. The general dip of their beds is north-easterly.

36. The western aspect of the Wastarwan I shall describe from S. to N., that is from Avantipoor to Reechpoora. It is a series of spurs with a general westwardly direction, and at the end of one of these spurs is a little knoll which I shall call for convenience sake the "Pampur knoll."

*The following is the section of these spurs from S. to N. (see Map C.).*

1. The whole of the spurs between Avantipoor and Tangur are composed entirely of volcanic rocks, viz., amygdaloidal greenstone, coarse basalt and ash, and black slate without fossils. The limestone is first seen about three quarters of a mile south of Barus, where two spurs approach very near the river Jheelum.

2. As we ascend the most southern of these spurs, we find, resting conformably on dark amygdaloidal greenstone, a bed of white quartzite about 2 feet thick, ..... 2 ft,

3. A coarse and rough trachyte, ..... 12 ft.

A fault N. N. E.—S. S. W. It opens towards the northern end, whilst the edges of it are crushed one against the other at its southern extremity. On the northern side of the fault we find :—

1. Quartzite, bluish grey, gritty and rough, ..... 2 ft.
2. Trap, having a shaly appearance. A great deal of kunkur is seen along the line of fault, ..... 1 ft.
3. Quartzite, excessively irregular and having a very peculiar appearance : it is divided in meshes like a very coarse travertin, or rather like lead which has been dropped in cold water while in a melted state. There is however a certain pretty well marked stratification or superposition of courses. The rock looks like a siliceous paste which had solidified suddenly when in a state of ebullition. It first dips W. about  $50^\circ$ , increasing gradually to the vertical and then inclining the other way, dipping S. E.  $80^\circ$ . It, however, soon becomes vertical and gradually dips again W.  $50^\circ$ , ..... 40 ft.
4. Pale trachyte. Dips W.  $50^\circ$ , ..... 15 ft.
5. Limestone, crystalline and metamorphosed ; no organisms. Weathering rough ; much stained by iron-oxyde, ..... 3 ft.
6. Zeeawan limestone with the usual fossils ; dips W.  $40^\circ$ , ..... 50 ft.
7. Zeeawan brown shales, ..... 10 ft.
8. Slate ; coarse, micaceous. Squeezed by proximity to a fault ; no fossils ? A fault, from N. E.—S. W. with a downthrow on the southern side. The slates are partially in the fault.

37. If we ascend the next spur, Barus spur, from the south, pretty high up the little ravine, and make our way to the monumental "Ling" which crowns the hill,\* we see nothing but trap and ashes which have been brought up again on the northern side of the fault. The top of the hill is covered with grass and debris which prevent the rocks being seen in situ, but many pieces of ash, amygdaloid and white quartzite are seen loose on the earth, showing that the usual quartzite bed exists here. On the western and north-western aspect of the hillock, the rocks are uncovered and we have the following series.

Trap and volcanic ash .....

Quartzite .....

Here two beds are covered by vegetable earth, as mentioned above.

1. Zeeawan limestone with usual fossils. Dips W.  $50^\circ$ , ..... 40 ft.
2. Greyish-blue limestone without fossils, ..... 15 ft.
3. Beds concealed by vegetable earth and by lacustrine deposits 30 ft.
4. Shaly limestone with few and broken shells ..... 40 ft.

\* This is, I believe, one of the largest, if not the largest "Ling" or "Emblem of Creation." It measures 14 feet in circumference and was about 20 feet high. The base is hexagonal ; the preputial line is in relief, and appears to have been carved. This monster ling is now broken in two or three pieces, and the upper half is prostrate on the ground ; the hexagonal base and about, 6 feet of the body of the ling are still standing.

5. Limestone, very impure and containing immense numbers of a Spirifer of large size, very similar to *Spirifera Verchèri*, De Verneil Pl. I. (fig. 1a. 1b. 4 ft.

6. Limestone with a few fossils, ..... 30 ft.

7. Limestone, filled with *Productus costatus* (S. W.) often extremely depressed by pressure. Many other fossils associated with the *Productus*, such as *Athyris Spirifera*, and a species of *Chonetes*, &c. The limestone is arenaceous and micaceous, often so much so that it passes into a calcareous sandstone. This passes gradually into the next bed, the fossils becoming less frequent and the rock less sandy.

8. Shaly limestone. The beds 7 and 8 are together about, ..... 60 ft.

All these beds are evidently, from their fossils, members of the Zeeawan group. The series is continued by beds of the Weean limestone.

9. Sandstone, grey, then pale brown. It contains lenticular beds of limestone. The bed is much disintegrated and overgrown with grass

*Goniatites*, ..... ?

10. Flinty-looking, shining limestone of a bluish grey colour. Divided by partings of shale, thin and irregular. It weathers rugose and contains no fossils, ..... 15 ft.

11. Calcareous slate, thin-bedded and exfoliating, ..... 1 ft.

12. Flinty limestone like 10, ..... 3 ft.

A lacustrine deposit covers any further bed which may exist.

The total thickness of this section is about 260 feet. The Zeeawan bed is nowhere so thick as it is here, being about 220 feet thick from stratum 1 to 8.

The remainder of the section is Weean limestone, but only partially seen here.

38. The end of the spur, immediately north of Barus, presents also some Zeeawan limestone, but it was not examined. The two following spurs are entirely composed of volcanic ash and agglomerate.

39. Then comes the long spur which ends in the somewhat detached hillock which I have called the Pampur knoll. We find in this spur the beds we have just seen above Barus, precisely in the same position and relation. The similarity is so complete that it is evident that the Barus beds once extended to the Pampur knoll without a break, but that a great portion of this limestone has been denuded.

The volcanic rocks, in the long spur, are well stratified and rather thin-bedded as they approach the limestone. They dip W. N. W. with an angle of about 45°. The Zeeawan bed rests on quartzite

and presents the same beds full of the gregarious fossil *Spirifera trigonalis* (?) and of *Productus Costatus* : the distance between these beds is the same as it is at Barus. On the top of the Zeeawan beds are seen Weean beds, but they are much more complete than at Barus, having a thickness, from the top of the Zeeawan bed to the foot of the knoll, of about 660 feet. But I believe there are probably some faults which cause beds to be repeated, and that the Weean bed is not quite so thick ; about 500 feet.

The Pampur knoll gives the following approximate section from east to west.

1. Coarse grey limestone.
2. Slaty grey limestone.
3. Patchy blue and yellow or pale brown limestone.
4. Compact blue limestone, argillaceous.
5. Patchy blue and dirty yellow.

These beds are together about 100 feet thick. They dip W. with an angle of 60°.

6. Flesh-coloured limestone.
7. Shaly coarse blue limestone.
8. Flesh-coloured limestone.

These 3 beds are together about 80 feet. Dip as above.

Other layers are buried under lacustrine deposits. This little hillock was examined very superficially, owing to want of time. No fossils were seen except the small broken bivalves mentioned above, and which are so common in all the rocks of the Weean group.

40. The spur seen half way between the Pampur knoll and Reechpoora, is tipped with Zeeawan limestone, but was not examined in detail.

41. Here ends our survey of the Wastarwan. I need not say that the central ridges and summits are entirely composed of volcanic accumulations. Black basaltic rocks are abundant, and by their disintegration, and the rearrangement by water of the black mud they gave in decaying, a great quantity of black slate was formed which is seen interbedded with beds of ash and agglomerate. These volcanic rocks do not require to be described, as they are identical with those of the Zebanwan Mountain. All the rocks of the Wastarwan present a stratification or superposition ; on the northern slope it

has a general dip to the N. E., whilst on the western aspect of the hill its dip is generally westerly. There is therefore a sort of anticlinal towards the centre of the hill, following a direction from the N. W. to the S. E. We have seen how this anticlinal affects the limestone at Reechpoora, a locality which happens to be at the end of it.

42. The next mountain we meet, travelling towards the S. E. along the banks of the Jheelum, is the Kamlawan (8601) which terminates over the village of Murhamma. The mountain is composed, like the Zebanwan and the Wastarwan, of volcanic rocks. Melted rocks predominate in the centre of the system, whilst ash and laterite compose, in a great part, the most extended spurs. Slate is intermixed with the beds of volcanic cinders, and over these carboniferous limestone rests conformably. But the limestone of the Kamlawan appears to have been extensively denuded, and is only found in a small bed which makes but little show. The following is a section of the spur immediately over Murhamma. Direction of the spur N.—S. Strike E. S. E.—W. N. W.; dip S. S. W. (See Pl. 11. Section D.)

1. Trachy-dolerite, coarse and dark, here and there amygdaloidal; it has large joints regularly disposed, at right angles to the stratification and yawning, giving it a somewhat columnar aspect. This bed appears to extend from the top of the hill, to the beginning of the spur now under consideration. It is of very great thickness, and, making allowance for faults, it cannot be less than 2000 feet.

2. Baked clay-stone or compact laterite, grey, smooth, much jointed; it dips S. S. W. 70°. It has a thickness of about ..... 200 ft.

3. Limestone, crystalline, coarse and metamorphosed. It contains a few fragments of fossils, not recognizable and mostly transformed into spar, 3 ft.

A fault, .....

4. Grey laterite or baked clay, like No. 2, ..... 200 ft.

5. Amygdaloid, ..... 20 ft.

6. Sandstone, or perhaps volcanic dust-stone; no fossils, ..... 5 ft.

7. Coarse grit of rounded grains.

8. Basalt, fine and dark brown. The beds 7 and 8 are together 150 ft.

9. Sandstone or duststone, like 6, ..... 5 ft.

10. Beds covered with grass and earth. Pieces of white quartzite and rotten ash seen amongst the grass, ..... 100 ft.

11. Limestone of the Zeeawan group with *Productidæ*, *Fenestellidæ*,

*Orthidæ*, etc. It is much fractured and fissured, and is evidently but the remnant of larger beds removed by denudation. It dips S. S. W.  $50^{\circ}$  and it is about, ..... 25 ft.

Any further beds which may exist are covered by the lacustrine deposit, which is here 150 feet above the level of the Jheelum.

The Sheri Bal is a small mountain close to the Kamlawan, to which it is united by a connecting ridge. It is entirely composed of the same semi-columnar trachy-dolerite which forms the bulk of the Kamlawan. The compact, smooth, grey, laterite or baked claystone, described in the section as No. 2 and 4, is seen extending on the flank of the hill, both to the west and to the east. It forms a conspicuous belt along the side of the Sheri Bal, appearing, from the high angle of its dip, to rest against the trachy-dolerite. Some of the volcanic and azoic rocks, described in the section of the Kamlawan as superior to the laterite, were seen on the slopes of the Sheri Bal, but no limestone was observed, it having probably been denuded.

43. Crossing the valley of the Lidar River, we find the next mountains to be the Hapatikri and Saijnarh group. The whole of this system of hills appears to be composed of limestone. It is continued to the S. W. by a low ridge, which is mostly buried under lacustrine deposits, but rises above these at Islamabad, forming a small hill at the foot of which the town is built.

The following section (fig. 8) will, I hope, give a good idea of the rocks composing these hills. The section is above the celebrated Tank of Mutton, near which locality the lacustrine deposit is about 120 feet thick. Above the lacustrine we find :

1. A limestone, coarse arenaceous and apparently much metamorphosed. It contains hardly any trace of fossils, excepting very crystalline rounded bodies which are altered stems of crinoids. The rock is divided into sub-beds by shaly or clayey partings, which are very false-bedded and very hard. Only a few feet of this rock appear above the lacustrine.

2. Limestone, jointed and cleaved ; but hard specimens have a remarkably compact, smooth appearance, like hornstone.

These 2 beds dip E. N. E.  $20^{\circ}$ .

3. The bed No. 2 becomes gradually bluer and more argillaceous and less cleaved ; towards the top of the bed it is the patchy blue and brownish rock which we have seen before repeatedly. It contains traces of fossils, but no shells sufficiently well preserved to be recognized. It has an enormous thick-

ness, varying however a good deal in places. There are remains of a Buddhist quarry in this bed.

The three beds have together a thickness of about ..... 200 ft.

4. White and friable sandstone, apparently a compressed quartzose sand without cement. It dips N. E. by E. 25°. It contains traces of fossils. It is remarkably well seen near the Karaise or Irrigation Canal which is cut on the flank of the hill.\* It is a thin bed and presents variations of color and aspect. It is only one and half foot thick, ..... 1½ ft.

5. Argillaceous blue limestone, ..... 2 ft.

6. Yellow sandstone, calcareous, not very hard, much disturbed and faulted, the faults, which are small and short, being at right angles to the strike. The sandstone has a thickness of about ..... 10 ft.

In this sandstone, which, by the bye, does occasionally pass into lenticular patches of impure arenaceous limestone, a great many sections or outlines of large bivalves and some small ones were seen; but no shell in a tolerable state of perfection could be obtained; I, however, made drawings of the outlines presented by these bivalves, on the weathered flank of the rock. When I first saw these outlines, I did not know of the large *Anthracosia*, *Pectens* and *Aviculopectens* which exist in the Weean group, and it appeared poor and ungrateful work to copy them. Soon after, however, I found the *Aviculopectens* and other bivalves represented at Pl. VI. fig. 3, and Pl. VII. fig. 4, 4a, and my sketches of the sections came in very opportunely, proving, in the absence of better fossil evidence, the Weean nature of the Hapatikri limestone.

7. Very hard and brilliant white quartzose sandstone, ..... 10 ft.

8. Sandstone, yellow and soft, like 6, ..... 5 ft.

These sandstone beds are remarkably wavy and undulated, as if they had suffered from lateral pressure. The limestone above and below participates but very triflingly in these undulations.

9. Sandy limestone, blue and compact. The debris of small fossils, 10 ft.

10. Dark shales, slightly carbonaceous. In this bed, casts of roots of trees with a concentric arrangement and, in rare cases, the vegetable cells filled with coal, were seen. The roots are generally thoroughly petrified; they are numerous and mostly horizontally (to dip) arranged; they are branching and have generally a starry disposition like *Stigmaria*. Some pieces of these

\* This canal was apparently intended to bring some of the waters of the Lidar to the Martand plateau; but it was never finished, and it is now falling into ruin. It is said to have been begun during the reign of the Mogul Emperors of Delhi; it is a work of considerable extent.

roots show a sort of epidermis, somewhat scaly like *Lepidodendron*. Large trunks were not seen. The bed is very thin, only  $1\frac{1}{2}$  foot, and is covered by a bed of limestone 25 feet thick. It appears therefore probable that, owing to littoral oscillations, the vegetable covering of the shale was denuded during the progress of the sinking of the coast and previous to the deposit of the limestone, ..... 1 &  $\frac{1}{2}$  ft.

11. Argillaceous limestone, compact and weathering white.

Shaly partings, ..... 25 ft.

12. Calcareous sandstone, of a compact structure and a dark blue color when fresh, but weathering reddish in an irregular and patchy manner, the redder patches being due to shaly masses which are seen here and there imbedded in the sandstone: these shaly masses sometimes form lenticular thin beds, as thin-bedded as sheets of paper. No fossils, ..... 10 ft.

13. Grey limestone; no fossils, ..... 6 ft.

14. Limestone, patchy blue and pale brown, ..... 15 ft.

These two beds of limestone are not quite conformable to the sandstone and preceding beds; they are nearly horizontal, with a trifling dip of about  $3^\circ$  to the E. N. E. This is probably due to littoral oscillations or earthquakes.

15. Sandstones, greyish-brown and pale, ..... 2 ft.

16. Limestone, ..... 4 ft.

17. Very arenaceous, grey limestone, weathering a deep yellowish grey; it shows no organisms. It dips E. N. E.  $20^\circ$ . It does not appear to participate at all in the faults and folds noted before. It has resisted atmospheric influence well and forms a prominent and striking wall near the top of the hill. It is about ..... 20 ft.

18. Pale blue sandstone, marly and shaly, weathering greyish-brown and patchy. It decays fast into a yellow sandy marl and forms a furrow at its outcrop, ..... 15 ft.

19. Compact limestone, very hard and cherty. It is fawn-coloured, but sometimes greenish blue. It contains no fossils, ..... 5 ft.

These three beds, 17, 18 and 19, form at their outcrop a ribbon similar to those described at Weean. Another ribbon is formed by the layers 14, 15 and 16, which appear to be the equivalent of the ribbon 7, 8, 9 at Weean. (?)

20. Sandstone, brown, hard and micaceous, ..... 2 ft.

21. Limestone in blue and brown patches, ..... 4 ft.

22. Sandstone, shaly and much fissured. Color grey or brownish-grey. It is hard, cherty and calcareous. It has a slaty cleavage, cutting the stratification obliquely by striking W. E. and dipping N. with an angle of  $60^\circ$ . It contains a few fossils. This bed varies a great deal, being sometimes a pure enough sandstone, at other times a sandy shale, and again a coarse sandy slate. It goes to the top of the cliff, ..... 20 ft.

This section gives a thickness of Weean limestone and calcareous sandstone, of 360 feet.

When I ascended the Hapatikri, I unfortunately did so above Mutton, and only carried my section as far as the top of the hill at that place, that is as far as layer 22. A little swelling of the surface concealed from me the summits to my right, and I thought that layer 22 was the highest of the hill. From the top of the Islamabad hill, about four miles to the S. W., I could see, while sketching fig. 8, that the summit of the Hapatikri is considerably above the layer 22. Two dark layers or ribbons are well seen near the highest summit of the Hapatikri, and it is not impossible that some faults bring up again the same beds. It is, however, probable that some beds of the uppermost or Kothair Bed exist near the summit of the hill, as I found amongst *éboulis* and loose stones near Martand some corals, which are, I believe, highly characteristic of the Kothair bed. (Pl. VIII. fig. 4, 4a.)

44. The Sketch-Section (fig. 8) shows that all the ridges of the Saijnarh are well and regularly stratified limestone and calcareous sandstones; I did not, however, visit these spurs. Behind the Saijnarh and the Hapatikri are seen the rugged volcanic mountains which bound Kashmir on the east, separating the waters of the Jhelum from those of the Chenab. The Arpat river brings down boulders from these mountains, and the lacustrine conglomerates, which are so extensively developed at the point where the Arpat and other streams leave the mountainous gorges to emerge in the open valley, give us a good idea of the composition of these mountains. All the boulders and pebbles, both of the bed of the river and of the conglomerates, are volcanic rocks, of which many varieties of amygdaloid are the most frequent. I never saw a single pebble of granite, syenite or gneiss, but quartzite is common, as well as limestone. That the pebbles and boulders of the conglomerate have been brought down directly from these mountains by torrents and rivers, and have not been drifted to where they are by the waves of the ancient great lake of Kashmir,\* is

\* The valley of Kashmir has been a huge lake since the appearance of man in the Himalaya. It is probable that a lake filling up the whole of the valley existed before that period, and that it was drained or tapped by some cause or another, allowing the valley of Kashmir to dry up nearly to the same

sufficiently proved by the shape of the boulders, these being rounded and ovoid in form, and not worn into the flat lenticular stones which are found on the beach of lakes, and which are so much appreciated by persons fond of making "ducks and drakes in the water."

45. I have said before that a spur of the Hapatikri extends to Islamabad, concealed under the lacustrine plateau (see fig. 8,) for a few miles, but appearing as a small hill over the town. The following is a section of this Islamabad Hill, from the S. W. to the N. E., beginning with the lowest strata exposed to view. The general dip of the beds of this hill is N. Easterly.

1. Marly limestone; bright blue; debris of fossils,..... 15 ft.
2. Ditto ditto; white; no fossils, ..... 20 ft.
3. Ditto ditto; grey; often reddish. Enormous number of *Foraminiferæ* forming ochrous bands in the rock, ..... 1 ft.
4. Arenaceous, dark grey limestone, divided by partings of shaly pale-yellow limestone, very false-bedded and very thin. Rich in the debris of fossils, but very few in a good state of preservation, ..... 25 ft.

These four beds dip N. E. 15°.

5. Limestone having a slaty cleavage and joints, white or pale grey, cherty in appearance, Fossils very numerous, but in comminuted fragments, 10 ft.
6. Marly, yellow, limestone. It is often flesh-coloured, and then shaly in appearance and weathering with a rough pitted surface,..... 2 ft.
7. Limestone like 4; full of the debris of fossils,..... 1 ft.
8. Limestone, brown and cherty; debris of fossils,..... 1½ ft.
9. Very pale blue limestone, often white; very hard and rough; weathers rugose like frosted glass. Thin and false-bedded; fragmentary shells, 15 ft.
10. Sandstone; yellowish white or greyish-white, ..... 6 inches
11. Coarse, gritty limestone, full of the debris of fossils; great abundance of *Foraminiferæ*, crinoid stems, *Fusus* (?) and fragments of a small bivalve, .... 3 ft.
12. Marly, dark grey-blue limestone; slaty cleavage, ..... 3 ft.

extent as it is now, and that the valley then became populated. The lakes, however, began to fill up again, and the whole of the valley was again converted into one immense lake. This in its turn was tapped and drained to its present state. The earthquake, which broke up the barrier or dam at Baramoola, is reported by tradition to have been the beneficent act of the Hindoo god Kashyapa. The Mahomedans, however, say that it is Kashaf, Solomon's minister, who performed the wonderful work, and it is very probable that both Hindoo and Musulmans borrowed the tradition from earlier inhabitants.

I hope to be able to prepare before long a paper "On the Lacustrine deposits of Kashmir," in which the proofs of two successive lakes having existed will be given in detail. See also my note to para 9, page 100.

- |                                                                                                                                   |          |
|-----------------------------------------------------------------------------------------------------------------------------------|----------|
| 13. Marly limestone, deep blue in colour, cherty in appearance and weathering rugose; it is compact and contains no fossils,..... | 15 ft.   |
| 14. A portion of 13, in a brecciated state, .....                                                                                 | 2 ft.    |
| 15. Same as 13,.....                                                                                                              | 12 ft.   |
| 16. Limestone similar to No. 2, .....                                                                                             | 2 ft.    |
| 17. Foraminiferous limestone, similar to No. 3, .....                                                                             | 8 inches |

This limestone contains many small yellow rounded bodies, mixed with the *Foraminifera* and appearing to have no organisation. They are perhaps excretions of mollusks. Also large patches of white, dotted, chalky, limestone which are, I believe, the remains of decomposed fossils of considerable size.

18. Argillaceous, pale grey, nearly white limestone. It gets coarse towards the top of the bed, and the uppermost layer is brecciated, ... 10 ft.

19. Indurated clay, ..... 1 ft.

20. Limestone varying in colour, being white, yellow, flesh-coloured, grey or pale lustreless blue. It is very argillaceous, occasionally sandy. The debris of fossils mostly encrinite-stems, ..... 10 ft.

21. Calcareous brown sandstone; no fossils, ..... 4 ft.

22. Shales, hard and without fossils. These shales are in places, fine, silty and foliated; in other places sandy, coarse and thicker bedded, 10 ft.

23. Sandstone like 21, ..... 5 ft.

24. Shales like 22, ..... 10 ft.

25. A repetition of the beds 22, 23 and 24; but the materials are generally coarser, the shales never being fine and thin-bedded, but rough and thick-bedded; and the sandstone contains so much lime that it passes in some places into a very arenaceous limestone. It contains but little of the debris of fossils, but shows some flat impressions like those of large flat *Algæ*. These impressions are, however, ill-defined and could not be identified, ... 25 ft.

26. Pale but bright blue limestone; very argillaceous and interbedded with thin films of yellow silt,..... 10 ft.

27. A second repetition of the beds 22, 23 and 24. A few shells, but no imprints of algæ. It becomes gradually a coarse sandy limestone, and at the top of the bed it is an argillaceous and arenaceous limestone, pale blue or rather French-grey, weathering rugose like frosted glass and containing a very few fragments of shells only, ..... 25 ft.

These three beds, 25, 26 and 27, seem to resist the influence of exposure better than the rocks above and below them, and they form at their outcrop a well defined ribbon; this, owing to the trifling angle of the dip, appears on the hill-side as a cliff which faces the city of Islamabad a little more than half way up the hill. These beds are slightly wavy along the strike, as if they had been pressed laterally. These undulations occasion trifling discrepancies in the dips taken in different parts of the hill. Along the line of our section, the cliff formed by the beds 25, 26 and 27 has a strike N. N. W.—S. S. E. and a dip E. N. E. 15°.

28. Limestone, patchy blue and yellow; argillaceous, ..... 20 ft.
29. Limestone, very argillaceous and having a pure lustreless grey colour, and being striped on section, owing to bands of a lighter colour. The rock is so compact and fine-grained that it resembles a fine greenstone in structure. It is traversed by bands of rougher stone and also by bands of blue limestone. It weathers rugose and pitted,..... 20 ft.
30. Limestone like 28, .... 20 ft.
31. Limestone like 29, ..... 15 ft.
32. Limestone, as white as chalk, but hard. It is full of geodes like an amygdaloid, the geodes being filled or lined with minute crystals of spar. The rock weathers in rounded bosses like granite or trap. It appears to have suffered a metamorphosis. It is probable that the calcareous mud which originally composed it was thrown into a bubbling condition by the infiltration of heated vapours or the immersion of hot volcanic products into a shallow sea. It presents no fossils or traces of fossils. The bed is not lenticular, but extends regularly along the strike the whole length of the hill, being conformable to the other beds, .. 5 ft.
33. Limestone similar to 31, ..... 5 ft.
34. Marly, dark bluish grey and rough limestone, ..... 5 ft.
35. Like 33 again ..... 15 ft.
36. Hard and cherty limestone, pale grey or flesh-coloured. It contains a few geodes like No. 32. It weathers pitted and rugose; no fossils (?) ..... 2 ft.
37. Limestone like 34, ..... 5 ft.

The last three beds are a good deal denuded, owing to their being at the top of the hill, which is narrow and barren.

46. There can be no doubt of the Islamabad hill being composed of Weean limestone; the argillaceous and arenaceous condition of the rocks is exactly what we have seen in other localities where this sort of limestone is developed. The fossils are very unsatisfactory, being extremely comminuted. I have found, however, one *Spirifera* and one *Athyris* which are to be seen in the beds at Weean. I have seen also many sections and outlines of large bivalves (*Aviculo-pectens* and unio-like *Anthracosia*) similar to those found near Mutton. The *Foraminiferæ* are also extremely numerous, and the fossil shell which gives on the surface of rocks an outline resembling a small pair of spectacles, is very common amongst the debris of comminuted shells. The upper beds of the hill, from 29 upwards, contain no fossils and have a peculiar appear-

ance, suggestive of their having been baked, and they weather in rounded bosses like many volcanic rocks. I have suggested that their amygdaloidal condition and their "metamorphic weathering" may be accounted for by the hypothesis that hot ejecta of volcanoes, either hot water, steam, hot ashes or a current of lava, had found their way into a shallow sea and set it a-boiling. It might be said that these very impure calcareous muds might have had gases generated in their interior by the decomposition of organic matter or some other cause; but many layers which are much more foetid and were therefore more likely to emit gases are not at all amygdaloidal, and besides, there is so much volcanic power manifested all over our tract of country, that it is more natural to invoke a little steam to boil mud with, than to look for less obvious hypotheses. But another reason in favour of volcanic metamorphism is, that these same white baked limestones have been observed in other localities, near Manus Bal in Kashmir and in the Kafir Kote mountain, in the Punjab, and in these localities they are disturbed by actions which appear to have taken place locally and to have affected these limestones much more than the rocks below them. The beds of Manus Bal will be described hereafter in these pages, and we shall be able to observe how faulted and twisted are the white limestones of that place. At the Kafir Kote there has been a similar local upheaval, and the disorder is very considerable. In this locality a felspathic sand, invaded by quartzite in tortuous branches, is the remains of the volcanic action which has taken place there, and the limestone, though much less marly than in Cashmir, is filled with geodes and veins of spar. I believe these actions to have been local and not very extensive; they had little effect on the Zeeawan bed which had, by the time they took place, become tolerably consolidated, and they merely fractured and pushed aside the nearest portion of the bed; but they acted powerfully on the yet soft and muddy Weean bed, curving it and twisting it in all sorts of manners and directions; and when these folds and twists were again disturbed, probably intensified and placed in new positions by the final upheaval of the Himalaya, they became what we see them now, viz. most incomprehensible doublings and reversings of strata. Let us also remember the beds which I mentioned as having been seen from the brow of the last spur of the Zebanwan

visited by me; these beds were the top or near the top of the series of Weean limestone seen along the section of the southern aspect of the Zebanwan between Zeeawan and Koonmoo. I said, "From the brow of the last spur I have visited, a fine view is obtained of the next spur, and this is remarkable for a great twist of the strata which compose it. The limestone is extremely white, and resembles chalk-cliffs at a distance." Is it not highly probable that there again we had the same altered limestone? The beds were wonderfully twisted and folded, whilst those above and below them were hardly affected.

I consider, therefore, that these altered limestones are portions of the Weean group, and I believe that the alteration was produced by bursts of water at a very high temperature, or of gases hot and compressed; the eruptive power of these agents being sufficiently powerful to displace and uplift the calcareous mud of the sea-bottom, a mud which must have been plastic, from the great admixture of clay it contained, and which was covered by no great depth of water. It is for such an action, as I have supposed, that Mr. Dumont has proposed the term of "Geyserian" action, and for the rocks precipitated from these watery volcanoes (such as the felspathic sand with quartzite of the Kafir Kote) the name of Geyserian rocks. The name is sufficiently suggestive and requires no explanation. It is probable that the quartzite which we have seen placed between the volcanic rocks and the limestone, belongs to that class of rocks.

47. The Arpat river runs through a district named Kothair or Kotehar, and it is from this district that I have named the uppermost bed of the Carboniferous(?) limestone of Kashmir. We have seen a small patch of this bed near Koonmoo, in the Zebanwan, but we will find the bed well developed in the next hills we are about to visit.

A few miles to the S. E. of Islamabad is a mass of well-wooded and picturesque mountains which separates the valley of the Arpat river from the Nowboog valley. Arekbal, Tippoo, Karpur, Dhar and Nawkan are summits which appear to form the centre of a small system of hills; their height is between 8 and 9000 feet, and they deserve careful study. I was unfortunately not able to do more than pay the most superficial visit to Arekbal and the iron mines of Kothair; and the following are the notes taken during that visit.

The rocks which overhang the well-known Arckbal Garden, near the western foot of the hill, are a rough grey limestone similar to the grey coarse limestone seen on the Islamabad hill, (see No. 27 of the section of that hill), full of sand and other impurities. It dips W. by S.  $52^{\circ}$ . There appear to be beds of shales between the limestone courses, and these shales by their decomposition furnish the fertile soil on which grow the fine forests of those hills.

The foot of the Arckbal hill is therefore Weean limestone and shales.

I then proceeded to the small village of Kothair, on the eastern side of the Arckbal hill, in a small valley situated between it and Karpur. The rock of the spur of Arckbal, which extends towards Pahaloo, is a whitish or greyish limestone with very few fossils, and interbedded with beds of calcareous slate, apparently belonging also to the Weean group.

From Kothair, the path to the mines, crosses a couple of small spurs which have a direction S. to N. until we arrive at the ridge which unites Dhar and Tippoo and has a direction W. N. W.—E. S. E. The spurs above mentioned are composed of marly limestone, either lustreless and velvety pale blue or dark blue, weathering frosted. The beds are very badly seen, on account of the vegetation and humus. Where the limestone crops out, it seems to be dipping S. E. or E. S. E. with a very variable but considerable angle. The beds of limestone appear to be separated one from the other by thick beds of shales and slate. The limestone has exactly the appearance of that seen a little higher up, and which we shall see contains fossils characteristic of the Kothair bed; but I failed, however, to find organisms in the present beds.

48. The iron-ore is obtained from the sides of the main ridge between Dhar and Tippoo. The ridge presents many beds of very argillaceous limestone of a lustreless bright blue colour, dipping S. S. W. with an angle of  $45^{\circ}$ . This limestone is remarkable for the large number of gasteropods it contains; it is also rich in corals, especially of the *Cyathophyllidæ*, but the fossils appear generally as sections or outlines on the surface of the rock, and I could not obtain any of them whole.

Between the courses of limestone are beds of slaty shales of various colours, but generally dark grey, brown or reddish. The outcrop of these shales has disintegrated and decomposed into a vegetable earth of a dark red colour and covered by grass and under-wood, and this earth has to be removed to bring the shales into view. In these shales the iron-ore is found as flat bands or ribbons of great tenacity and hardness, accompanied by softer ochrous clayey earth which is also used as an ore. The richest ore is the steel grey variety; this is not continuous as a regular bed, but forms bands or ribbons in the shale, sometimes thickening into a trunk a foot thick, at other times thinning into a flat ribbon a quarter of an inch thick.

The shales containing the iron-ore are about four feet thick, and are between beds of an arenaceous limestone which is blue and compact when freshly fractured, but weathers into a coarse, brown, nearly friable sandstone in the neighbourhood of the iron-shales. This change in the limestone (evidently produced by the infiltrating water becoming charged with peroxide of iron in its passage through the shale, and then acting as an acid on the limestone below the iron bed), is the indication sought after by the miners to dig an exploring hole; they dig above the altered limestone, and after removing a few feet of vegetable mould, discover the iron-ore in the upper part of the shaly bed. They make a hole just large enough to creep in and use a short miner's pick; the ore is difficult to detach, and, from the cramped position of the miner, the work is excessively laborious. The mines do not extend any distance under ground, and are generally abandoned in favour of a fresh hole, when artificial light is required to work.

From the examination of three or four of these small mines, I feel satisfied that the ore does not form a bed, but is arranged in a succession of ribbons and bands which run in the direction of the dip, sometimes anastomosing into a broad plane two or three feet across, sometimes thickening into a trunk or pocket, and sometimes dividing into thin and narrow ribbons which become lost in the shale.

The mines are all situated high up the hill (on this side of the ridge at least), within about 200 feet of the summit. The miner I had for a guide told me that no iron-ore is found lower down.

49. The ore is carried in kilters or baskets, carried on the back, by the means of shoulder-straps, to Kothair, a distance of two miles on a bad hill-path. It is not smelted nearer the mines, on account of the want of water; though it seems that it would be very much easier to bring up water for the miners, who only know of that element as a drink and therefore require but little of it, than to take the ore down to the village. The ore is broken into small fragments by children, and mixed with the ochrous earth and with coarsely powdered limestone. These materials are piled up in a small furnace about two feet high, with intervening beds of charcoal, and two hand bellows are used to create a blast; the smelting lasts about 12 hours, and the produce of a furnace is only a few seers. The heat is not sufficient to make the iron run; and it remains at the bottom of the furnace as a viscous mass, full of scoriæ, and very brittle when cold, with a tufaceous aspect. The slag is a black glass, compact, and much less scoriaceous than is customary. The iron is heated and beaten with hammers to refine it. It is short, probably from bad manufacture.

Two or three men and children and some women, all of one family, working as miners, carriers and smelters, turn out about two maunds of iron in the month from one furnace. There are only three furnaces at Kothair, giving a supply of six maunds of iron per mensem. There are similar mines at Loap and at Kookur Nag in the Bringh valley, on the southern side of the same mass of mountains. From the dip of the beds, it is probable that these works are in a much more favourable position than those of Kothair; they are said to be much more considerable; the ore is obtained in the same manner as at Kothair, and there are no regular mines. The ore is the same, according to my guide, a miner who had worked at Loap, but it is obtained much more easily and is found in thicker beds. Mr. Turner showed me some iron from Kookur Nag, and it appeared identical to the pig-iron of Kothair.

The turn-out I have given of the smelting at Kothair is not to be regarded as an indication of the richness of the mines. I believe that the miners only work the ore to pay their taxes to the Maharajah's government, and that their most usual occupation is to grow a little rice and Indian corn. I have no doubt that the amount of ore is

considerable, and that a large quantity of iron could be obtained by increasing the mines, and adopting better furnaces with a blast worked by water-power, windmill or horse-power; but the miners and other inhabitants of the villages take great care not to mention to the Maharajah's officials any valuable deposit of ore which may be worked with advantage; they pretend that the Maharajah takes away all the iron for his arsenal and pays nothing for it, and that, when a supply of any ore is discovered near a village, the inhabitants have to work it by *corvées*, so that the discovery of a vein of valuable mineral is a calamity to the people of the neighbourhood. But this is probably untrue in many ways: the iron they supply is, as I have said before, taken in lieu of taxes; the care with which many of the holes are concealed with rubbish and branches, induces me to believe that a good deal of iron is smelted in a contraband way; and last but not least, making a secret of mineral wealth is quite consistent with the love of hoarding riches so prevalent amongst natives. The same concealment of ores is now going on in Huzara, where a little iron is known to exist, and where the reason of the Kashmir miners would certainly not avail; and it is reported by the geological surveyors of the Ranigunj coal-field that it is impossible to believe negative reports from natives. In Kashmir, moreover, the Maharajah's government entertain the same childish fear, lest the mineral wealth of the country should become known, and I well remember with what silly recommendations of secrecy I was shown by one of the Maharajah's servants a small piece of iron pyrites of the most insignificant value.

50. The rocks we have described form the Kothair bed (of Carboniferous limestone?). They are a succession of courses of limestone, shales of a dark reddish or ochrous colour, dark slates and calcareous sandstones. I am sorry I cannot give a section, but the following remarks will, in a way, supply its want.

The limestones are of two descriptions, viz.: some coarse and very sandy, indeed so much so, that when the carbonate of lime is removed by water charged with peroxide of iron, a brownish sandstone is left; it contains no fossils, and passes gradually into a rough grey sandstone with a calcareous cement. The other variety of limestone is argillaceous, and passes into calcareous slate; it is dark blue or even

perfectly black when fresh-fractured, lustreless like a clay and with a strong earthy smell; it weathers much paler, becoming covered with an incrustation which is bright pale blue, yellowish or whitish; the surface being at first velvety or satin-like, and so fine-grained in some specimens, that drops of rain or of dew falling from grasses leave small blots or stains, which after a while becoming frosted. The fossils of this limestone are well brought out on the weathered surfaces, as outlines or sections which are slightly in relief. The shales when ochrous, are very sandy, sometimes calcareous, oftener not so; they contain beds of clay iron-stone in irregular and wavy tabular bands or ribbons of an iron black and bluish black colour, and also of yellow carbonate of lime, and iron in a more or less friable condition. These shales have a well-marked slaty cleavage cutting the strata at a right angle. The slate is black, thick and massive and contains no fossils. It often becomes pale green and unctuous, and is then very thin-bedded and exfoliating. The sandstone is composed of rounded grains of transparent glassy quartz which are brittle, and break across when the rock is fractured, and each broken grain reflects the light, so that the sandstone has somewhat the aspect of a micaceous sandstone.

The fauna of the Kothair bed is more remarkable for the abundance of certain animals than for any species that I can well define. *Gasteropoda*, generally small, and corals of the "*Cyathophyllidæ*" are nearly the only animals seen. A few bivalves, small and thin-shelled, also occur, but they are rare, compared to the quantity of gasteropods. A few roots and stems, generally small, have been observed in some beds, but could not be recognized.

The following fossils are the most usual in the Kothair bed,

*Naticopsis* ?

*Macrochilus* ?

*Chemnitzia* ?

*Loxonema* ?

*Nerinea* ?

The fragments of *Gasteropoda* in great number.

*Cyathophyllum* ? sp. Pl. VIII. fig. 2.

„ ? sp. Pl. VIII. fig. 3.

„ ? sp. Pl. VIII. fig. 4.

It is evident that a list of fossils, such as is given here, is insufficient to determine the age of a bed. My calling the Kothair bed Carboniferous, is therefore only temporary, and it is possible, and indeed probable, that the bed is either Permian or Triassic. I have often felt inclined to regard it as Triassic; but the total absence of *Monotis*, *Ammonites* and other characteristic fossils prevents my doing so. I have therefore preferred to represent the Kothair bed as the top of the Carboniferous series, until some characteristic forms be discovered. The Kothair bed was examined much more superficially than the others, owing to want of time; yet it is worthy of notice that I have never heard of an ammonite having been found in the valley of Kashmir, though the mountains of Kothair limestone, at the extreme eastern end of the valley, are very often visited by tourists and amateur geologists.

51. The Kothair formation differs from the Zeeawan and Weean by the great quantity of shales it contains, these being in thick strata between thin beds of limestone. The fauna is, I believe, strongly indicative of a low swampy shore bathed by a shallow brackish sea. The arrangement of the iron-ore is, I fancy, to be explained only by the hypothesis of a clayey shelving sea board: any one who has observed hot chalybeate springs issue from the earth, near a flat piece of ground, must have noticed the sluggish stream divide into rills and rillets, form shallow pools here and there, reunite and divide again, meandering over the clayey soil; he will have noticed the oxide of iron contained in the water precipitated along the rivulets and in the pools as a bright red peroxide, whilst the surface of the nearly stagnant water is covered by a many-coloured film. This, I would submit, is the very process by which the iron of the Kothair shales has been deposited on the flat muddy shore of the Carboniferous sea: the rills of chalybeate water have become the tabular ribbons of our iron-ore, and we have therefore the iron-stone arranged as a main flat vein, or rather in somewhat parallel veins, with irregular small shoots on both sides, and occasionally a thickened and widened mass representing a pool or a hole in the bed of the stream. Many springs, such as I have described, exist now-a-days in the Salt Range, near the Kafir Kote hill, and in several localities in the Himalaya; the iron mud they deposit would, under favourable circumstances, and in the course of long years, form beds

similar to the iron-ore of Kothair; and when it is remembered how essentially volcanic the Carboniferous period has been, it is no great stretch of imagination to assume, that much of the iron contained in the rocks of that period was derived from hot chalybeate springs, rather than from decomposed minerals on the surface of the earth.

Here ends the description of the Kothair bed. No rocks superior to it (excepting lacustrine and alluvial deposits) were seen in Kashmir, and the Kothair bed appears the most superficial stratum existing there. In other localities, both in the Himalaya and in the Punjab, Secondary and Tertiary rocks cover in the Palæozoic beds, but neither Oolitic, Nummulitic nor Miocene are to be seen in Kashmir proper, that is, between the Pir Punjal and the Ser and Mer chains, and between the northern branch of the Kaj Nag and the chain connecting the Ser and Mer chain to the Kistwar mountains.

52. As far as I could learn, the whole of the hills, which fill up with their spurs the south-eastern end of the valley, are composed of carboniferous limestone; this appears to go as far as the foot of the range which separates Kashmir from Maroo and Kistwar, where the limestone rests on volcanic rocks. *Producti* have been found among éboulis close to the volcanic rock high up the slopes, and it is therefore probable that the Zeeawan bed reappears under the Weean and Kothair beds, as we near the volcanic rocks. The river Bringh, which drains all the S. E. and a good deal of the east of the valley, carries in its bed boulders of volcanic rocks and of carboniferous limestone. No granite was seen.

As I have not visited these hills and possess only little information on their geology, I will not enter here into any detail of what may be inferred from reports received by travellers who are not geologists, and I must refer the reader to the map for the probable position of the several rocks which compose these hills.

53. To the N. W. of Srinuggur there is one more mountain belonging to the same catenated chain of summits which we have described in this chapter; it is the Safapoor, with its outlier, the Aha Tung, and the beautiful little lake of Manus Bal at its foot. This locality is interesting, and I will describe it in detail. (See Sections E and F; Section IV. of General Map). The Safapoor and the Aha Tung are both composed of volcanic rocks exactly similar to those which we have seen at the Tukt-i-Suliman and the

Zebanwan. In the small valley or gap between the two hills are beds of limestone which I will now describe. (See Section E; and also Sketch-Section F.)

Proceeding from S. to N., we first find at the northern end of the Aha Tung a limestone quarry. The limestone is about 120 feet thick, and dips south with a very high angle. It appears to be covered by beds of greenstone confusedly stratified; but on examining the bottom of the quarry, the courses of limestone are seen to bend towards the N., and the limestone is therefore superior to the trap. The

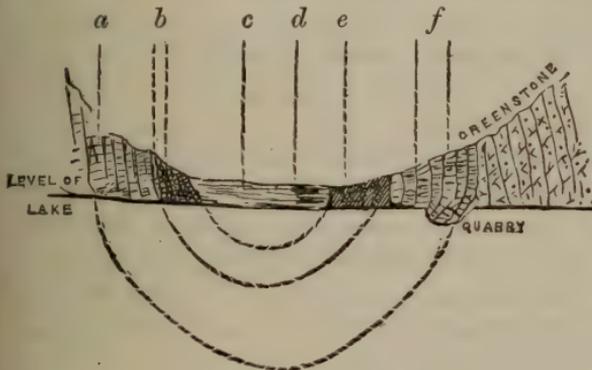


Fig. 9.\*

diagram here given fig. 9, represents the position of the rocks. I am indebted to Captain Godwin-Austen of the Great Trigonometrical survey for calling my attention to this bend of the courses of

limestone at the bottom of the quarry. If this curving of the limestone was not seen, it would be nevertheless easy to understand the true position of these beds, as they are precisely similar to those on the other side of the road (see Section), but in an inverse position: the rock nearest the greenstone is a glaring white and much altered limestone. It is succeeded by a dark, greyish, argillaceous limestone, weathering bluish and rugose. On the other side of the road, the dark limestone appears first, and underneath it the bed of glaring white altered limestone. There is therefore every evidence of a synclinal; but, of course, the discovery of the bend of the beds in the quarry completes the evidence very satisfactorily.

Taking our Section from the S. to N., beginning at the road and leaving out the beds redressed against the Aha Tung which I have just described, we have the following strata:—

1 Greyish-blue limestone; marly, rugose, hard, dips S. 60°, increasing to 70°; much broken bed: about ... .. 20 ft. thick.

\* a White Limestone.      b Dark Limestone.      c Alluvium.      d Road.  
 e Dark Limestone.      f White Limestone.

2. Pale limestone, weathering glaring white; filled with geodes, lined with small spar-crystals. No fossils. Dips S.  $80^{\circ}$ , ... .. 100 ft.

3. Thin-bedded, shaly, striped limestone, ... .. 5 ft.

Fault. It runs E.—W. and is about 10 feet wide at the top. It is filled with rocks similar to No. 3, folded in all directions.

4. Limestone like 3; vertical, ... .. 15 ft.

5. Pale limestone; with geodes, like 2. Traces of fossils were observed, but much altered and not recognizable, ... .. 100 ft.

6. Pale blue, shaly limestone; dips N.  $80^{\circ}$ , ... .. 3 ft.

7. Like 5; dips N.  $80^{\circ}$ , ... .. 50 ft.

Fault; it runs E.—W.

8. Same as 7, ... .. 50 ft.

9. Argillaceous, thin-bedded, pale grey limestone, breaking in flat thin pieces, like pottery, ... .. 80 ft.

10. Sandy limestone, hard and dark, ... .. 20 ft.

11. Conglomerate limestone, varying from a coarse sandy limestone to a perfect conglomerate, the pebbles being rounded, pieces of limestone imbedded in a soft calcareous paste. It contains many sections of the *Aviculopectens* and other large bivalves peculiar to the Weean bed. Portions of the bed are white and altered, ... .. 100 ft.

12. Sandy, micaceous, limestone; dark grey, ... .. 2 ft.

13. White limestone; no fossils, ... .. 15 ft.

14. Argillaceous limestone, blue and pale; weathering lustreless and velvety, ... .. 5 ft.

15. Conglomeratic limestone like 11, ... .. 50 ft.

16. Brecciated and sandy limestone; sometimes a coarse calcareous sandstone, ... .. 5 ft.

17. Ash-blue, pale, muddy limestone; weathering lustreless, ... 25 ft.

18. Brecciated and sandy limestone, ... .. 12 ft.

19. Ash-blue, pale and muddy; weathering lustreless, ..... 25 ft.

All these beds dip S. with an angle diminishing gradually from  $80^{\circ}$  to  $35^{\circ}$ .

20. This bed is the top of a well defined anticlinal. The rock is a yellowish-grey limestone, with rolled pieces of limestone imbedded. It is sandy, sometimes quite a sandstone, oftener a sandy impure limestone. It contains a great many remains of fossils. The southern branch of the anticlinal dips S.  $35^{\circ}$ ; the northern branch dips N. N. W.  $25^{\circ}$ . There is therefore a squeezing of the strata at the western end of the strike, and a divergence or opening of the fault at the eastern end. Thickness about 30 feet.

Then we get a repetition of the beds seen before, as follows:

21. Ash-blue, lustreless muddy limestone, ... .. 25 ft.

22. Brecciated and sandy limestone, ... .. 12 ft.

23. Ash-blue limestone, ... .. 25 ft.

24. Brecciated limestone, ... .. 5 ft.

25. Conglomeratic limestone, with sections of large bivalves, ... 50 ft.
26. Ash-blue, lustreless limestone, ... .. 5 ft.
27. White limestone, ... .. 15 ft.
28. Micaceous and sandy limestone; thin-bedded dark grey;  
dips N. N. W. 80°, .. .. 2 ft.
29. Conglomeratic limestone; gritty; in places a conglomerate, in others  
a breccia; dips N. N. W. 85° at first; then it becomes vertical and at last  
dips S. 80°, ... .. 100 ft.
30. Arenaceous limestone, dark, rough and forming a prominent ridge; it  
dips south 80°, ... .. 20 ft.
31. Thin-bedded, muddy limestone, breaking in pieces like pottery; dip  
irregular; bed folded and wavy, much disintegrated, ... .. 80 ft.
32. Shaly limestone, very impure; dips N. 80°.
33. Sandy limestone, dark and rough and hard; dips N. 70 to 75°. These two  
beds together are about, ... .. 30 ft.
34. Limestone, generally sandy and grey, but sometimes more compact and  
bluer, and then showing innumerable white lines crossing each other in all  
directions. It dips N. 70°, ... .. 100 ft.

35. These several varieties of limestone, viz. shaly and sandy, and blue with white lines, repeat themselves continually as far as the top of the hill, but the rock becomes more and more massive and presents portions of crinoid stems well preserved and petrified into a black spar. Sometimes the rock is flesh-coloured, and then the crinoid stems are lighter in colour, and weather in relief on the surface of the rock. These are the sections of crinoid stems which have been taken for nummulites by Mr. Vigne and Dr. A. Fleming. 150 ft.

The strike of the beds of limestone wheels more and more to a N. to S. direction. As we approach the volcanic rocks of the Safapoor, the dip becoming more and more westerly. This wheeling of the strike is well shown by the Sketch-Section (Sect. F), where we see the face of the limestone-courses uncovered and exposed, and facing the W. N. W. The thickness of the Weean bed is altogether 649 ft.

A large fault, well marked by a deep ravine, separates the limestone from the volcanic rocks. It runs N. E.—S. W. At the highest point the limestone is seen to attain, the fault is a mere crack, and the limestone is in contact with the volcanic rocks; but at the S. W. end of the fault, it widens considerably, and beds of limestone are to be observed on its northern side, applied against the trap and conformable and superior to it. The trap dips S. S. E.

On the western face of the Safapoor, long beds of well-stratified laterite and ash are conspicuous; they dip S. with an angle of 40.

54. Our section runs through the spur of limestone nearest to the lake; three other spurs, parallel to it, descend towards the village of Paturmoola (see Section F.). They present very won-

derful twists and foldings, but appear less altered than the beds which are bathed by the lake; their fossils are better preserved. I have not ascended these spurs, but amongst the *éboulis*, I saw many fossils characteristic of the Weean limestone, amongst others large *Aviculo-pectens* and *Anthracosia*, of which sections only had been discovered in the rocks in situ.

Some blocks of limestone were also found exhibiting *Gastropoda*, so conspicuous in the Kothair bed, and it is therefore evident that this bed forms the uppermost layers of the limestone of the higher spurs. I need hardly say, that the beds of Manus Bal belong to the Weean group, and that they have been folded and altered in part by volcanic action, subsequent to the formation of the volcanic rocks on which they rest. The order of the beds is from the anticlinal upwards on both sides of it, and the rocks nearest to the trap are the most superficial, excepting, however, the detached beds which are conformable to the volcanic rocks on the northern side of the great fault. If the limestone had been baked by the amygdaloid and the greenstone, we would naturally expect to find the beds nearest to these rocks most altered; the reverse is however the case; and we must therefore admit that a burst of hot gases or hot water had taken place at the time these limestones were still a soft and plastic mud, and that it upheaved, folded and metamorphosed them.

It must not be forgotten, that the limestone might have been much less folded by this first disturbing action than we see it now, when the last upheaval of the Himalaya took place: the beds then slightly folded would naturally give way in the same direction as they were already bent, especially if the space they occupied between two unyielding trappean hills had become so restricted that the limestone must of necessity either be folded or override the trap. On the application of such lateral pressure, a straight, flat, hard bed might have slid over the trap, but a bed already undulating would more naturally give way at the weakest parts, viz. the angles of the undulations, and thus become gathered in crumpling folds. Such folds are well shown in the Sketch-Section, (plate F).

55. Having terminated our examination of the several mountains which form the first catenated chain on the N. E. of the valley of Kashmir, we can now understand how this chain was once conti-

nuous, the several summits being re-united to one another by ridges of stratified ash, agglomerate and limestone. These connecting ridges have been denuded by the several streams which flow towards the bottom of the valley, and the limestone is now found only in limited beds, which have escaped denudation from the shelter they received of large and hard volcanic mountains. These streams and rivers, it is hardly necessary to mention, have had a volume very different from what we see now-a-days; the enormous layers of lacustrine conglomerate, which they have accumulated near their entrances into the valley, demonstrate plainly their former great denudating power. The direction of these streams being from the high mountains in the N. E., to the bottom of the valley in the S. W., they have cut for themselves channels which are directed from N. E.—S. W., and thus bands of the ridges, which united the summits of our first chain to those of the second chain, have remained between the channels of these streams, and given to those mountains the appearance of being long spurs descending from the N. E. to the S. W.

56. I shall, I hope, best terminate these detailed Sections, by appending a table of the fossiliferous and other rocks in Kashmir, together with such observations as the nature of the rocks or the fauna best justify.

| For-<br>mation     | Masses, Beds, &c. &c.                           | Fossils. | Conditions indicated.                                                                                                            |
|--------------------|-------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------|
| A. VOLCANIC ROCKS. | a. Granitoid porphyry; trachyte and felstone.   | .....    | Melted masses which have not flowed, or have flowed under water. Centres of volcanic action.                                     |
|                    | b. Greenstone amygdaloid, basalt.               | .....    | Melted masses which have flowed under water or in the air.                                                                       |
|                    | c. Felspathic and angitic ash; agglomerate, &c. | .....    | Volcanic ejecta falling in shallow water.                                                                                        |
|                    | d. Black slate, sometimes amygdaloidal.         | .....    | Mud derived from volcanic rocks, rearranged by shallow water, often heated by showers of hot ashes, vapours or currents of lava. |
|                    | e. Laterite, slate, baked clay.                 | .....    | Same origin and same conditions.                                                                                                 |
|                    | f. Quartzite.                                   | .....    | Geyserian action. End of the great volcanic eruptions approaches.                                                                |
|                    | g. Similar to e.                                | .....    | Occasional eruptions and slight fall of ashes and dust in shallow seas.                                                          |

| For-<br>mation    | Masses, Beds, &c. &c.                                                                   | Fossils.                                                                                           | Conditions indicated.                                                                                       |
|-------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| ORGANISMS APPEAR. |                                                                                         |                                                                                                    |                                                                                                             |
| B. ZEEAVAN BED.   | a. Crystalline limestone, coarse and with very few fossils.                             | Few.                                                                                               | Open sea coast, not very deep.                                                                              |
|                   | b. Massive limestone, granular, or crystalline.                                         | <i>Productus</i> ,<br><i>Orthis</i> , <i>Spirifera</i> , <i>Fenestellidæ</i> , <i>Orthoceras</i> . | Open sea coast. About 50 fathoms.                                                                           |
|                   | c. Ferruginous calcareous brown shales.                                                 | Same fossils.                                                                                      | Sea coast, not distant. Heavy water-fall on Volcanic islands.                                               |
|                   | d. Dark sandy shales.                                                                   | Same fossils.                                                                                      | Sea coast, not distant. Drift near shore. Heavy water-fall on Volcanic islands.                             |
|                   | e. Limestone, shaly, with shaly partings. Thickness = 200—250.                          | Same fossils; no <i>Bryozoa</i> .                                                                  | Sea becoming shallow; shore shelving and drifty.                                                            |
| FAUNA CHANGES.    |                                                                                         |                                                                                                    |                                                                                                             |
| C. WEEAN BED.     | a. Shaly and sandy limestone.                                                           | <i>Encrinites</i> ; small bivalves; Debris.                                                        | Shallow shelving, coast line.                                                                               |
|                   | b. Black argillaceous limestone.                                                        | Debris.                                                                                            | Shallow sea between islands.                                                                                |
|                   | c. Altered, amygdaloidal limestone.                                                     | None or mere traces.                                                                               | Local volcanic action; geysierian bursts of water or vapours. Earthquakes.                                  |
|                   | d. Flesh-colored limestone with lenticular beds of pale blue, nearly friable limestone. | <i>Anthracosia</i> ,<br><i>Aviculopectens</i> ,<br><i>Pectens</i> ,<br><i>Solenopsis</i> .         | Proximity of land; banks and shallows on a shelving coast-line.                                             |
|                   | e. Thin-bedded, argillaceous limestone, breaking in slabs.                              | <i>Goniatites</i> .                                                                                | Slow formation of fine silt in well protected creeks,                                                       |
|                   | f. Shaly, muddy, very foetid limestone, with gregarious fossils.                        | <i>Cyrtia</i> and small <i>Terebratula</i> .                                                       | Warm, damp and shallow sea, swamps, teeming with life.                                                      |
|                   | g. Argillaceous and arenaceous limestone paleless blue and yellow.                      | Debris of small thin bivalves. Roots of plants.                                                    | Very shallow sea-shore; sub-littoral oscillations; frequent freshes of fresh water carrying mud to the sea. |

| For-<br>mation  | Masses, Beds, &c. &c.                                | Fossils.                                         | Condition indicated.                                                                                        |
|-----------------|------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| FAUNA CHANGES.  |                                                      |                                                  |                                                                                                             |
| D. KOTHAIR BED. | a. Dark, blue or black argillaceous limestone.       | <i>Gasteropoda</i><br>and <i>Cyathophyllidæ.</i> | Protected creeks, rather swampy.                                                                            |
|                 | b. Slate and shale.                                  | None.                                            | Rivers bringing down mud to a shallow sea. Sublittoral oscillations.                                        |
|                 | c. Sandy limestone without fossils.                  | .....                                            | Drift on shallow shelving coast.                                                                            |
|                 | d. Shales; sandy shales; clay iron-ore in ribbons.   | .....                                            | Shelving low land near sea-shore, traversed by rills from hot chalybeate springs. Sublittoral oscillations. |
|                 | e. Limestone like a; passing into calcareous slates. | <i>Gasteropoda</i><br>and <i>Cyathophyllidæ.</i> | Shallow creeks or protected sea coast. Swamp with grasses? Shallows between tides?                          |
|                 | Thickness = 500 feet.                                |                                                  |                                                                                                             |

This succession of beds shows a steady shallowing of the sea. If we reflect for a moment how the sea bottom which received the limestone was formed, by volcanic ash and ejecta falling into the sea around the craters of numerous volcanoes, we would be led to expect a shallow shelving sea coast. Whether the volcanoes had existed for ages and prevented the development of life during the Silurian epoch, or whether they broke out after the Silurian beds had been deposited and buried these beds under their ejecta, I cannot say. It appears much more probable however that the volcanoes existed during the Silurian epoch, and prevented marine animals from living, by keeping the water at such a temperature or permeating it by such gases as were incompatible with life. However this may be, there can be no doubt that the volcanic ejecta were disposed in very gently sloping beds all around the volcanoes which produced them, and, as these ejecta were arranged by water, we would naturally expect the beds they formed to extend far into the sea. Hence a long shelving shallow coast would be formed, a coast which would speedily become more and more shallow from the enormous

amount of sand and clay which was washed into it from the volcanic islands which studded it, by a rain-fall of tremendous volume.

57. We have yet to describe the second and third catenated chains of Kashmir; the second is marked by the summits of Liwapatur (13,012), Churn Wolkalbul (14,310), Girdwali (14,060), Batgool (14,423), Boorwaz (13,087), Handil (13,273), Saijhaha (11,334), and joins the first parallel at the Safapoor on the eastern shore of the Woolar lake. On the other side of the lake, it is continued by the Kahoota, the Manganwar (8,728), and the Sheri Bal. These mountains are all composed of volcanic rocks and of azoic slate interbedded with ash and agglomerate. They need not therefore be described in detail. The Boorwaz, Handil and Batgool form a porphyritic mass which is generally described by travellers as granite; it passes gradually on the west into amygdaloid and greenstone to form the summits of Saijhaha over the village of Gunderbul. The transition between the porphyry and the greenstone is a feldspathic rock of a pale colour and imbedding very numerous transparent crystals of quartz, a description of rock which is also found to form a passage between the porphyry and the felstone of the Kaj Nag. From the examination of a few specimens, kindly given to me by travellers, I have no doubt that the whole of this mass of mountains is composed of volcanic rocks, volcanic ejecta and slate. I am not aware that limestone exists anywhere amongst the spurs of these hills. Between the valley of Thral or Trahal and the river Lidar, there is a great labyrinth of mountains with many of the summits enumerated above, but I could obtain no information regarding them. I therefore requested Captain MacQueen, of the Punjab Irregular Force, who had arranged a shooting expedition to these hills to be kind enough to bring me a few specimens of the commonest rocks of the country he was about to visit, and also any rock which appeared to him in any way remarkable. By the use of the specimens thus obtained, and the examination of Captain MacQueen's route on the map, I was enabled to ascertain that the whole mass of these mountains is composed of the same volcanic rocks, which I have described in detail at the Tukt-i-Suliman and the Zebanwan. Ashes appear to have been accumulated in enormous quantity; they are interbedded with bands of black compact slate such as is so well seen

in the Wastarwan and Zebanwan, and both ash and slate are occasionally cellular or amygdaloidal. There is neither limestone, granite or porphyry among Captain MacQueen's specimens, and I believe therefore that the two last rocks at any rate do not occur in these mountains, as pieces of granite and porphyry generally attract the attention amongst the dull ash-rocks and would not have failed to form part of the collection, if they had existed. It is very possible that remains of beds of limestone are to be found amongst the spurs of the hills.

On the north of the Woolar Lake, many mountains of no great height form a sort of amphitheatre. They are nearly entirely composed of amygdaloidal greenstone, ash and slate interbedded, but near the village of Bundipoor, about two miles east of the road, some beds of limestone are seen. Mr. Drew has kindly sent me some specimens of it that are a flesh-coloured, sometimes greenish, very arenaceous and argillaceous. They are not at all crystalline, but contain an enormous number of encrinite stems transformed into spar with a cleavage oblique to the axis of the stem, so that when the section of a stem weathers, it appears striated across. This crystallisation has destroyed the structure of the stem, but the central canal is seen in a few specimens. We have seen this rock well developed at Manus Bal, towards the end of our section, where the beds of flesh-coloured limestone alternate with grey sandy limestone containing crinoid-stems transformed into a spar as black as coal. (See 35 of the section of Manus Bal). The limestone of Bundipoor is therefore Weean limestone.

On the west shore of the Woolar lake, the Taltiloo and the Chalkoot present perpendicular cliffs of volcanic rocks descending into the water. From a boat on the lake, it is easy to observe the usual thick and confusely bedded masses of greenstone and amygdaloid forming the centre of these hills, and the more sloping and regularly stratified layers of ash, laterite, agglomerate and slate well developed, in the long spurs which descend on all sides. The whole mass of hills appears to be made of volcanic rocks, and the lowest spurs which approach the shore of the lake present no fossiliferous beds. Of the higher peaks, the Kahoota, Manganwar and Sheri Bal, I know nothing, but there can hardly be a doubt, however, of their being volcanic in their formation.

58. The third catenated chain is composed of summits of great height, the Gwashbrari (17,839), the Harbagwan (16,055) the Basmai (15,652), and the Haramook (16,903), and many other peaks which, with their spurs and connecting ridges, separate Kashmir proper from Tillail and Gurais. All these high summits are formed by porphyry having a granitoid appearance, which passes, towards the north, into felstone generally earthy and similar to the earthy felstone of the Atala Mount near Baramoola. On the north-western extremity of the chain, this felstone becomes continued with that of the great chain of hills which unites the Kaj Nag to the Ser and Mer chain. This flaggy rock is continued to near the city of Gurais where, in the valley of the Kishengunga, beds of limestone appear extending from about 15 miles N. W. of Gurais to Tillail. The limestone is, after a break, continued at the Sono Murg and is in all probability identical to that of this locality. I have never seen any specimen or fossil from the Tillail limestone, but the Sono Murg limestone is Carboniferous, and it is most probable that the Tillail limestone, which appears to be the continuation of that bed, belongs to the same epoch.

Due north of Sono Murg, the limestone is much developed and forms the summit of a considerable peak.

The porphyry-centres of mountains pass towards the south to rocks of an appearance different from that of the northern spurs; while we have seen that, towards the north, the porphyry generally graduates to a felstone more or less earthy. Towards the south it changes, as we travel from the peaks towards the end of the spurs, into trachyte, greenstone, amygdaloid, basalt, ash and agglomerate, together with interstratified, azoic and often amygdaloidal slate.

The northern spurs of Gwashbrari, the Harbagwan and the Basmai are composed of felstone, and near the road to Drass, in the valley of the Sind Torrent, of amygdaloid and ash. On these beds of ejecta rest fossiliferous beds, and, near the small village of Sono Murg, the beds of limestone are well developed. Captain Godwin-Austen found in that locality some fossils which he was kind enough to show me. They were identical with the forms described as characteristic of the Kothair group of Carboniferous limestone, viz, the *Gasteropoda* and *Cyathophyllidæ* which are represented at Pl. VIII.

fig. 4, 4a. They occur in a thin-bedded, dark-grey, argillaceous limestone, having in some places the appearance of a calcareous slate. But beds of Weean limestone must exist not far from Sono Murg and form probably some of the beds of limestone which are seen in the high valley between the Ambernath and the Gwashbrari, as blocks of limestone of this description, rounded by running water, were found in the bed of the Sind, near the traveller's home at Sono Murg.

*To be continued.*

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EXPERIMENTAL INVESTIGATIONS *connected with the supply of WATER from the Hooghly to CALCUTTA, by DAVID WALDIE, Esq. F. C. S. &c.*

[Received 31st August, 1866.]

The attention which of late years has been given amongst civilized communities to the preservation of health and prevention of disease, has naturally been directed amongst other subjects to that of the water employed for economical purposes, and more particularly to its purity and wholesomeness as a beverage and as the medium for the preparation of food. The subject has been under the consideration of the municipal authorities of Calcutta, who, as is well known, have organised a scheme for the supply of the town from the river Hooghly, for the carrying out of which arrangements are now in progress. The Sanitary Commission appointed some time ago in the Bengal Presidency, and I believe in the other Presidencies also, recommended to the several governments of the Subdivisions, that the water of the various cantonments and stations should be subjected to chemical analysis for the purpose of ascertaining their wholesomeness, and these recommendations are in course of being carried out.

In England, and more particularly in the metropolis, much attention has been given to the same subject, and also to another one closely connected with it, namely, the disposal of the sewerage of towns. This subject is connected with that of water supply, not only, because in the plan generally followed for getting rid of sewerage in towns, a large

supply of water is necessary, but also on account of the circumstance that in many cases the readiest way to dispose of the liquid sewerage is to turn it into rivers. And as it frequently happens that these rivers may afford the easiest or perhaps the only practicable source of supply of water for other towns, the pollution of their waters so produced may be not a little deleterious. From the enormous extent and population of the English metropolis, and the comparatively small size of the river on which it stands, the evil in that case has become palpable and notorious. The most eminent chemists and engineers have been engaged in the examination of the subject as respects both the supply of water and disposal of sewerage, and the results of their enquiries have been published and subjected to public criticism and discussion.

So far as I am aware, nothing has yet been published of the results obtained by the examination of the waters of the Military cantonments of India, nor do I know if it be intended that anything shall be. With respect to the Calcutta supply, as is well known, a series of analyses has been made, and a Report of results and conclusions drawn out, by the Chemical Examiner to Government, Dr. Macnamara. That report, no doubt from being intended for a non-professional, and (regarding it collectively and officially) not a professedly scientific body, gives only results and conclusions, omitting altogether the details of analyses and the specification of the methods employed. Dr. Macnamara's attention seems to have been directed chiefly to the water of the Hooghly, to ascertain the proper point nearest to the town from which a supply of water of sufficient purity all the year round could be obtained. The examinations were made on samples from Cossipore, Pultah Ghat near Barrackpore, and Chinsurah. The general conclusion arrived at is, that the influence of the tide is little felt at Chinsurah at any period of the year, not much more at Pultah Ghat, except towards the close of the hot season in May and June when it is decidedly perceptible though not great, and not only decided but to a large amount at Cossipore during the months of March, April, May and June; and that the river water from its admixture with sea water and the sewerage of Calcutta during that time is unfit for human consumption. The organic matter is stated to be much larger in quantity during these months than at other periods, and also to be highly nitrogenized; the quantity amounting to 6 or 7 grains or even 10 or

12 grains per Imp. gallon during the months of April, May and June; and this increase in quantity and deterioration in quality is considered to be due to the organic impurity from the sewers and banks at Calcutta. The analyses, I may observe, were chiefly made on samples taken at high water, obviously to get the water at its worst. Analyses are also given of the waters of two tanks in the Maidaun or plain round Fort William, namely Monohur Doss's Tank and General's Tank, which are considered as unquestionably superior to the river water.

I may observe that, when I commenced this investigation, it was not in connection with the water supply of Calcutta at all, or even in connection with the economical use of water or its wholesomeness as a beverage. These enquiries had been placed in the hands of others; but it occurred to me, that residing, as I did, on the banks of the Hooghly, and possessing certain facilities for the purpose, it might be a contribution to science of some small value to make a minute examination of the constituents of both the water and the mud of a great river draining so large an extent of country as the Ganges. The investigation is as yet far from completion, but during its course, it occurred to me that many of the results obtained might have some value in relation to the subject just adverted to—the economical use of water; and that the local interest attached to it might render it in some degree appropriate to publish these results, more particularly at a time when all the knowledge attainable connected with the subject is desirable.

This communication then is not intended to present a full statement of the composition of the Hooghly water, but only to treat of such points as are of more particular interest in connection with its application to supply the wants of the inhabitants of Calcutta. And indeed this is all that is necessary for the purpose in view. As regards the general composition of the river water at different seasons of the year, my own results only go to confirm those already given in Dr. Macnamara's Report, but in some particulars, not of minor importance, the results I have obtained and the conclusions drawn from them are somewhat different; and in other particulars it may be found that I have added to the stock of information on the subject.

It is scarcely necessary to allude to the course of the seasons in Bengal and the way in which they affect the river. But for

convenience I shall briefly state how I shall speak of them in what follows. From the middle of June when the rains generally commence and the river rises, till the end of October or middle of November, when the rains have ceased and the river is rapidly falling, I shall speak of as the rainy season; thence till the end of February as the cold season; and thence again till the rains recommence as the hot season. The first is identical with Dr. Macnamara's "Full season," the two latter with his "Low season."

During the rains, the river comes down in full stream from the parent Ganges through the effluents which unite to form the Hooghly, viz. the Bhagiruthy, Matabangah and Jellinghy, with contributions from other tributaries from the west. During that period, and more particularly during its earlier part, the water is loaded with mud in a very fine state of division and very slow in settling. As the season comes near its termination, the water becomes clearer, and remains so during the cold season, any mud in suspension rapidly settling. The water, which during the rains naturally contained the smallest proportion of saline matter, now contains more, the proportion gradually increasing till the end of February, the first increase having been more rapid at the stoppage of the rains. All this, of course, is the natural and obvious result of evaporation without any rainfall to supply the place of the lost water, aggravated by the diminished supply of water from the Ganges caused by the bars at the entrance to the tributary effluents. These causes operate with still greater power during the hot season, aided by strong southerly winds and powerful tides. During this season the mud is stirred up, and the water rendered more dirty, but the mud is not in the same state as during the rains, and settles without difficulty. The influence of the tides becomes increasingly felt as the season advances, and the admixture of sea water becomes unmistakable.

The following table exhibits the results I have obtained as respects the amount of solid residue obtained by evaporating the water. They are given for 100,000 grs. of water, instead of the Imperial gallon used by Dr. Macnamara. By multiplying by 7 and dividing by 10, the quantities per gallon are obtained.

*The following Table showing the amount of solid matter dried at 212° to 220° Fah. in the river water at ebb tide, at a point from two to three miles above Calcutta.*

TABLE I.

|                                               |        | For 100,000 grs. | For 70,000 grs.<br>or Imp. gall. |
|-----------------------------------------------|--------|------------------|----------------------------------|
| 1865                                          |        |                  |                                  |
| August 31st, 1865, including very fine clay,* | Ebb,   | 12.13            | 8.41                             |
| December 6th,                                 | Ebb,   | 24.00            | 16.80                            |
| 1866                                          |        |                  |                                  |
| February 25th,                                | Ebb,   | 30.00            | 21.00                            |
| May 2nd, spring tide,                         | Ebb,   | 36.20            | 25.34                            |
|                                               | Flood, | 88.50            | 61.95                            |
| 24th, Neap tide,                              | Ebb,   | 21.25            | 14.88                            |
| June 14th, spring tide,                       | Ebb,   | 30.70            | 21.49                            |
|                                               | Flood, | 151.90           | 106.33                           |
| July 6th, including very fine clay,*          | Ebb,   | 12.59            | 8.81                             |
| August 8th, clay and some silica deducted,    | Ebb,   | 8.13             | 5.69                             |

These numbers confirm the results exhibited by Dr. Macnamara's report, making allowance for difference of seasons. They shew clearly the increase of solid contents more especially during the dry season. And here I may remark that samples were chiefly taken during ebb tide, as my primary object was the examination of the river water proper, and it was only during the hot season that particular attention was paid to the state of tide, after my attention had been directed in part to what is the special object of this paper. And indeed, except during the hot season, the composition of the water is little affected by the tides.

And further, as the object was to make a full analysis of the water at several different seasons, I did not adopt the readiest or simplest methods of merely comparing the water at different periods for sanitary purposes, which would have been done, had that been my primary object. The methods adopted will be noticed in due course.

The preceding table exhibits a very great variation in the amount of solid constituents during the hot season, owing to the influence of the tides, a subject which will be separately considered.

\* These waters had settled well—that of August 1865 for 19 days, that of July 1866 for about 35 days, yet by comparison with that of August 1866 it will be observed that about one third of their solid contents was fine clay.

*Influence of the Tides.*

It will indeed be convenient to take up this subject first in order. Dr. Macnamara's results exhibit very clearly the increased quantity of saline constituents during the hot season, commencing in March, and coming to its height just before the commencement of the rains. His table shews as much as 77.7 grs. dry saline residue from 1 gallon of water at high water on 12th June, 1862. I obtained from water taken at full spring tide, on 14th June of this year 1866, as much as 106.3 grs. per Imp. gallon. This is easily accounted for when it is found, as ascertained from examination of the rainfall, that from June 1861 to end of May 1862 there had fallen 87.4 inches of rain, while during the corresponding period of 1865-66 there had been only 47.9 inches: the river must have been much lower and its current feebler, and consequently the sea water had penetrated farther. My observations were all made on water taken from the river near my own residence at the village of Baranagur or Barnagore, with a few exceptions which I shall notice afterwards. The locality is about two miles above Cossipore. But I made observations also on the effect of time of tide.

This point is also noticed in Dr. Macnamara's report, though not very fully. He mentions that the water varies much in the degree of its impurity with the time of tide, falling as low during April and May as  $23^{\circ}$  at low water, that is, 23 grains of saline matter in 1 gallon. My observations indicate even a greater amount of variation than is by this suggested, as will be shown by the table I have prepared. As the evaporation to dryness and weighing the residue of numerous samples is very tedious and troublesome, another plan was adopted for estimating the amount of variation. The river water proper contains very little chlorine in its composition, while in the state of common salt this is the characteristic constituent of sea water. The quantity of chlorine was therefore ascertained by the usual volumetric process with nitrate of silver, and calculated as if it existed entirely as chloride of sodium or common salt, which afforded a very good means of comparing the samples and estimating the proportion of sea water present.

I endeavoured to make some observations further up the river, but found that it could not be done properly except with an expenditure of time, trouble, &c. that I could not devote to it. Any observations that I did make were only confirmatory of Dr. Macnamara's results.

The following table exhibits the results of my observations on the

influence of the tides. The change of course is gradual, commencing in March and increasing as shewn by Dr. Macnamara's report. I did not make observations until the first of May.

TABLE II.

| <i>To compare Ebb and Flood Tide.</i>                  |                                      | Chlorine calc.<br>as Chloride<br>of Sodium. | Saline matter dried<br>at 220° F. |                                  |
|--------------------------------------------------------|--------------------------------------|---------------------------------------------|-----------------------------------|----------------------------------|
|                                                        |                                      |                                             | For<br>100,000<br>grs.            | For<br>100,000<br>grs. Imp. gal. |
| 1866 a mile above Baranagar—                           |                                      |                                             |                                   |                                  |
| May 1st, second day of full moon.                      |                                      |                                             |                                   |                                  |
|                                                        | Low water nearly complete, .....     |                                             | 28.0                              | 19.60                            |
|                                                        | High water nearly complete, Surface, |                                             | 61.55                             | 43.08                            |
|                                                        | Deep,                                |                                             | 59.55                             | 41.68                            |
| At Calcutta—                                           |                                      |                                             |                                   |                                  |
| 2nd, third day of full moon,                           |                                      |                                             |                                   |                                  |
| {                                                      | About $\frac{7}{8}$ Ebb, stream,     | Surface,                                    |                                   | 36.20 25.30                      |
|                                                        | Opposite Bankshall.                  | Deep,                                       | 15.50                             |                                  |
| {                                                      | About $\frac{3}{4}$ Flood, stream,   | Surface,                                    |                                   | 88.50 62.19                      |
|                                                        | Opposite Hatkolah.                   | Deep,                                       | 55.50                             |                                  |
| At Baranagar—                                          |                                      |                                             |                                   |                                  |
| 16th, third day of new moon,                           |                                      |                                             |                                   |                                  |
|                                                        | Above 1 or $1\frac{1}{2}$ hour Ebb,  | Surface,                                    | 40.00                             | 66.40 46.48                      |
|                                                        |                                      | Deep,                                       |                                   | 68.60                            |
|                                                        | Above $\frac{3}{4}$ Flood,           | Surface,                                    | 78.00                             | 107.20                           |
|                                                        |                                      | Deep,                                       | 75.00                             | 109.00 76.30                     |
|                                                        | Nearly high water complete, Surface, |                                             | 82.50                             | 104.70                           |
|                                                        | Deep,                                |                                             | 80.00                             | 106.20                           |
| <i>To shew state at Neap tide.</i>                     |                                      |                                             |                                   |                                  |
| 24th, fourth day of first quarter of moon.             |                                      |                                             |                                   |                                  |
|                                                        | 1 hour after beginning of Ebb,       | Surface,                                    | 17.50                             |                                  |
|                                                        |                                      | Deep,                                       | 18.50                             |                                  |
|                                                        | 3 hours after do.                    | Surface,                                    | 12.50                             | } 21.25 15. <sup>05</sup>        |
|                                                        |                                      | Deep,                                       | 11.50                             |                                  |
| <i>To shew rate of change during<br/>Ebb and Flow.</i> |                                      |                                             |                                   |                                  |
| May 30th, third day of full moon.                      |                                      |                                             |                                   |                                  |
|                                                        | At shore 5 h. before tide begun, ... |                                             | 27.00                             |                                  |
|                                                        | 2 h. before do, .....                |                                             | 21.50                             |                                  |

|                                     |          |        |                |
|-------------------------------------|----------|--------|----------------|
| Stream, above 4 hours flood,.....   | 64.00    | 83.85  | 58.7           |
| June 1st, fifth day of full moon.   |          |        |                |
| 5 h. 10 m. before tide begun, ..... | 35.00    |        |                |
| 1-20 ditto ditto, .....             | 16.50    |        |                |
| 2-10 after ditto, .....             | 26 50    |        |                |
| 5-10 after ditto,                   | Surface, | 69.50  |                |
|                                     | Deep,    | 58.50  |                |
| 14th, third day of new moon.*       |          |        |                |
| Tide commencing about noon,         |          |        |                |
| At 6 h. 40 m. A. M.                 | Surface, | 63.50  |                |
|                                     | Deep,    | 65.90  |                |
| 11-5 A. M.                          | Surface, | 15.00  | } 30.7 21.49   |
|                                     | Deep,    | 14.00  |                |
| 2-20 P. M.                          | Surface, | 71.00  |                |
|                                     | Deep,    | 85.50  |                |
| 4-20 P. M.                          | Surface, | 123.00 | } 151.9 106.33 |
|                                     | Deep,    | 126.00 |                |

The water was collected either by filling vessels from the surface, or in the case of the deep water by lowering a tin bucket provided with proper valves. The much larger quantity of heavier mud brought up by the bucket proved that it acted properly. The water was collected in almost every instance under my own personal superintendence.

The collection was made by means of an ordinary small boat or dinghy. The changes of position which could not be avoided account for the irregularities between the surface and deep waters, taking into account the strong currents and eddies that prevail.

The table exhibits the great influence of the tides: taking the extreme case of 14th June after long drought, just two days before the rains commenced, we have in 100,000 fl. grains of water 151.9 grs. solid matter at high water, and 30.7 gr. at low water, or nearly 5 to 1; while comparing the Chlorine as Chloride of Sodium or common salt, the proportion is fully 8 to 1. These great differences occur chiefly at spring tides. The results of 24th May shew how comparatively small this is at Neap tides, 19 grains of salt at nearly high water to 12 grs. at nearly low water.

\* Highest tides are on third day of new or full moon.

A study of the particulars of this table shews that the period during which the water can be obtained with the smallest admixture of sea water is during the last three or four hours of ebb tide and the first one or two of flood. From tables of the analyses of the waters supplied to London which I shall have to refer to more particularly afterwards, it appears that the water of five Thames Companies contains at an average from 26.41 to 26.97 grs. of saline matter per 100,000 ; and that of four other Companies,—two river waters contain about 26 grs., and two artesian well waters contain from above 38 to 40 grains. The Hooghly water at Baranagur therefore even during the hot season at ebb tide contains little more solid matter than the Thames water, but probably a larger proportion of this is salt.

*Constituents of River Water proper.*

We have now to direct our attention to the river water proper, which we may consider that we can get from the Hooghly at different degrees of dilution all the year except three or four months of the hot season. The water of rivers is of course in greater part generally water fallen from the atmosphere. Aided by the carbonic acid of the atmosphere, it acts upon rocks, even silicious rocks, producing a certain amount of decomposition and carrying off their constituents partly in solution, partly in suspension as mud ; it carries off similar constituents from the soil, which consists of decomposed rocks ; and also from this source a quantity of organic matter, the result of the decomposition of vegetable and animal substances, as also the excrementious matters deposited there. Except in special circumstances the water of rivers generally contains a rather small proportion of alkaline salts in the state of silicates, sulphates, chlorides and carbonates, with a larger proportion of carbonates of lime and magnesia kept in solution by excess of carbonic acid gas. They differ from spring or deep well waters and agree with surface waters generally in containing a notable proportion of potash as well as soda, and also more silica, phosphates, earthy carbonates and organic matter, and sometimes ammonia and nitrates, than deep spring waters do. When brought in contact with argillaceous deposits, they part with their potash, ammonia, silica, phosphoric acid and organic matter, while the soda, lime, magnesia, sulphuric acid and chlorine are generally retained, forming the usual constituents of spring waters. This subject is treated of fully in an Essay on the

Chemistry of natural waters by Mr. T. Sterry Hunt, which will be found\* well worthy of perusal.

I am not aware whether much consideration has been given to the peculiarities of the constitution of such surface waters in regard to their mineral constituents and their action on the animal economy, except in the case of the abundance of earthy carbonates. This, however, is perhaps the least characteristic of these constituents, as many spring waters abound in earthy carbonates, or at least in earthy salts, sulphates and muriates of lime and magnesia. More characteristic is the deficiency of muriate of soda or chloride of sodium in the surface waters and its comparative abundance in spring waters. Soda is the characteristic alkali of the components of the human body, but some curious observations have been made by physiological chemists on the relative proportions of the two alkalies in different parts or tissues of the system; and though it is stated in these cases that the peculiarities exist entirely irrespective of the nature of the food taken, it would scarcely be warrantable to assume as certain that such differences in the predominance of potash or soda in food or drink are entirely destitute of influence. The point is at least worth bearing in mind.

Phosphoric acid, when present, exists in such small quantity that only in very minute analyses is it sought for by the analyst. Silica is found much more generally. From its neutral and indifferent character, much attention has not been given to it in its influence on animal bodies. But attention has been given to all of these substances in relation to vegetable physiology, as plants draw their food directly from the soil in part at least, and the nature of its constituents is therefore of immediate importance.

To the other constituents I have mentioned, namely organic matter with the products of its decomposition, including ammonia and nitric acid, more attention has lately been paid in connection with water to be used for human consumption. Indeed this may be said to be the principal point to which the analysis of waters selected on sanitary considerations has of late been chiefly directed.

The water of the Hooghly has a composition similar to that already given as that of river waters generally. According to Dr.

\* Silliman's American Journal of Science for March, July and Sept. 1865.

Macnamara's report, in the month of August there was in 1 gallon of water 1.2 grains of soluble salts and 5.4 grs. of insoluble earthy salts, beside silica and organic matter, and in February 1.8 of soluble and 13.4 of earthy. Or, as I prefer to express it, there was in August 1.7 grs. alkaline salt and 7.8 grs. earthy carbonates in 100,000 fl. grs., and in February 2.6 alkaline salt and 19.1 grs. earthy carbonates in the same volume. The first represents the water in its most diluted state during the height of the rains, the last in its most concentrated state at the end of the cold season, just before tidal influence begins to be felt. I do not intend to give any of my own results, partly because a full analysis of the water is not the object of this paper, and partly because a circumstance entirely unforeseen and unexpected has thrown doubts on the correctness of some of those obtained, and I do not wish to give them in an imperfect state, as they cannot be corrected until the return of the cold season gives me a new supply of water. It is sufficient to say that they do not appear to differ materially from those given in Dr. Macnamara's report. The only point to be noticed is, that Dr. Macnamara, in accordance with the usual custom, where minute accuracy is not required, assumes that the alkali is soda. Both potash and soda, however, are present in the river water; to what extent they vary, I have not yet ascertained. During the hot season, from the increase of common salt from tidal water, there is of necessity a great increase in the proportion of soda in the state of common salt.

The alkaline salts consist of potash and soda in combination with sulphuric acid, silicic, and probably hydrochloric acid (or more strictly their metals combined with chlorine) and perhaps some organic acid. The earthy salts are carbonates of lime and magnesia, kept in solution by excess of carbonic acid. On evaporation nearly the whole of the lime and magnesia separate as carbonates insoluble. Besides these there are a few minute constituents to be noticed afterwards. The only particular now to be noticed is, the different proportion of solid constituents in the water at the two extremes; in August there is 9.5 grains of alkaline and earthy salts in solution in 100,000 fl. grs. of water, in February there is 21.78 grs. or about two and a quarter times as much. This great difference is of course due to the nature of the seasons in Bengal, where almost all the rain falls during four or five continuous months.

It may be useful to refer for the purpose of comparison to the composition of some other waters supplied to towns, and I shall take for that purpose one of the most recently published reports on the subject, namely, that by Professor Frankland on the water supply of London during the year from February 1865 to January 1866.\* The only points determined connected with the mineral constituents are the total amount of saline matters and the amount of earthy salts as ascertained by the soap test; this, as is well known, being the application of the familiar fact that hard water curdles soap, to ascertain its purity; a solution of known strength of soap being added to a measured quantity of the water to be examined from a graduated tube, until the curdling effect of the salts of lime and magnesia which cause the hardness is exhausted, and the water produces a lather on shaking. The quantity of soap required indicates the amount of earthy salts present; an easy and speedy means of obtaining a sufficiently good estimate of the amount of earthy salts in water.

By deducting from the total solid matter first the amount of organic matter, the total inorganic is obtained; and by deducting from this the amount of carbonate of lime, the remainder will indicate, with sufficient approximative accuracy, the amount of alkaline salts. Here are the results of this proceeding—for the waters of

|                                   | Five Thames<br>Companies<br>average. | New River<br>and River<br>Lea. | Kent and S.<br>Essex Co.'s<br>Artes. Wells. |
|-----------------------------------|--------------------------------------|--------------------------------|---------------------------------------------|
| Total solid matters, mean         | 26.63                                | 26.11                          | 39.03                                       |
| Deduct organic and volatile, mean | 1.60                                 | 1.30                           | 1.73                                        |
|                                   | —                                    | —                              | —                                           |
|                                   | 25.03                                | 24.81                          | 37.30                                       |
| Carbonate of Lime                 | 17.69                                | 20.65                          | 25.16                                       |
|                                   | —                                    | —                              | —                                           |
| Alkaline salts                    | 7.34                                 | 4.16                           | 12.14                                       |

It will be observed that the alkaline salts are in much larger proportion to the earthy carbonates than in the Hooghly water, this being specially the case in the Artesian well waters. The waters of New River and River Lea come nearest the Hooghly. The amount of solid matter is much greater in the average than that of the Hooghly river

\* Journal of the Chemical Society, June 1866.

water proper, the mean indeed being nearly as much as the maximum of the Hooghly before tidal influence begins. The amount of variation is much smaller in these waters: of the Thames water the highest quantity of solid matter was 32.62 grs. the lowest 18.78, and the well waters vary less. And it was observed that the quantity of solid matter tended to increase after heavy rain fall.

Other river waters contain more or less of such constituents, dependent on the nature of the rocks and soil they traverse. Mr. Sterry Hunt gives an analysis of the Ottawa water, taken before the melting of the snows, containing 6.12 grs. solid in 100,000. Bischoff, in his *Chemical Geology*, gives a pretty large list of analyses of river waters, showing a variation of from 2.61 to 54.5 grains solid matter in 100,000. The nature of their mineral constituents also varies greatly, but that will not engage our attention at present as it is more a geological question than a sanitary one. We shall proceed to the point more immediately connected with the object of the paper.

The substances treated of can scarcely be called impurities with reference to natural waters. They are rather constituents, and are only to be considered impurities in a sanitary point of view when they are excessive in quantity, as for instance exceeding 40 or even 50 grains in 100,000. The remaining substances to be noticed may in a purely chemical point of view be called constituents also with quite as much truth, but with reference to sanitary considerations may with propriety be termed impurities. They were enumerated before as organic matter, ammonia and nitric acid. It may be better to consider them as organic matter of vegetable origin and organic matter of animal origin, with the respective products of their decomposition.

Vegetable substances of all kinds mixed with the soil, exposed to air and moisture or immersed in water, dead animal bodies of every variety in similar circumstances, all rotting, fermenting and putrefying, with the excrementitious matters from living animals, constitute the materials from which river water derives that portion of its constituents called organic matter. Its nature is so heterogeneous and its quantity so small, that it would be hopeless to attempt to separate it into its proximate constituents. All we can attempt is to get some general idea of its nature, from which to form some judgment of its

properties, especially with reference to its action on the human system. Of late more attention has been paid to this subject, previously little thought of.

The first point requiring attention is to ascertain its quantity as correctly as practicable. The plan formerly followed was to dry the solid contents of the water obtained by evaporation carefully at a certain fixed temperature such as  $212^{\circ}$  or  $250^{\circ}$  F., or even about  $300^{\circ}$ , till the weight remained constant; then to burn off the organic matter by as moderate a heat as possible and weigh again: the loss of weight was considered organic matter. But this method is liable to great error, and may give grossly erroneous results. Other substances may be volatilised: salts of ammonia have been mentioned, but they may be included amongst organic matter; nitrates may be partially or wholly decomposed, but they generally exist in very small quantity. Earthy carbonates may lose carbonic acid:—carbonate of lime will not readily lose it if the heat be moderate, but carbonate of magnesia will very readily, and moreover chloride of magnesium (or muriate of magnesia) loses part of its acid easily. It is the magnesium salts which are the chief source of loss, but this can be prevented or remedied. If the contents of the water be not naturally sufficiently alkaline, a sufficient quantity of accurately weighed and perfectly dry carbonate of soda is added to the water on evaporating it; the soda combines with hydrochloric acid to form chloride of sodium and water, while the magnesia remains as carbonate; and by this means, as the chlorine is not separated by ignition from the sodium, the loss of chlorine is avoided. The only loss is of carbonic acid, which can be restored again. This is done by adding to the ignited residue in the platinum crucible distilled water charged with carbonic acid and evaporating to dryness by gentle heat, drying again at the same temperature as was employed at the first weighing before ignition till the weight is again constant. The loss of carbonic acid is by this means corrected, the acid being restored, and the difference of weight shows the quantity of organic matter, at least more correctly than by any other method known.

This plan is attributed to Dr. Thomas Clark, the inventor of the soap test, by Dr. W. Allen Miller in a paper\* to which I shall have further occasion to refer. It is tedious and troublesome, requires a fine balance,

\* *Journal of the Chemical Society for May, 1865.*

patience, and care ; but it is not too much to say that the results obtained without the above detailed precautions are of no value, or rather worse than useless, as they mislead. The results which I shall give were obtained by this plan carefully carried out. It will be found that they differ materially from those given in Dr. Macnamara's report ; and I can only account for the discrepancy, by supposing that some precaution requisite for ensuring accuracy in the process was omitted, either from inadvertance, or because it had not at that time (1862) been generally known to or used by chemists.

In the table in that report the smallest quantity of organic matter entered is 0.9 grain in 1 Imperial gallon, the largest 8.3 grains, generally however 3 or 4 grains per gallon, which are equal to respectively 1.23, 11.8 and 4.3 or 5.7 grains per 100,000 grains. My own results have yielded me only from 0.6 to 1.9 grains in 100,000 and Dr. Frankland's in the report already alluded to, vary from .54 to 3.3, or average about 1.6 for the Thames, and 1.3 for the other two river waters. The table which will be given will exhibit the results I have obtained. Remarks will be postponed till the whole subject is considered.

The time, trouble, and care necessary for estimating the amount of organic matter by weight is so great, that chemists have been desirous of finding some easier and speedier method of estimating its amount. Precipitation of the organic matter by salts of lead or reduction of salts of silver and gold have been proposed, but never come into general use. But another re-agent has of late been very generally employed, the permanganate of potash, which from the facility with which it yields its oxygen to organic substances has been made the means of estimating the amount of these ; and as it can be very easily employed, it has come very much into favour. A good deal of difference of opinion prevailed at first as to the proper method of applying it and as to the value of its indications, but more agreement is being arrived at lately. It is used in the state of weak solution poured from a graduated tube, and the permanence of a slight pink tinge in the water to which it is added is the sign of the action being complete : the quantity by measure of the solution required indicates what is wanted. Dr. Letheby continues to add the solution at intervals for 24 hours : if the action was completed, then this would be very well, but it is not, as there are different kinds of organic water, some

of which act slowly on it, others more rapidly. Dr. Miller strictly enjoins that the water should not be warmed, without however stating any reason, and other English chemists seem also to practise it cold; Dr. Woods, who wrote a paper on it some years ago published in the *Chemical Society's Journal*, recommends warming the water, as also does Dr. Macnamara, and gives reasons for it. It now generally seems to be agreed that it is desirable to restrict the use of the permanganate to the oxidation of those substances that can be rapidly acted on; and after consideration and experiment, I have adopted with some small modifications the details of Dr. Frankland's practice, except that the water is heated to about  $120^{\circ}$  F. at the commencement. English chemists forget that what is our natural cold here, requires artificial heat with them, and that it is desirable to follow a plan that can be easily made uniform for all climates. The solution of permanganate is added in small portions at intervals, until a perceptible tinge of pink remains for ten minutes; when this is the case, the quantity used is read off. I use 4000 fluid grs. of water with 80 fluid grs. of diluted sulphuric acid, containing 1 grain concentrated acid by weight in 5 fl. grs., heat the whole to about  $120^{\circ}$  F. and having removed it from the lamp, proceed to add the solution. This is made of such strength that each measure of the tube (it may be, each equal to 1 cubic centimetre or to 10 fluid grains) yields .001 grain oxygen as ascertained by its action on oxalic acid in solution in similar circumstances, that is dissolved in a similar quantity of pure distilled water with the same quantity of sulphuric acid and treated in the same way. As .63 grains oxalic acid requires .08 grain oxygen, the solution will be of proper strength, if 80 measures are required for oxidizing that quantity of oxalic acid: that is, 80 measures are equal to .08 grain oxygen, or 1 measure is equal to .001 grain oxygen.

Although it is certain that in many or most cases the permanganate as used in this process does not oxidise all the organic matters, and that we cannot tell how much remains unacted upon; and though at present at least we do not know what is the particular chemical constitution of the matters oxidized, it is at least certain that it acts upon those substances which give the putrid odour to stagnant water, and renders them after a time, when the products of its action have settled, pure and transparent and quite free from offensive smell.

It thus removes the matters which are actually in a state of putrefaction, and I believe preserves the water from further putrefaction for at least a considerable time. For this purpose it is advantageously employed for the purpose of purifying water for domestic use. In such application it is used alone, no sulphuric acid being used: a very small quantity being added to the water, just sufficient to give it a very slight pink tinge, which will remain for above 15 minutes; the water is allowed to stand till next day, and is then decanted off and filtered and is fit for use. The minute quantity of potash salt produced can do no harm.

Provided it be properly understood what the use of this re-agent indicates, and it be not credited with more than it does effect, the permanganate test is a valuable addition to our means of examining the quality of drinking water. The results of my examination of the Hooghly water by means of it, and the amount of organic matter by weight, are given together in one table.

The quantity of oxygen required is very small. The results are given as obtained, but cannot be counted on too minutely, as there is a certain amount of error unavoidable, in not getting the colour exactly of one degree of intensity, in slight difference of quantity required dependent on rapidity of adding the liquid, and probably on other causes not very well ascertained. The purity of the waters as respects such offensive constituents is in proportion to the oxygen required to oxidize them: the purer the water the less oxygen is necessary.

TABLE III.

*River water taken from the Hooghly two to three miles above the north end of the town, except when otherwise specified.*

For 100,000 fl. gs. water.

|                                                                                                                            | Organic matter dried at 212° to 220° Fah. |         | Oxygen required. |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------|------------------|
|                                                                                                                            | Grains.                                   | Grains. |                  |
| 6th July, 1866 Ebb, from surface, ... ..                                                                                   | .80                                       | .0375   |                  |
| 10th ditto, from shore, ... ..                                                                                             |                                           | .0338   |                  |
| 8th August, Ebb tide, ... ..                                                                                               | .60                                       | .0450   |                  |
| 21st ditto ditto, ... ..                                                                                                   | .86                                       | .0345   |                  |
| 31st August, 1865, Ebb tide; had stood in stoppered bottles ten months, and much vegetable growth had been removed, ... .. | .74                                       | .0225   |                  |

|                                                             |          |     |      |       |
|-------------------------------------------------------------|----------|-----|------|-------|
| 9th December, 1865, Ebb, Surface,                           | ...      | ... | 1.02 |       |
|                                                             | Deep,    | ... | .78  | .0175 |
| 25th February, 1866 Ebb, Surface,                           | ...      | ... | .92  |       |
|                                                             | Deep,    | ... | .45  |       |
| 2nd May, Ebb at Bankshall, southern part of<br>Calcutta,    | ...      | ... | ...  | .0325 |
| Flood at Hatkolah, northern part of Calcutta,...            |          |     | 2.70 |       |
| 30th May,                                                   | Ebb,     | ... | .90  | .0238 |
|                                                             | Flood,   | ... | 2.60 | .0275 |
| 14th June,                                                  | Ebb,     | ... | .90  | .0250 |
|                                                             | Flood,   | ... | 2.20 | .0225 |
| 6th June at Chandernagore, 20 miles above<br>Calcutta, Ebb, | Surface, | ... | .60  | .0163 |
|                                                             | Deep,    | ... | .67  | .0213 |

From an inspection of this table, it will be observed that the permanganate test exhibits the largest quantity of organic matter in the river water during the rainy season, and the smallest quantity during the cold season, the hot season giving results intermediate.\* The same ratio is not so distinctly perceptible in the weight of the organic matter. If the water at all these seasons were at the same state of dilution as regards saline matter, there would be the largest proportion of organic matter during the rainy season and the smallest during the hot season. The hot season is usually associated with ideas of corruption and concentration of impurities, the rainy season with purification by the abundance of pure water from the clouds. In point of fact it is directly the reverse. The same thing has been observed in England, as will be manifest from the following quotation from Dr. Frankland's report on the London waters. He says, "This

\* It was with considerable hesitation that I left the indications given by the permanganate test in the table, on account of objections raised to my determinations of the organic matter which led to a supplementary paper read at the succeeding meeting of the Society. But after due consideration, they were allowed to remain as sufficient for the purpose required. The objections will be noticed as occasion calls for it, in notes or in the Supplement.

It is to be observed also that, as reported in the Proceedings of the Society for October, page 1866, I had stated 1.4 grains per gallon as the largest amount of organic matter obtained. Two of the results in the table, those of 2nd and 30th May somewhat exceed this, viz. 2.7 and 2.6 grains corresponding respectively to 1.89 and 1.82 grain per gallon. The correctness of these was doubted from supposed inaccuracy in the process, but this not being certain they have been introduced into the table. 30th Nov. 1866.

comparison shews clearly (as might be anticipated) how closely the condition of river waters is connected with the amount of rain-fall; but, in opposition to the commonly received opinion, it proves that the waters in question are much purer in dry than in wet weather, even if the drought occurs during a very hot summer." He seems, however, to hesitate a little about drawing general conclusions from the observations of one year; and in the report of the discussion which followed at the Chemical Society's meeting as reported in the *Chemical News*, some of the speakers seemed inclined to attribute it to special and particular causes. I have no doubt that it is owing to general causes, and that when we consider the circumstances, we cannot expect any other result.

Unfortunately in the case of the Hooghly at Calcutta, the question is complicated by the admixture of sea water during the hot season. This introduces two sources of error into the process of examination, namely an increased amount of saline matter, and a difference in its nature and properties. These will probably tend to cause indications of an amount of organic matter in excess of the truth. The point is under examination. There is also great difficulty in estimating correctly the amount of organic matter during the rainy season, on account of the impossibility of getting the water clear by filtration, and the very long time it requires to become clear by subsidence. This point is also under investigation.\*

There can be no doubt also that the kind of organic matter in the sea water mixture is different in some respects from that of the river water proper. I was much struck with the observation made many months ago of the difference of colour presented by the different specimens of water when highly concentrated, that of the August water being so much deeper in colour than the others. On the contrary, a sample of water from the salt water lake to the east of Calcutta, though indicating both by the weighing and the permanganate processes much more organic matter than the river water, when concentrated, was almost colourless.

But to return to the greater proportion of organic matter during the rains, it seems to be nothing but what may be expected. During the

\* For the reasons stated there is considerable uncertainty respecting the correctness of the weight of organic matter in the waters of July and August

remainder of the year, vegetable and animal matter of every kind is deposited in or upon the soil in all stages of decomposition. The amount of drainage is small and the flow of water gentle: the water carried thus to the river is comparatively pure, and that from the sources of the streams is from places bare of vegetation and part of it from melting snow. But when the rains come, they wash off all the accumulated products of decomposition of vegetable and animal substances in the state both of solution and suspension, of which the appearance alone of the water and its flavour give ample evidence. The increased proportion, it is true, is counteracted by the largely increased quantity of the water which dilutes it; for if, instead of looking to the proportion of organic matter to the water, we look to its amount in proportion to the inorganic or mineral saline matter, then in the rainy season the excessive proportion of organic matter is rendered much more evident. After the rains the mud subsides, which is favourable to the purification of the water, and the atmospheric oxygen contained in solution in the water, as it is in natural waters generally, acts upon the organic matter in solution, oxidizing and destroying it. And as heat in general materially increases the energy of chemical action, there can be little doubt that this purifying influence goes on more rapidly in tropical than in temperate climates, and that this explains why the organic matter in the Hooghly water is smaller in amount than that of the London waters, both of river and wells in their natural state.

But we have to consider not only the quantity but the quality of the organic impurity. We can scarcely expect to go more minutely into this than to endeavour to ascertain the relative proportions of vegetable and animal matter, and to get some idea of their state or of the stage of decomposition in which they exist in the water. The chemical constitution of these gives us some aid in this enquiry, the main constituents of vegetable compounds being carbon, hydrogen and oxygen, those of animal substances containing nitrogen in addition; a statement which, though not strictly exact, is sufficiently characteristic, so much so, that by azotized or nitrogenous substances are generally understood compounds of animal origin. The ultimate products of the decomposition of non-nitrogenous organic matter in presence of oxygen, namely water and carbonic acid, of course give us no help in this enquiry, nor are the intermediate products likely to be

possessed of any such striking properties as to aid us much, as they are mostly of a neutral nature without active chemical or physical characteristics. Nitrogenous bodies, however, yield products more readily recognised, and as it is this class of substances which are most likely to possess properties injuriously affecting the animal economy, their detection is also the most important.

The ultimate products of the decomposition of nitrogenous organic substances are, in addition to water and carbonic acid, also ammonia, and where excess of oxygen is present, nitric acid. But there are also numerous intermediate products, and these are often characterised by offensive smells which give a certain character to the putrefaction of animal substances, different from that yielded by the fermentation or corruption of vegetable bodies. The smell or flavour then of a water is a very good test of its purity, though it indicates rather the stage of decomposition in which its organic matter exists than the amount of organic matter present. And in connection with this I may mention the test of keeping the water and observing the changes which take place in it, the production of animalcules or of aquatic vegetation. Now I have kept samples of water taken from the river at all seasons for many months. Those taken during the cold and hot seasons settled easily and suffered very little further change; at the most a little greenish deposit at the bottom of the bottle formed, which is the case, however, with ordinary distilled water. It was very different, however, with the water of the rainy season. Some water taken from the river on 31st August, 1865, was kept for about two or three weeks, then syphoned off the deposited mud into other clean stoppered bottles in which it remained, the bottles being closed for about four months, when the bottles were found to have their sides covered with abundant green branching vegetation: the water was again syphoned off quite clear to other clean bottles and kept for about six months longer, when the same appearances were observed, though to a much smaller extent. There was abundant proof in this case of the presence of organic matter, probably both in the form of living germs and of chemical compounds dissolved in the water. The water taken during the hot season may have contained as much: possibly the presence of the excess of saline matter may prevent such development, but I am not prepared to give an opinion on the subject. The

water of the hot season shewed more indications of vegetation than that of the cold season, though greatly less than that of the rains.

*Ammonia.*

Ammonia, perhaps one of the most characteristic evidences of the presence of nitrogenous matter, can be detected in natural waters, and even when in such minute proportion as in natural waters, its quantity can be estimated. Dr. Miller has given a process for doing so with sufficient accuracy, and without the necessity of operating on very large quantities of water, which will be found in the paper I have already mentioned on the analysis of mineral waters in the *Journal of the Chemical Society* for May 1865. It depends on the great delicacy of the test for ammonia possessed by an alkaline solution of the Hydrarg-Iodide of Potassium, which produces a fine rich yellow brown colour with a very small quantity of ammonia, or a precipitate, if the quantity be larger. In the weaker solutions, the colour varies in depth of shade with the proportion of ammonia present, and by a comparison with another solution containing a known quantity of ammonia the proportion is estimated. Dr. Miller attributes the plan of proceeding to Mr. Hadow, and gives the details of procedure. He gives the formula for the preparation of the alkaline solution of Hydrarg-Iodide of Potassium, which I have strictly followed and adopted. His standard solution for comparison is a weak solution of pure muriate of ammonia of such strength that 1 fluid grain of the solution contains .0001 (one ten-thousandth of a) grain of ammonia or 3.17 grains muriate of ammonia in 10,000 fluid grains. I also adopt this solution, but have modified the plan of proceeding, it appears to me with advantage. It is thus :

A convenient quantity, 10,000 fluid grains is very suitable, of the water, to which a small quantity of pure hydrochloric acid has been added, is concentrated by a gentle heat to about 1,000 fluid grains : it must of course be slightly acid. This is put into a flask, some excess of pure milk of lime added, and the flask connected by a bent tube with a small Liebig's condenser, to the extremity of which is connected a small Woulfe's bottle, and to this another one furnished at its further neck with a tube containing broken glass moistened with water, this being to prevent escape of ammonia. About half or 500 fluid grains of

product is distilled over and emptied into a tube graduated into 100 divisions of 10 fluid grains each, the bottles washed out with distilled water and added to the tube to make up 100 measures of liquid which is to be thoroughly mixed together. Two wide mouthed bottles or jars of as nearly the same size as possible are provided, into each of which 25 fluid grains of the Hydrarg-Iodide solution is introduced with some distilled water. Then into one of these an aliquot part of the distilled liquid is poured, say  $\frac{1}{10}$  or  $\frac{1}{4}$ , so as to produce a distinct colour, and the bottle is filled up with water. Another similarly graduated tube or burette has been prepared ready filled with the standard solution of muriate of ammonia, and this is carefully added to the second bottle, until the colour produced is as exactly as possible of the same shade as that of the first, both bottles being of course made equally full. The quantity added is then noted, and then calculated on the whole. Thus: suppose 74 fluid grains of the standard solution of muriate of ammonia has been required, this is equal to  $74 \times .0001$  grains or .0074 grains ammonia. If 25 measures of the distilled liquor has been used for trial, this is  $\frac{1}{4}$ th of it, consequently the whole contains  $.0074 \times 4 = .0296$  grains ammonia, and as this was from 10,000 fluid grains of water, by consequence the standard quantity of 100,000 fluid grains water contains .296 grains ammonia.

The process requires great care, that there be no accidental admixture of ammonia. The vessels must be scrupulously clean, the distilled water and the lime used must be carefully examined to make sure that they contain no ammonia. The plan of measuring the distillate enables the operator to repeat the trial in case of accident or uncertainty. It is better to work with rather weak colours, as the eye can better detect differences of shade: .0074 grains ammonia is too much for a 2000 grain bottle: any size of bottle may be used, provided the two bottles be as exactly as possible alike in size, shape and capacity.

TABLE IV.

The following table shews the results obtained by this process.

|                                 |         |     |     |     |     |     | Ammonia in<br>100,000 fl. grs. |
|---------------------------------|---------|-----|-----|-----|-----|-----|--------------------------------|
| River water of<br>RAINY SEASON. |         |     |     |     |     |     | grains.                        |
| 6th July, 1866,                 | ...     | ... | ... | ... | ... | ... | .1133                          |
| 21st August,                    | ...     | ... | ... | ... | ... | ... | .1825                          |
| Average,                        |         |     |     |     |     |     | .1429                          |
| COLD SEASON.                    |         |     |     |     |     |     |                                |
| 9th December, 1865,             | Shore,  | ... | ... | ... | ... | ... | .0162                          |
| Ditto,                          | Stream, | ... | ... | ... | ... | ... | .0220                          |
| Ditto,                          | ditto,  | ... | ... | ... | ... | ... | .0208                          |
| 27th ditto,                     | ditto,  | ... | ... | ... | ... | ... | .0328                          |
| Average,                        |         |     |     |     |     |     | .0229                          |
| HOT SEASON.                     |         |     |     |     |     |     |                                |
| <i>Ebb tide.</i>                |         |     |     |     |     |     |                                |
| 30th May,                       | ...     | ... | ... | ... | ... | ... | .0250                          |
| 14th June,                      | ...     | ... | ... | ... | ... | ... | .0189                          |
| Ditto repeated,                 | ...     | ... | ... | ... | ... | ... | .0550                          |
| Average,                        |         |     |     |     |     |     | .0329                          |
| <i>Flood Tide.</i>              |         |     |     |     |     |     |                                |
| 30th May,                       | ...     | ... | ... | ... | ... | ... | .0370                          |
| 14th June,                      | ...     | ... | ... | ... | ... | ... | .1850                          |
| Ditto repeated,                 | ...     | ... | ... | ... | ... | ... | .1075                          |
| Average,                        |         |     |     |     |     |     | .1098                          |

Now on an inspection of this table it will be easily observed that the discrepancies are so great that the results cannot be depended on as at all accurate. I have mentioned the difficulties and nicety of the process, and the errors manifestly point out the necessity of

carefully examining wherein they lie, in order to see if they can be avoided. Yet notwithstanding these inaccuracies, it seems to me that the general results are pretty evident, that the amount of ammonia is greatest in the rainy season, diminishes during the cold one, and again increases during the hot, which increase, however, is probably not in the river water proper. One examination of water from Chandernagore, which was very slightly if at all contaminated with tidal water, yielded only .0118 grain ammonia in 100,000 flood grains. This conclusion is not a certain one; to make it so, it would be necessary to have examinations of the Chandernagore water at all seasons; but other considerations, to be afterwards noticed, render it probable.\*

I am disposed to attach a good deal of importance to the estimation of the ammonia, not only because it helps to indicate how far the nitrogenous matter has gone in the stage of decomposition, but because that stage is not improbably one of importance. It has been long known that many, I may say most, of the organic proximate principles found in vegetables are alkaloids possessing active properties and producing the most marked physiological effects, and that there are many similar principles produced in the decomposition of nitrogenised substances by destructive distillation or otherwise, which possess marked physical properties, and probably, if they were examined, also decided physiological actions. But by modern chemical research, it would appear that these alkaloids are all formed on the type of ammonia, or are ammonias having one or more atoms of its hydrogen replaced by some other organic combination or radical. Hence it seems not at all unlikely that such compound ammonias as they are called may be produced at the same time and along with the ultimate or ordinary ammonia. And even though no such compounds should exist, the amount of ammonia would give some probable indication of the stage of decomposition, and existence of compounds is a state of transition towards ammonia.

\* The examinations for ammonia were all made about the same time in the month of August, consequently the waters were of different ages. The samples had been preserved mixed with a little Hydrochloric acid and mostly in a concentrated state. Of course objections may be made to their value on this account and possibly may be valid. This will again be referred to in the sequel. 30th November, 1866.

I have seen few published analyses of water indicating the presence or amount of ammonia. Such examinations have been made, but they do not seem to be common. In the case of waters examined for sanitary purposes it appears to me that the point should be attended to. One observation that has come under my notice on the subject is in a paper by Messrs. Lawes and Gilbert on town sewage,\* in which is mentioned the quantity of ammonia found in the River Wandle before and after receiving the drainage water from the land irrigated by the sewage of Croydon. In both instances, it amounted to .18 grain per gallon or 70,000 grains, being therefore more than I have found at the worst in the Hooghly water viz. .185 grains per 100,000 grains.

#### *Nitrates.*

The presence of nitrates has been more noticed than that of ammonia, though it appears to me less worthy of attention. It is true that they indicate the existence of nitrogenous matter, but it is rather as a thing of the past: the animal matter has been there, but is no longer now, at least that part of it which now has the form of nitric acid; it is now fully oxydized, its animal essence and corruptibility destroyed: it ranks with water and carbonic acid, no longer an organic substance. A process has been devised for estimating small quantities, known as Pugh's process, which Dr. Miller in the above quoted paper recommends for application to water. I have not made use of it, indeed have not had time, but have satisfied myself with some other observations and experiments on the presence of nitrates in the river water. In many instances indeed very distinct deflagration has been observed during ignition of the residue obtained by evaporating the water. This alone does not give good grounds for forming an opinion as to the quantity of the nitrate, as it may be masked or altogether obscured by an excessive proportion of other salts, as of common salt during the hot season. The presence of nitrites can also be observed by the blue colour produced with starch and iodide of potassium by the water acidulated. But as nitrites are simply imperfectly oxydised nitrates, the same observations apply to the former as have been made respecting the latter.

\* Journal of the Chemical Society, April, 1866.

I had intended, and still intend, to estimate the quantity of nitric acid for the complete analysis originally contemplated; but for the reasons just stated, I preferred, for the purpose of this communication to direct my attention to other points which appeared of greater importance. That of ammonia which has been just discussed was one of these, and a greater number of determinations of ammonia would have been made, but time did not permit: besides I wished first carefully to examine the ammonia process in order to ascertain the causes of the discrepancies already referred to, with a view to discover the precautions necessary to be taken to ensure more concordant results.

*Other nitrogenous matter.*

But ammonia and nitric acid are only the ultimate terms of the fermentative and oxydised decomposition of nitrogenous organic matter, and there may be much more present in all stages of decomposition intermediate between these and unchanged animal or vegetable constituents. The amount of these could be estimated by ascertaining the quantity of nitrogen they contain, but the operation is too troublesome to be generally applied to such minute quantities of matter as exists in drinking waters. Animal matters in being ignited or burnt, as is well known, emit a peculiar smell, different from that produced by burning non-nitrogenous substances such as wood, and this has been used as an indication of the presence of, and even as a means of forming a judgment respecting the proportion of matter of animal origin. But it affords a very uncertain means of judging, as even corrupting vegetable matter gives a different smell from fresh, and the peculiar animal odour may be more or less obscured by the greater or less proportion of vegetable matter mixed with the animal. Besides the most characteristic smell given by burning animal matters is that produced by albuminous or gelatinous substances such as muscular fibre, blood, skin, or in short the undecomposed tissues of animal bodies in general. But these substances are probably not to be found in sewage except in small quantity, its constituents are more nearly of the nature of urine and other excrementitious animal matters and the sour products of vegetable decomposition: many of them are volatile and evaporate by a moderate heat with a peculiar

nauseous smell, but one not so characteristic as that produced by burning horn or wool for instance.

Nevertheless not to neglect any means of obtaining information on the subject, I not only, in the course of ascertaining the weight of organic matter by burning it off, paid attention to the appearances then presented, but afterwards made a few experiments on purpose. But with all I cannot concur in the satisfaction expressed by Dr. Angus Smith on the results, as quoted by Dr. Macnamara in his review of the pamphlet.\* He speaks of the remarkably clear insight given by boiling down a few thousand grains of water and burning the residue. He says, "We can by the eye and the smell detect humous and peaty acids, nitrogenous organic substances, and nitrates, and estimate their amount to a very useful degree of accuracy. We may even decide by it the animal or vegetable origin of the matter." Now I have carefully evaporated down repeatedly quantities of 50,000 and 100,000 grains of water and attended to these appearances, and the only conclusion I came to was, that the information obtained was very limited and unsatisfactory. I have also varied the experiment and instead of burning the matter in an open platinum crucible have heated it in a glass test tube. For some of the objects in view this is a better plan; and I compared in this way samples of water of the rainy season, of the cold season, and of the hot season during flood tide. For the latter, which is a mixture of river and sea water it is necessary to mix the saline matter with some dry carbonate of soda, or better, to evaporate the water to dryness with this admixture, in order to prevent the evolution of hydrochloric acid vapours. The mouth of the tube is to be loosely closed with a glass stopper which is removed from time to time to examine the smell and try with test papers. Examined in this way, all those samples gave some ammoniacal vapour with no very marked difference; all gave a somewhat urinous animal smell, but not one the characteristic smell of burning flesh or horn: there were slight variations, but none very distinct. The rainy season water gave more of the smell of burning vegetable matter than the others, this being the most distinctive point observed; but altogether the information obtained was very small.

After the failure of all these plans, there remained but one likely to

\* Indian Medical Gazette, April, 1866.

be satisfactory, and that was to determine the amount of nitrogen existing in other forms than those of ammonia and nitric acid, this being the only way in which the amount of undecomposed or imperfectly decomposed animal matter can be estimated. The way in which this is usually done is by what is well known to chemists as the soda lime process, and depends on the circumstance that all such animal substances containing nitrogen (this not including nitric acid however), when heated to redness in contact with a hydrated alkali, yield up all their nitrogen combined with hydrogen as ammonia, and this ammonia can by suitable arrangement be collected and its amount ascertained. I am not aware that this plan has been much applied to the examination of animal matter in waters, no doubt on account of the minute quantity of nitrogen present; nevertheless it appeared to me that it might be modified so as to estimate it even in drinking water. I intended to have postponed the trial of this process altogether, as I had not time to make proper arrangements and test the accuracy of the plan. However I made three experiments in a rather hasty and crude manner with such means as I had at hand. They are not at all to be depended on, but I may give the results as obtained.

River water of 2nd June, Ebb, from Chandernagore, containing very little tidal water. 100,000 grains gave .028 grains ammonia.

River water of 21st August, Ebb, from Barnagore. 100,000 grains gave .030 grains ammonia.

River water of May and June, Flood tide, from Barnagore. 100,000 grains gave .010 grains ammonia.

The results, as I have already said, are not to be depended on. Yet it cannot be denied that they are in accordance with the results obtained in other ways, respecting the organic matter. The ready formed ammonia existing in the water had of course been previously removed.

In a practical point of view this portion of the subject is of the principal importance, as more than any other it bears on the question as to how far the river water is contaminated by the sewage of Calcutta. Judging from the results obtained and just mentioned respecting ammonia and fixed nitrogenous organic matter, the amount is not great: even at the highest tide at flood on the 14th June of this year, after twelve months of an unusually small amount of rain-

fall, it is no worse as regards ready formed ammonia than the water of the rainy season; and if the rough experiments on the other nitrogenous matter are to be trusted, it is no worse or not so bad even in this respect; and comparing the results with the one observation quoted respecting the river Wandle as regards ammonia, the Hooghly water even at the worst, has the advantage. In considering this point, it must be borne in mind that the refuse which Calcutta can yield must bear but a very insignificant proportion to the great volume of the waters of the Hooghly compared with that which a large English town will yield to an English river, and more particularly London to the Thames. And then the purifying influences here are so much more active that contaminating constituents are much more speedily destroyed; nature with her all pervading oxygen, its power exalted by a tropical temperature, burning all up. The water of the stream in constant motion presents perpetually renewed surfaces to the atmosphere to absorb the great purifying agent, and the importance of this will perhaps be more clearly manifested by comparison with another class of waters with which I shall conclude this paper.

#### *Tank Waters.*

This class is the tank waters, a few of which I have made a partial examination of, for the purpose of comparison. These are General's tank, near the entrance to Park Street; Monohor Doss' tank, near that to Lindsay Street, both of them on the plain round the Fort; Dalhousie Square tank, supplied by the river; Cornwallis Square Tank, at the northern part of the town; a newly cleaned and dug out tank at Dhurruntollah (supplied by Mr. Dall); and a village tank near my own premises. Also I have examined slightly two well waters, and the water of the Salt Water Lake to the east of the town; the results of all will be given in one table and a few remarks appended afterwards.

The water of the two tanks from the plain in May and June had a slightly putrid flavour; in August this was much less. Cornwallis Square tank was very low in May and putrid, had not increased very much in August and was still bad. The Dhurruntollah tank was bad flavoured and abounded in vegetation; the Barnagore tank in May and June was covered with a thick coat of floating vegetation, and was very dirty and bad smelled, quite unfit for use even by the villagers. In August during the rains its appearance improved somewhat.

TABLE V.

For 100,000 fluid grains.

|                             | Date of collecting. | Solid matter. | Organic matter. | Oxygen reqd. to oxidise. | Ammonia. |
|-----------------------------|---------------------|---------------|-----------------|--------------------------|----------|
|                             | 1866.               |               |                 |                          |          |
| General's Tank,             | ... 6 June,         | 12.05         | 1.35            | .0825                    | .235     |
|                             | 14 Aug.             |               |                 | .1225                    |          |
| Monohur Doss's Tank,        | ... 14 May,         | 24.60         | 2.00            | .0913                    |          |
|                             | 6 June,             |               |                 | .1000                    |          |
|                             | 14 Aug.             |               |                 | .1400                    | .204     |
| Dalhousie Square Tank,      | ... 14 May,         | 23.85         | 1.50            |                          |          |
|                             | 6 June,             | 25.80         |                 | .0750                    |          |
| Cornwallis Square Tank,     | ...                 |               |                 |                          |          |
| settled and veg. matter de- |                     |               |                 |                          |          |
| posited,                    | ... 14 May,         | 58.00         | 4.40            | .1550                    |          |
| not settled,                | ... 14 Aug.         |               | 5.15            |                          |          |
| Dhurruntollah Tank,         | ... Aug.            |               |                 | .2975                    | .237     |
| Barnagore,                  | ... 11 May,         | 51.00         | 4.25            | .3170                    |          |
|                             | 8 June,             |               |                 | .2938                    |          |
|                             | 17 Aug.             |               |                 | .3375                    |          |
| Dhurruntollah well,         | ... Aug.            |               |                 | .0725                    |          |
| Barnagore well,             | ... 18 Aug.         |               |                 | .0900                    |          |
| Salt Water Lake,            |                     |               |                 |                          |          |
| from Canal at Dhappa Toll   |                     |               |                 |                          |          |
| House,                      | ... 13 June,        | 908.00        | 20.00           | .1250                    |          |
| Ditch conveying sewerage of |                     |               |                 |                          |          |
| Calcutta,                   | ... 1 June,         | 295.80        | 33.10           | 5.680                    |          |
| * Ditto,                    | ... 8 Sept.         |               | 27.33           |                          |          |
| * Ditto,                    | .. 13 Sept.         |               | 22.25           |                          |          |

On examining this table, it will be observed that even the best tank water contains more organic matter by weight, and requires more oxygen to oxydise it than does the river water during ebb tide; even Dalhousie Square water appears to deteriorate by being removed from the running stream into a stagnant reservoir. The excess of organic matter in the bad tanks is also very noticeable. The two well waters require more oxygen than the river water generally.

\* Added since the date of the paper.

The Salt Water Lake water did not require more oxygen than the tank waters.\*

I have little to add in the way of concluding remarks, as my object was not to report on any scheme or recommend any plan, but simply to communicate to a scientific society the results of numerous experiments and observations on a subject of practical importance. Some of these investigations are defective, but I intend to endeavour to remedy these defects by further investigation. And even after these are remedied, the results may indicate that there are yet other points to examine. There is work for the naturalist in the investigation of the animal and vegetable life in such waters, possibly exercising as great an influence on their salubrity as their chemical composition. Yet even this can only be aided by a full and accurate knowledge of their chemical constituents. There are also questions connected with the preservation and use of the water, and these too are more likely to be correctly answered, the more complete is our knowledge of the nature of its composition.

But I may briefly sum up the conclusions arrived at with reference to the application of the Hooghly water to the supply of the wants of Calcutta. As regards its inorganic constituents, the Hooghly water taken near Calcutta is at least as pure as any of the waters supplied to London, or indeed generally more pure for about eight or nine months of the year; during the hot season it is mixed with sea water under the influence of the tides and thereby rendered brackish. This can be avoided by taking the supply of water from further up the river.

As regards organic matter, again, my results, if correct, indicate that the state of the water seems to be worst during the rainy season, and that notwithstanding the influence of the tides and the sewerage of Calcutta, it is doubtful if even at the hottest part of the hot season in June its impurity equals that of the water during the rains; and it is

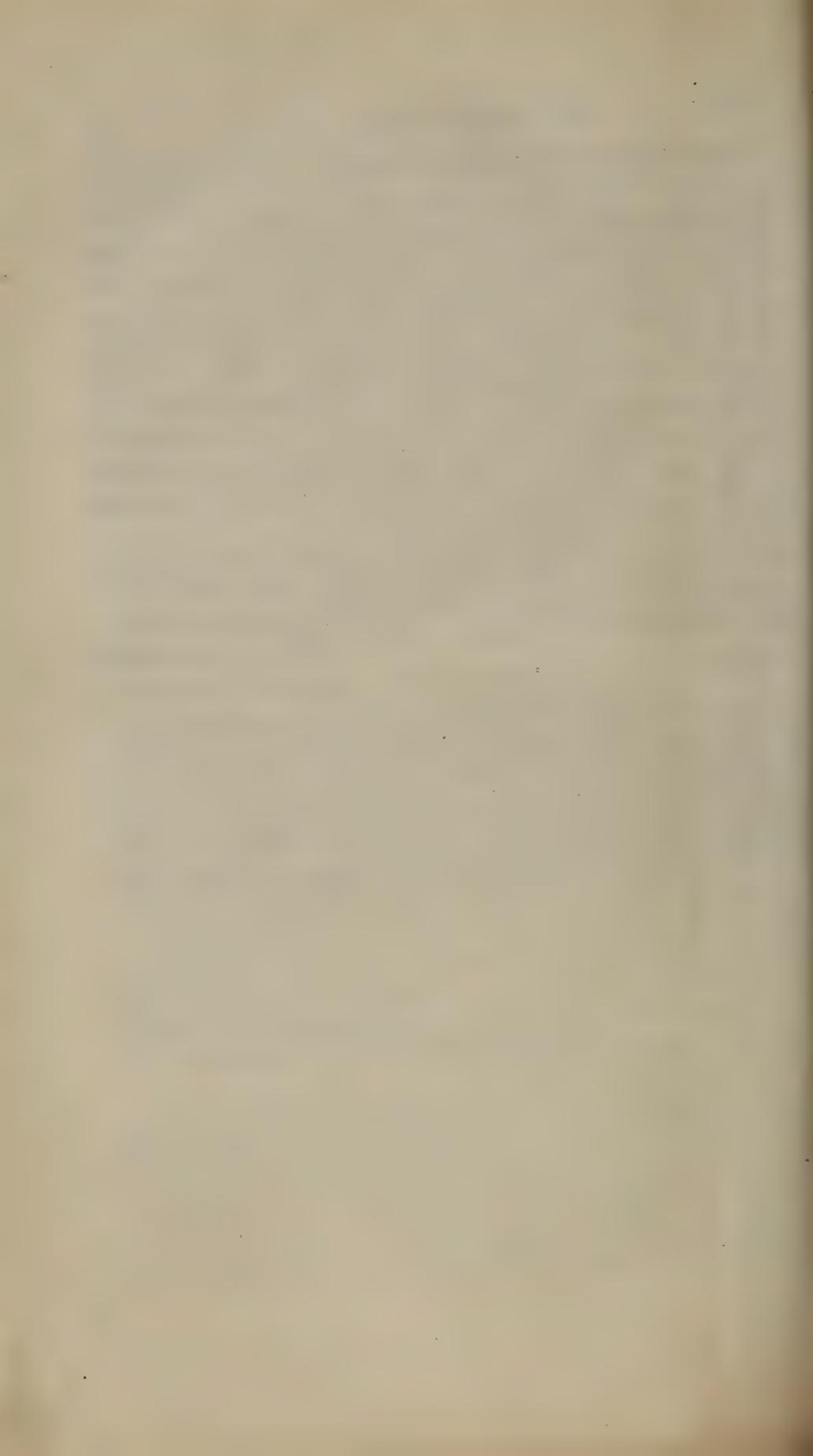
\* I have already stated that it was with considerable hesitation that I left the indications of the permanganate Test in table III. on account of the objections raised to their value: similar hesitation was felt as to inserting Table IV. and it was the indications given in Table V. which determined me to retain them. The same objections indeed apply to the results shewn by it, but this does not materially affect the purpose for which it is introduced. It will serve sufficiently well for purposes of general comparison, the trials for oxidizable matter and ammonia having been made at the same times on both river and tank waters, so that generally both kinds were of the same age or nearly so. More exact determinations will be made in future. 30th Nov. 1866.

questionable if even in the nature or quality of the organic impurities it is worse. Now as it is not likely that during the rains the water is materially different at Barrackpore from what it is at Calcutta, there will be little or nothing gained by taking it from Barrackpore during these months, the chief advantage being therefore that the salt water of the hot season will be avoided. Still even as it is, there seems to be no better source; for the organic impurities of the tank waters, even the best of them, seem at least equal in amount to those of the river water during flood tide, and greater than the same during ebb tide. And so far as a judgment can be formed from the means of comparison within reach, the water during the rains probably contains less organic impurity than the London waters.\*

Such are the conclusions I have arrived at, some of them unexpected even to myself, and which may be disputed by others. They are of course open to criticism and discussion. They may be suggestive of other things possibly of practical application, but into these I have not yet had time to enter.

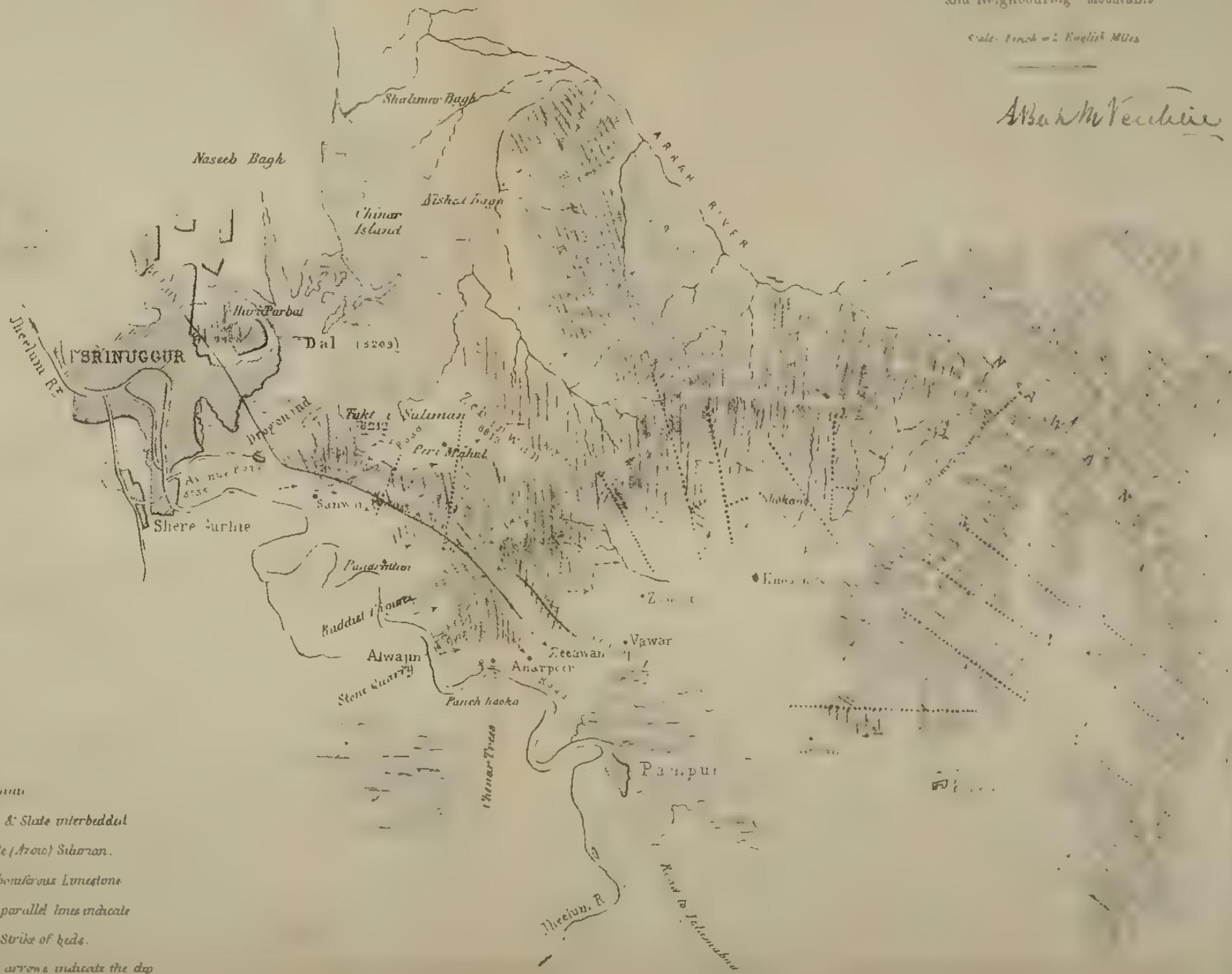
\* I have much doubt upon these points, as much of the organic matter of the rainy season is probably adherent to the finely divided mud in suspension in the water, which is so difficult to separate. With a view to the use of the water, the point would require to be investigated in connection with the process to be employed for the purification of the water. Judgment may be considered suspended on them, more particularly on that of the purity of the water of the *best* tanks at all seasons of the year, and of the nature and amount of the organic matter of the river water during the rainy season. Further remarks will be made on these subjects in subsequent communications. 30th Nov. 1866.





Scale: 1 inch = 2 English Miles

*Arthur M. Kennerly*



- Veins
- Ish & Slate interbedded
- Slate (Arzo) Silurian.
- Carboniferous Limestone
- The parallel lines indicate the strike of beds.
- The arrows indicate the dip
- Faults
- Str. or.

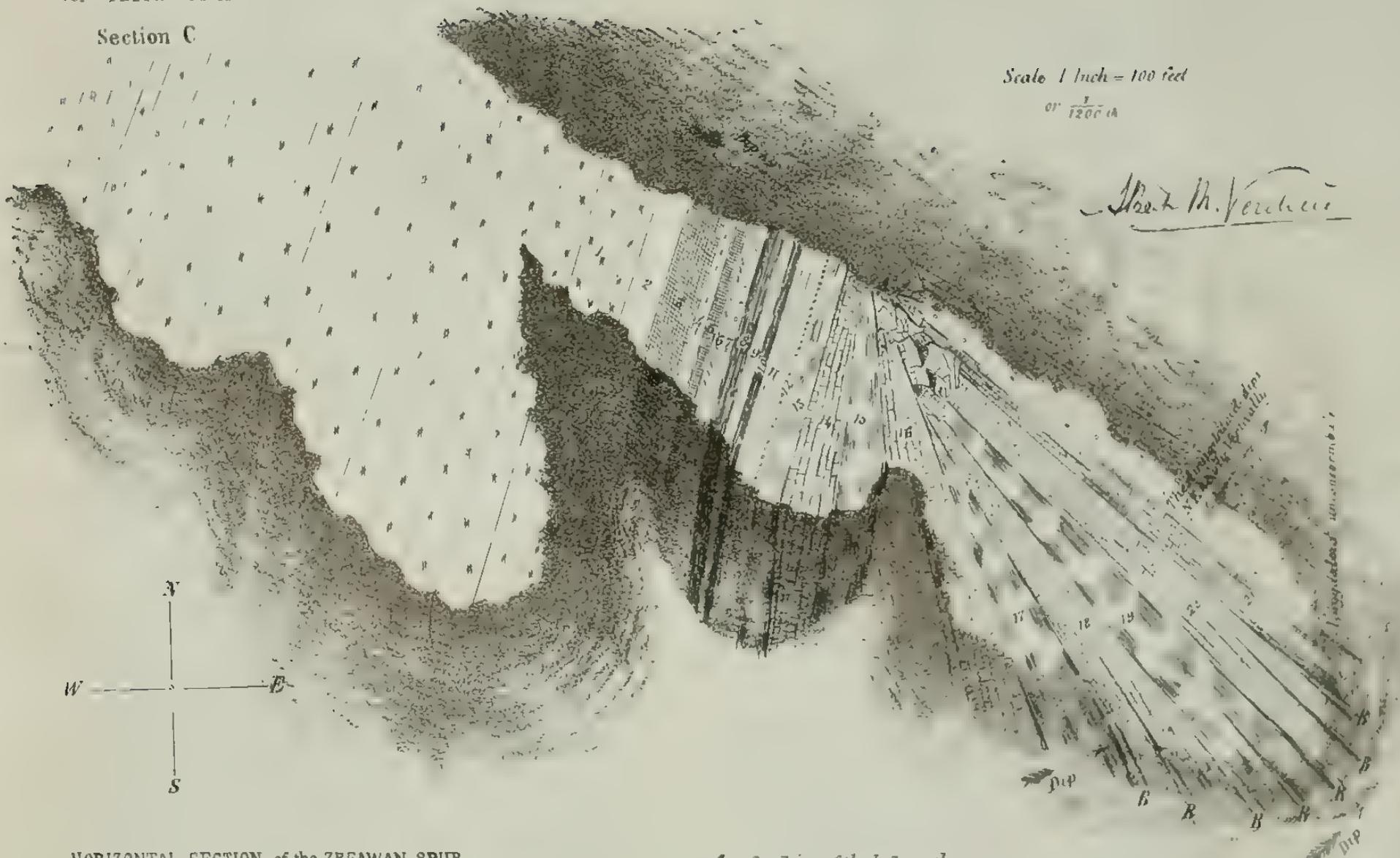


Section C

Scale 1 Inch = 100 feet

or  $\frac{1}{1200}$  in

*Wm. H. Verbeek*

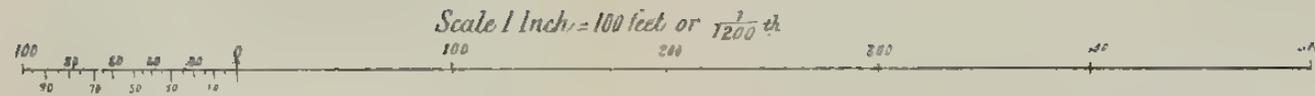


HORIZONTAL SECTION of the ZEEAWAN SPUR  
of the ZEBANWAN

Showing the fan-like disposition of the  
courses of limestone and Brown Shales

- A. Crushing of the beds at the small end of the Fan
- B.B.B. Openings between the beds and courses of rocks at the expanded end of the Fan.

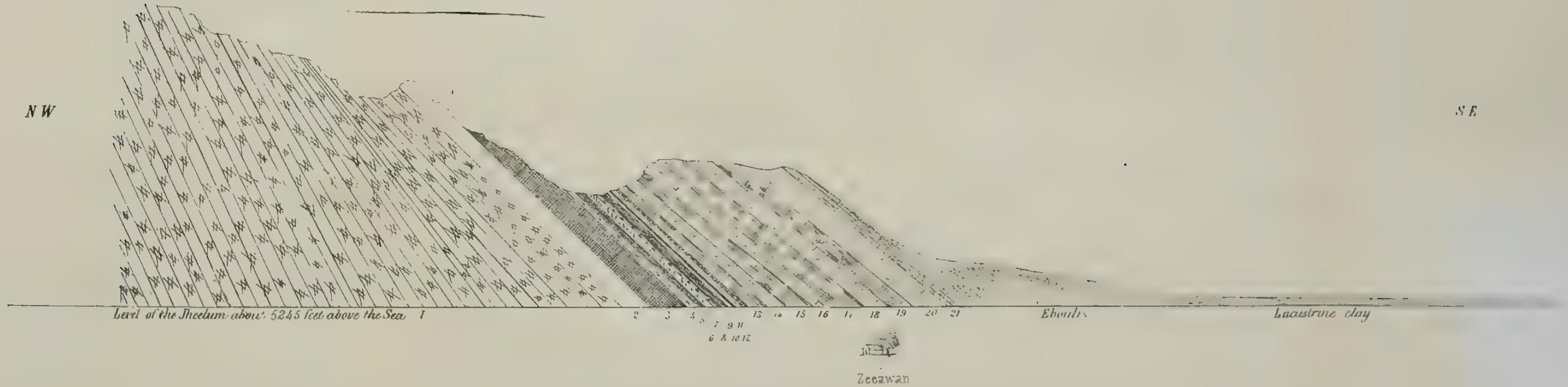




*Albert G. Verbeke*

NW

SE



Level of the Sheelum about 5245 feet above the Sea 1

2 3 4 5 7 9 11 13 14 15 16 17 18 19 20 21

Eboules

Lacustrine clay

Zeezwan

VERTICAL SECTION of the ZEEAWAN SPUR of the ZEE-NWAN



GEOLOGICAL MAP  
of the  
**WASTAR WAN**  
in Kashmir

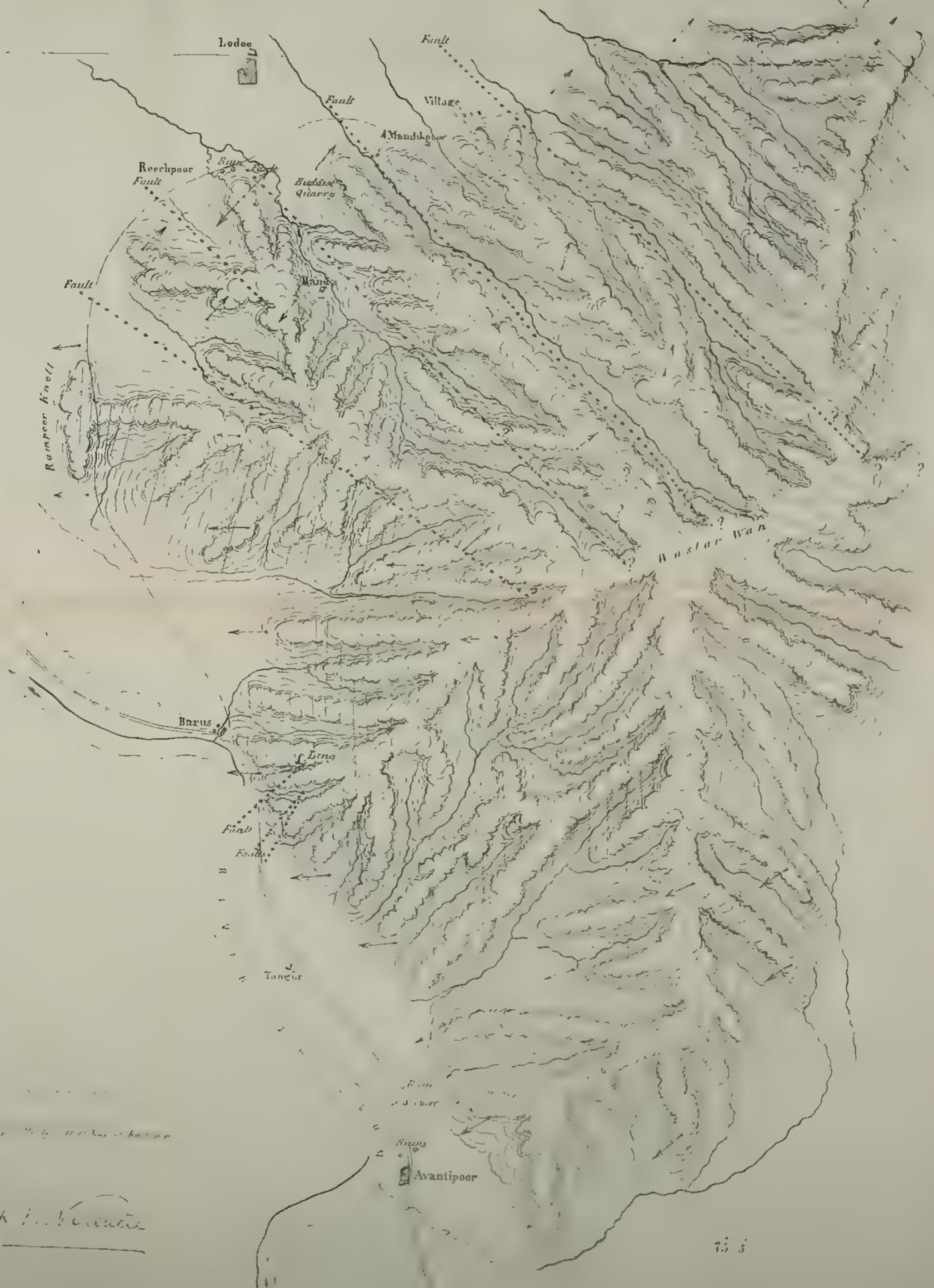
Map C.

54

54

Shar

75 5



- Quartzite
- Volcanic Rocks
- Azoe Slate (Silurian)
- Carboniferous Limestone
- Slate

indicate Strike of Beds

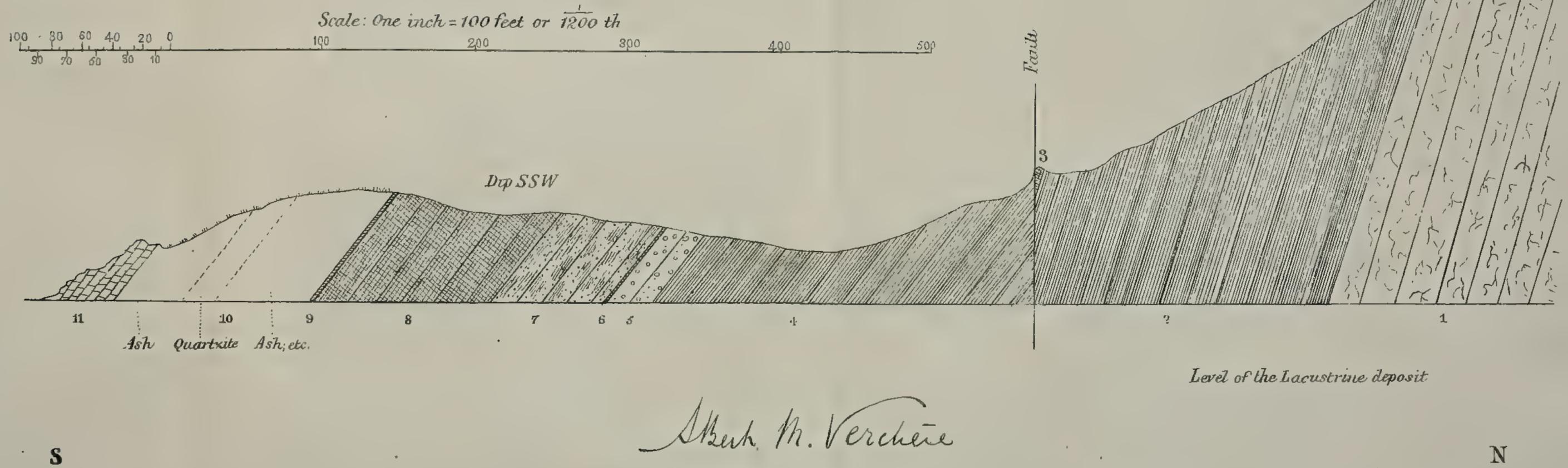
indicate Dip

Map of the Wastar Wan region in Kashmir

*Mark P. ...*

75 5





Level of the Jheelum, about 5250 feet above the Sea.

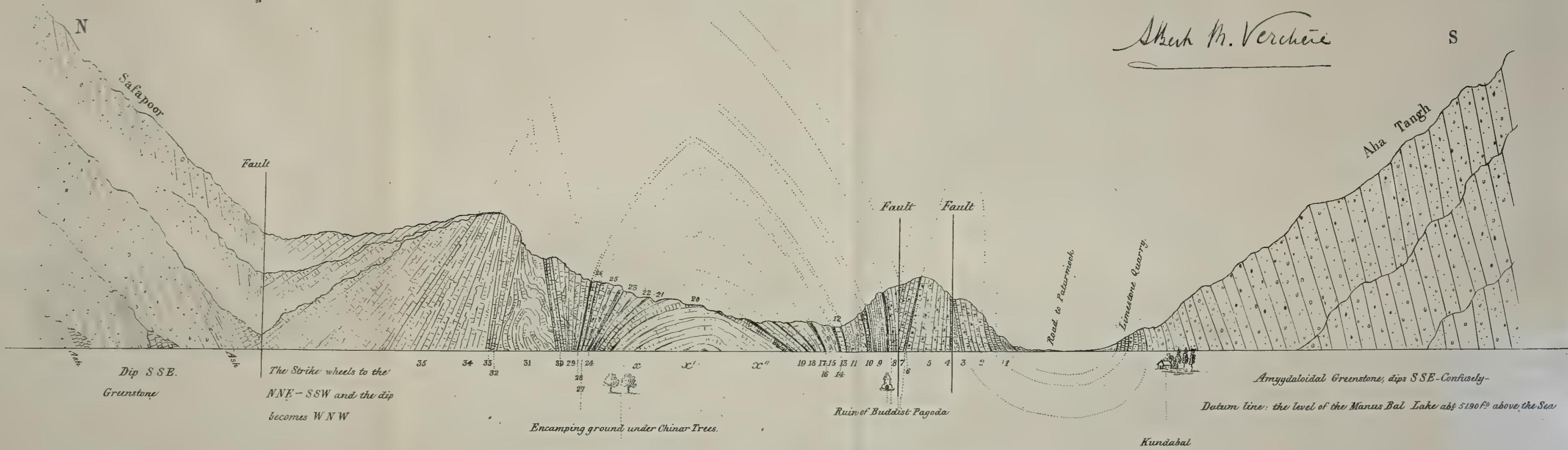
SECTION across the Spur of the KAMLAWAN above the Village of MURHAMMA.



Scale One Inch = 500 Feet. or  $\frac{1}{6000}$



*Albert M. Verchère*



Dip S S E.  
Greenstone

The Strike wheels to the  
NNE - SSW and the dip  
becomes W N W

Encamping ground under China Trees.

Ruin of Buddhist Pagoda

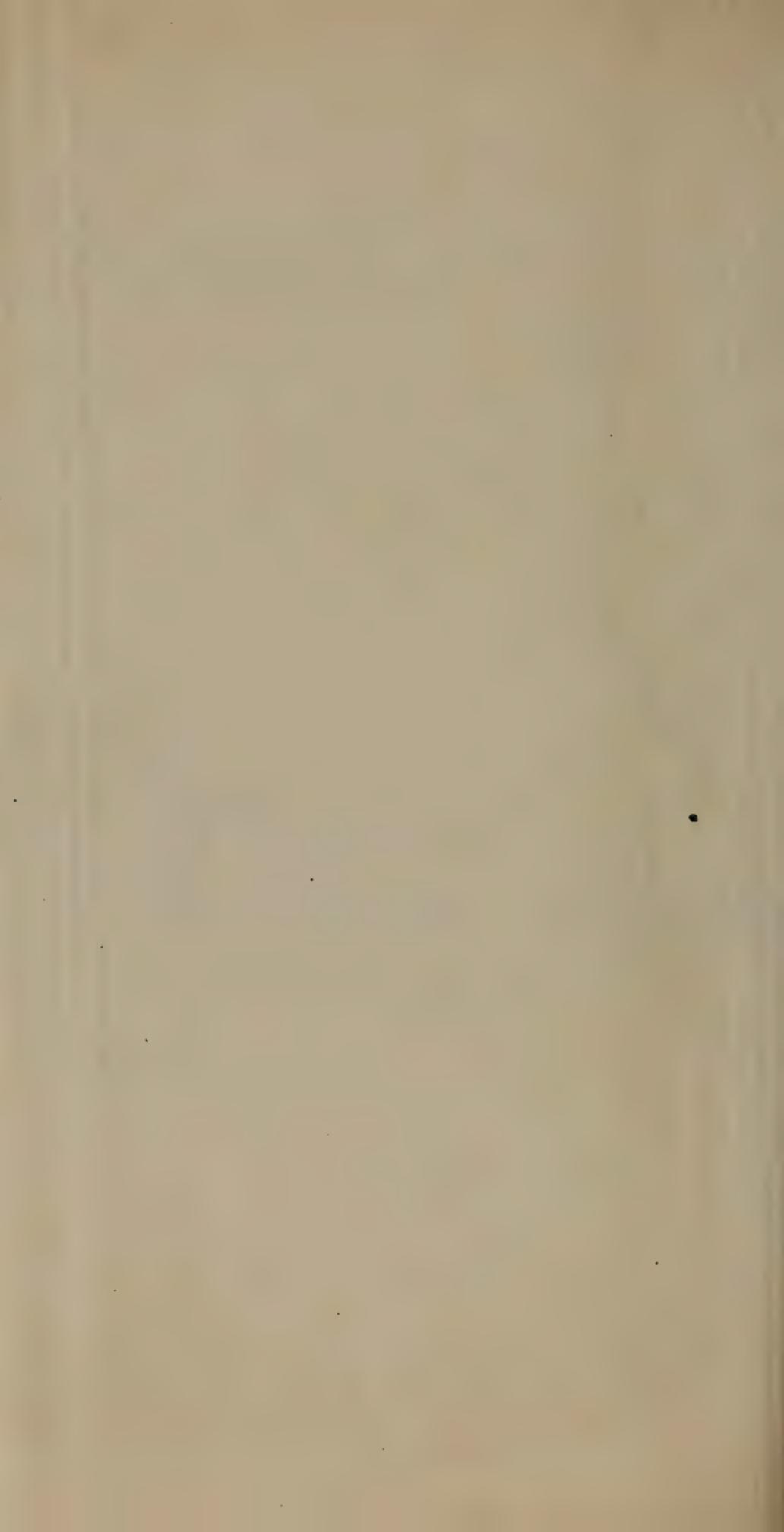
Kundabal

Amygdaloidal Greenstone, dips S S E - Confusedly -

Datum line: the level of the Manus Bal Lake abt 5190 ft above the Sea

SECTION of the MANUS BAL LIMESTONE  
between the SAFAPOOR and AHA TANGH.

Lith: by H. Niven Surv<sup>r</sup> General's Office Calcutta Aug<sup>t</sup> 1866.



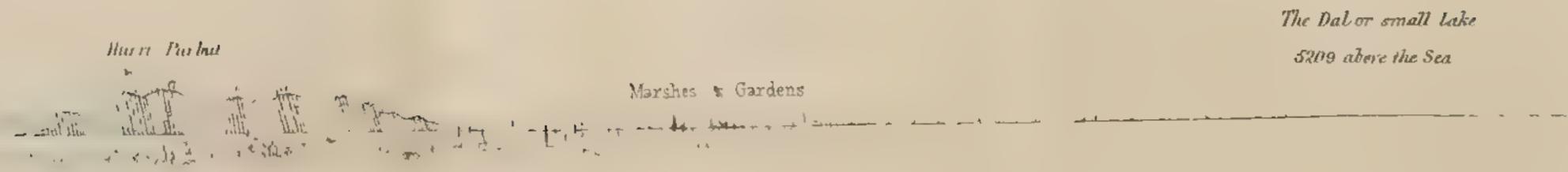
Section A (Section II of General or (A) Map)

Scale . 1 English Inch = 1000 feet, or  $\frac{1}{12000}$

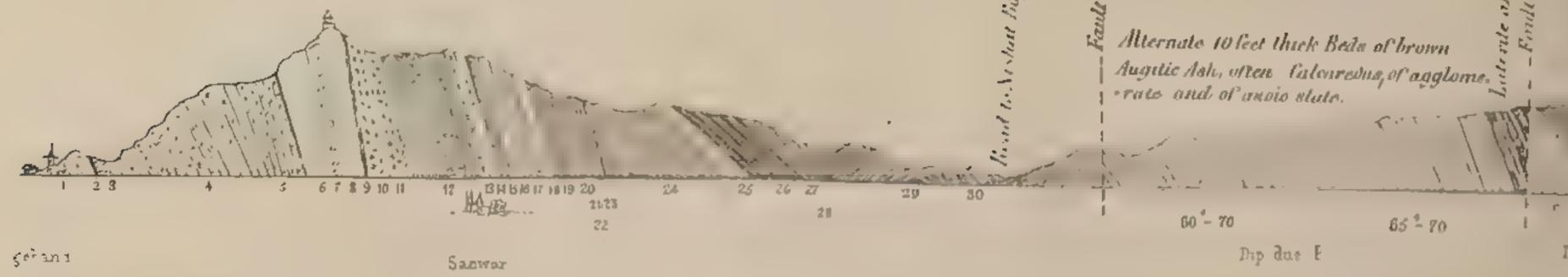


*Wash M. ...*

N 65° W



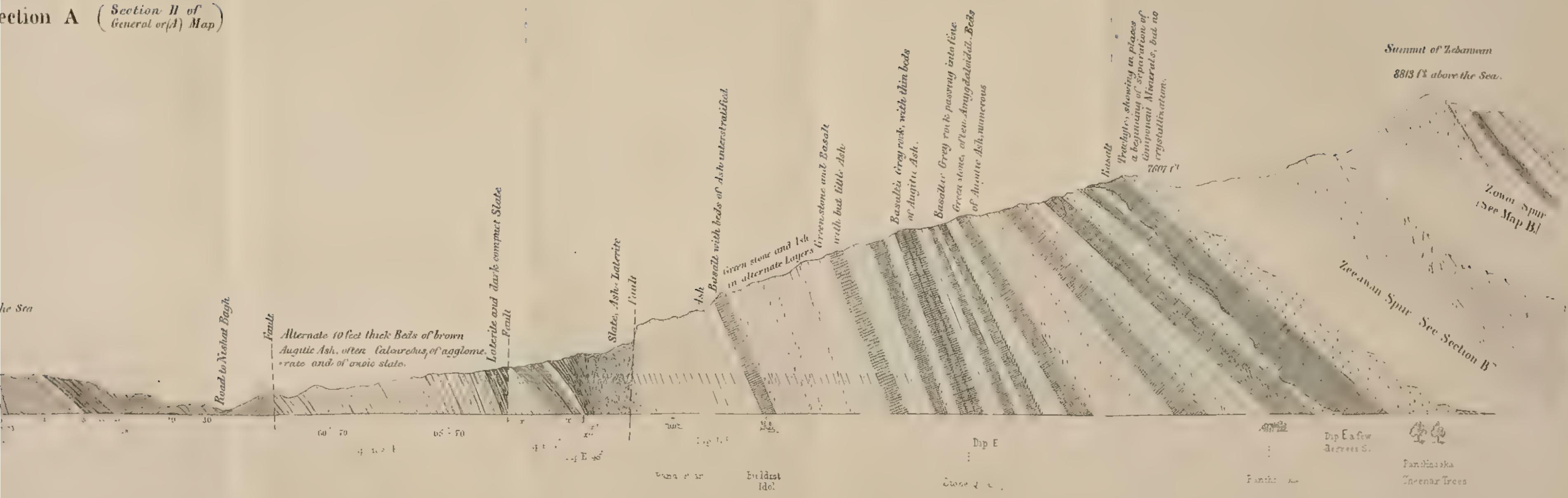
Buddhist Ruin  
Tukt-i-Suliman, 6063 f<sup>t</sup> above the Sea



SECTION across the HURRI PURBUT, TUKT-I-SULIMAN and W N W. portion of the ZEBANWAN

Section A (Section II of General or (A) Map)

S 65° E



...s the HURRI PURBUT, TUKT-I-SULIMAN and NW. portion of the ZEBANWAN

Section F.



1. The porphyritic Summit of Kutwal (14271. ft). 2. The Northern Extremity of the Saij-aha (11334). composed of Greenstone, Ash, &c. 3. One of the Spurs of the Safapoor (10309). similarly composed. 4. The Spur of Safapoor which overhangs Manus Bal (Lake) Greenstone, Basalt, Ash, &c. 5. The Aha-Tang, similarly composed. 6. The bed of Limestone between the Safapoor and Aha-Tang; wonderfully contorted by having been squeezed between the two hills. 7. The spur of Limestone of which a detailed section is given, (see Section 10) 8. Face of the beds of Limestone, dipping WN.W. 9 small beds of Limestone conformable to the Ash, and Greenstone, dipping S.S.E. 10. Fault.

*Mark M. Verchère*



- 6-1
- 6-2
- 6-3
- Silurian
- Carboniferous
- Permian (Formation of Trilobites?)
- Jurassic (Woolly Dinosaurs)
- Triassic
- Miocene (see also see 120)
- Quaternary (perhaps Zoroastrian)



SECTION ACROSS THE WESTERN HIMALAYA, THE GREAT PUNJAB MIOCENE PLATEAU AND THE AFGHAN MOUNTAINS

Sea level

Sloping towards the Swamps of the Zareh Lake & the deserts of Eastern Persia

Plains towards Kandahar

Rughzah (7000 ft)

Bunoo (1300)

Chacalee

Great Miocene Plateau of the Punjab

near Rawl Pindlee

River Indus (Flows towards the S)

near Rawl Pindlee

River Indus (Flows towards the N.W.)

2nd Colateral Chain (Diverging N.W. of N.)

Sea and Air Chart (see opposite)

10000 ft

Dip NW

Dip NW

Dip NW

Dip NW

Dip NW

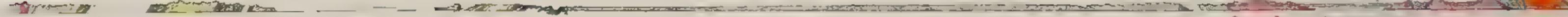
Dip NE

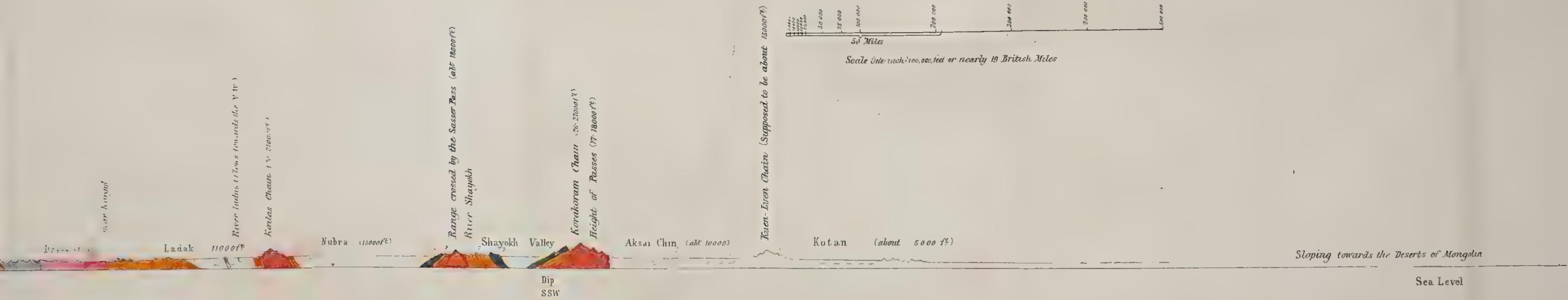
Dip NE

Dip NE

Dip NE

Dip NE





# JOURNAL

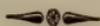
OF THE

# ASIATIC SOCIETY.

PART II.—1866.

SPECIAL NUMBER.

ETHNOLOGY.



## CONTENTS.

### ETHNOLOGY OF INDIA, BY MR. JUSTICE CAMPBELL.

| INTRODUCTORY.                                 | <i>Page.</i> |
|-----------------------------------------------|--------------|
| General remarks, ... ..                       | 1            |
| Points recommended for observation, ... ..    | 8            |
| General divisions, ... ..                     | 13           |
| <br>                                          |              |
| THE ABORIGINES.                               |              |
| General description, ... ..                   | 20           |
| Main divisions, ... ..                        | 25           |
| Southern or Dravidian tribes, ... ..          | 34           |
| Northern or Kolarian tribes, ... ..           | 30           |
| Tribes of Western India, ... ..               | 40           |
| Tribes under the Himalayas, ... ..            | 46           |
| The 'Bhooyas' of the Bengal borders, ... ..   | 51           |
| Question regarding the Brahuis, ... ..        | 54           |
| <br>                                          |              |
| THE MODERN INDIANS.                           |              |
| The Bramins or Khashas, ... ..                | 56           |
| The Jats, ... ..                              | 77           |
| The Rajpoots, ... ..                          | 85           |
| The Koonbees or Koormees, ... ..              | 92           |
| Some Punjab tribes, ... ..                    | 95           |
| Mahommedan settlers, ... ..                   | 98           |
| Pastoral tribes, Goojars, Aheers, &c., ... .. | 101          |



JOURNAL  
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*The Ethnology of India.*—By MR. JUSTICE CAMPBELL.

[Received 4th June, 1866.]

I trust that the great subject of Indian Ethnology has been taken up by the Society in a serious and earnest manner, with a view to that actual observation and practical inquiry which is only possible in the countries and on the spots where the various races are found, or where specimens of them may be collected together. The Government has already consented to take the first step in aid of the movement by collecting from its officers, in all parts of India, lists of the races and classes existing in the various districts. The present paper is designed to assist both Government officers and private persons in making classified and descriptive lists in such a uniform manner, and with such a uniform nomenclature and arrangement, that it may be afterwards possible to weld together the whole of the information thus obtained. Without some common plan and nomenclature, without, as it were, some Ethnological skeleton to serve as the guide and model into which the various details may be fitted, and by which they may be classed, I fear that there may be much confusion and error in bringing together lists which must necessarily often be made by officials who have little knowledge of Ethnology as a science, and whose practical knowledge and nomenclature are limited to their own particular parts of India. My object then is, to supply a sort of rough

hand book of existing information on the subject, particularly as regards the North of India, and my hope is, that such a guide may render much more easy, intelligible, and uniform, the collection of a mass of details, which will render our knowledge ample and complete. It happens that my personal experience has been wider than that of most officers; I have also travelled much in those parts of India in which I have not served, and have made the people a constant subject of observation and inquiry. I have farther, for some time past, noted the information on this subject which I could collect from books. And lastly, I have received much aid in my inquiries from many kind friends. During a late visit to the Punjaub frontier, I was under great obligations to many of the officers employed there, and feel that I can always look for assistance in that quarter. Recent papers by Colonel Dalton, Commissioner of the Chota-Nagpore territories, have given much information respecting several of the tribes of that locality of which I have made free use, and I had looked also to use another paper on the Coles promised by Colonel Dalton. It has not been received, but I hope that it will soon add to the information which I am now able to give. During a tour in the Bombay Presidency, I was fortunate enough to make the acquaintance and to obtain the assistance of Mr. Perceval of the Civil Service there, since Private Secretary to His Excellency Sir B. Frere, and through Mr. Perceval I have received a series of very interesting notes on the aborigines of that part of India by Captain Probyn, Major Keatinge, Mr. Ashburner, Mr. Probert, and the Rev. Messrs. Moore and Taylor, containing information not elsewhere procurable. During a former tour in the Mysore country and in some of the Madras districts adjoining, I received much kind assistance, and Mr. Bowring has since been good enough to point out to me some very interesting additional information. With respect, however, to the Telinga country, and the extreme South of India, I have not been fortunate enough to obtain all the information that I could desire.

It will be understood, moreover, that as respects every part of India, I by no means profess to give a complete sketch. I have not the necessary information, and have not time for the necessary study to enable me to attempt that. Indeed, in this as in so many other things, the more one learns, the more one sees one's ignorance and the vast

amount of inquiry that still remains. I only desire to tell so much as I know, and to suggest points on which inquiry is desirable. Although I have always been much interested in the people, I have usually not had time and opportunity to commit all that I have observed to writing; it is in fact only of late years that I have in some degree done so. I am obliged therefore frequently to use such expressions as 'I think,' not because I do not speak from personal observation, but because, writing from memory, I must give my impressions subject to the chance of error. In attempting too so wide and general a subject without great opportunities of study, I am at every turn liable to error. I would at once avow that I warrant nothing, even when I do not specially qualify my phrases. I only give my impressions for what they are worth. It is true that it would have been possible to verify many doubtful points, to fill up many gaps, and to solve some difficulties which occur to me in writing this paper, by farther enquiries in the proper quarters; but looking to the character of my paper, as an avowedly imperfect sketch, designed to elicit the information which may afterwards render possible something more complete, I have preferred not to delay, but to give what I now can, *as I now can*. In truth, my object is to suggest our deficiencies, to point to them, and to prospect the quarters where valuable strata of information may be found. I shall say what I have to say in the most simple and least technical form—in a rough and unpolished way.

My philological acquirements are very deficient. As respects Southern India, Dr. Caldwell, by his comparative grammar, has made comparison easy. But there is no such synthetical account of the Northern languages. The character of each can only be separately learned. The Rev. Mr. Trump has done much for the languages of the extreme North West, but as respects the characteristics of Bengallee, Maratta, Guzeratee, &c. when compared to Hindee and Punjabee, I find no easy guide, and have not been able to acquire any adequate knowledge.—Cashmiree is still scarcely known at all. We very much want such an account of the languages of the North as Dr. Caldwell has given us for the South.

In the mere matter of nomenclature, it is surprising how much confusion arises, both from calling the same tribes by different names, and also from calling different tribes by the same name. The former

error can only be met by explaining in detail the tribes variously known in various localities ; but in respect to the latter, some general caution seems necessary. It often happens that the same term is applied both to a Tribe or Caste, and to the profession usually exercised by that caste, and that while in one sense the term is proper to the caste, whether exercising the same or any other profession, in another sense it is applied to all exercising the profession, whether of the same or of any other caste. For instance, in the greater part of the Punjaub, the great agricultural tribe is the Jat, and there the words 'Jat' and 'Zemeendar' have come to be used by the people as almost synonymous. A man who is asked of what caste he is, will reply 'a Zemeendar,' meaning a Jat. And, *vice versa*, a Punjabee will sometimes call a man a Jat, meaning only that he is a Zemeendar. When I pressed some of the servants of the Maharajah of Cashmere regarding the Ethnology of the valley of the Upper Indus and other little known parts, I was at first much puzzled by finding them declare that the great mass of the people there are 'Jats,' but I presently discovered that they meant merely Zemcendars or cultivators, there being in fact no Jats within the Hills. In the West and South too, I believe that the terms 'Koonbee' and 'Wocal' are used both to designate certain agricultural tribes, and cultivators generally ; so that while "the Wocals are by the Mahommedans called Koonbees," that circumstance gives no assurance that the tribes are the same. The term Bunneah or Banian is properly applied to the great trading caste, but it also means a trader, and is often so applied. Again in India *religious* denominations are often applied in a way which confounds them with proper tribal denominations. The character of the Hindoo religion is such that it is a pretty safe Ethnological guide, converts not being ordinarily received. Mahommedan and other proselytising religions, on the other hand, are no guide in Ethnology ; on the contrary, the Mahommedan Laws of Marriage and Legitimacy are such as to tend very much to efface Ethnological demarcations. For our purposes therefore, Mahommedan denominations may be entirely put aside. But the mere fact, that people are Mahommedans, should not deter us from seeking their Tribal denominations in the back ground. Many Mahommedan tribes still retain their Hindoo caste names, some Hindoo laws, and something of caste exclusiveness.

Though not so pure or characteristic as their Hindoo brethren, many Mussulman Rajpoots and Jats are just as well known as such as the Hindoos; while many whole tribes have become Mahomedans without changing their tribal designations and occupations. Most of the modern Sikhs in no way separate from their tribes, and are known as 'Jat,' or 'Khatrie,' or 'Braman Sikhs,' one member of a family being frequently a 'Sing,' while others are not. Jains, I believe, are not ethnologically distinguished from Hindoos. Among the Bunneahs, it appears that some are Hindoos and some Jains, in the same tribes and sections of tribes. Very puzzling in the South is the term 'Lingaiyat' applied to those Ultra-Sivites who wear the Lingam, who seem *almost* to form a caste, and who are generally spoken of as such. So far, however, as I can gather, the term is really a mere religious denomination, and the Lingaiyats are of various castes, which should be distinguished.

In all inquiries then, great care is necessary in sifting out tribal, as distinguished from mere professional and religious denominations. When we arrive at proper tribal titles, it is farther desirable to inquire into the aliases or varieties of title often possessed by the tribes; for it may happen that while an obscure local title is in the most common use, another, less frequently used, will at once indicate identity with some well known and widely spread caste.

It is also very necessary to attend to the distinctions between great caste titles, and the sub-divisions of those castes. All the great castes have numerous gotes or sub-divisions; and when a man is asked to what caste he belongs, he will sometimes give the name of the general, and sometimes of the special caste or gote. Some of these sub-divisions really are or may be ethnological sub-divisions, others, from the peculiarity of Hindoo laws, are not so. On the principle which forbids the marriage of relations (carried by Hindoos to an extreme) men of the Rajpoot and other castes cannot marry in their own 'gotes,' but must seek their wives in other gotes. In blood therefore such castes really form but one race—so far at least as the intermarriages are carried—for there are many tribes claiming to be Rajpoots whom the higher tribes will not recognize. Of other castes, the primary sub-divisions keep altogether apart. I apprehend that under the general term 'Bunneah,' are to be found many separate

tribes who would on no account eat together or intermarry. I think, however, that throughout all the great Hindoo castes, a strong ethnological resemblance exists. I do not propose in this sketch to attempt to notice the sub-divisions, except in any case in which they may suggest marked ethnological features.

The details of Rajpoot and Bramin heraldry and hierology have been amply given in several excellent works, and I shall touch on nothing of that kind.

A caution which seems to me to be necessary is, that the accounts of their origin given by many tribes, and especially by their Chiefs, must be received in a very guarded way, because there is a great tendency to invent origins illustrious in the eyes of men of the races and religions to which they belong. Among the Hindoos, the Rajpoot rule is so famous, that almost all tribes which have taken to soldiering or acquired power, pretend to a Rajpoot origin. At this day, some of the followers of Maratta Chiefs have the impudence to tell strangers that they are really Rajpoots, as if their origin was not matter of the most recent history; and almost all the aboriginal tribes who have risen to any power (or at least the chief families among them) affect a Rajpoot descent. As Colonel Dalton describes it, they are undergoing a gradual process of '*refining into Rajpoots*,' a process probably founded on a very small Rajpoot immigration and alliance, and a very large amount of invention. Even the Jats and other tribes who need hardly descend to such stories, frequently make themselves out to be Rajpoots who have been separated from the orthodox for some looseness of practice; but my impression is, that most of these stories are quite idle. Even acknowledged Rajpoots of the North-Western hills who are, in an Ethnological point of view, a much finer and purer race than any in the plains, assert that their ancestors came from Ajoodea or Oude. So in Cashmere, the Bramins there, whose mere features at once proclaim them to be one of the highest and purest races in the world, instead of adopting the more ancient and better traditions which would point to their country as the common origin of the Bramin races of India, prefer the story that when Kashyapa dried up the Lake (a geological fact patent even to Hindoos) detachments of all the most famous and most sacred of the different Bramin classes were brought into Cashmere, who, amalgamating, formed the present

Cashmeeree Bramins. The real cause of all these stories, I take to be this. The Hindoos, as Hindoos and from an orthodox Hindoo point of view, did not attain their highest religious, literary, and political development, till they were settled in the plains of India; consequently the early Bramins of the valleys of the Himalayas are not considered nearly so orthodox, so sacred, or in the Hindoo scale so high, as the more famous Bramins of the plains. And the Rajpoots of the Punjab and the adjoining hills, are not so high in the scale of strict Rajpoot orthodoxy as the Solar and Lunar races of Ajoodea. Hence it is that the races, really earlier and purer, think it necessary to claim descent from those who, in our point of view, are really very inferior.

Again, most tribes which have been for many centuries converted to Mahomedanism, set up some origin founded on the traditions and literature of the dominant Mahomedan races. They are generally descended from Soleiman or Nooshervan, or something of that kind. Jewish names and traditions are particularly in vogue among the Mahomedans (Abraham, Jacob, Joseph, and many others known to us, are their most common names, in the form of Ibraheem, Yacoob, Yoosoof, &c. &c.) and it has been pointed out, that the Affghan assertion of Jewish descent loses most of its significance, when we find how many other tribes have stories of the same kind. I have not been able to ascertain whether the "Soleiman's Throne" met with in so many places is to be specially referred to the Jewish Solomon, or whether the term is merely the "Suleh-man" or wise man of the East. At any rate I believe that most of the pretended Mahomedan genealogies are in brief 'bosh.'

I do not mean that popular traditions are to be neglected, on the contrary, I think that they often lead us far towards the truth; but I say that we must use caution and discrimination, to sift the wheat from the merest chaff.

I should add that I believe that the claim of aboriginal and other tribes to Rajpoot and such like origin, is not always without some foundation in fact. The Rajpoots seem, like the Normans, to have frequently found their way in small numbers among inferior races, and there amalgamating and intermarrying with them, to have acquired by force of character a leadership over them, and to have considerably

raised the position of such tribes. There is, I think, a good deal to suggest that during the various invasions of Southern India by a succession of Northern 'Yavanas,' small tribes of these latter may have taken up their position in difficult parts of the country, and there, amalgamating with the aboriginal tribes, have formed half-breed races of much robber-like and semi-military energy.

Before going farther, I would suggest the following as especially deserving the attention of those who are willing to aid in a popular way in classing the various tribes and castes in India.

1. Physical appearance. The three main types, Caucasian, Mongolian, and Negro or Negrito, are well-known. In India we have, in the extreme North, the finest and purest Caucasian type, the handsomer and more open form of that which we know as the Jewish cast of countenance; fine head and features, high brow and nose, long beard, tall, lithe, powerful figure, colour generally light. Throughout India, we have this type modified and subdued by every variety of straight and snub nose and plebeian features, much as in Europe, and with a dark skin unknown in Europe. Sometimes the skin becomes very black, and the lips are thick and protuberant; *there* may be marked the infusion of blood of the Negrito type which probably modifies the higher phase of the Caucasian type, even when actual Negrito features cannot be traced.

This Negrito type we find in India not accompanied with the muscular form of many Africans, but in a small slight race. The principal points to be marked, in addition to colour, are the lips, already alluded to, shape of face, nose, and eyes, presence or absence of a considerable beard, character of the hair.

Among the Thibetans and Nipalese we have extreme examples of the type which I call generically Mongolian. The eyes particularly there is no mistaking. The hair is straight. The colour is yellowish, but never dark.

2. Language is liable to disturbances, and has been perhaps too much taken as a sure guide, but it is always of great assistance, and in 19 cases out of 20 tells a true tale. In practice I think that no considerable philological acquirements are necessary to enable an observer to make most useful observations of a language quite unknown to him, if he can only get the rudest interpreter. There are certain

words which may almost be taken as unfailing tests in classifying language; for instance, the first few numerals, the names for the commonest parts of the human body—as hand, foot, nose, eyes, mouth, head, &c.—the names of the commonest family relations—father, mother, brother, sister—sun and moon, fire and water—the personal pronouns, and one or two others. I shall try to add to this paper some of Mr. Hodgson's lists. I do not know that they are all the best selected words, but they are uniform lists of different languages in parallel columns, and will enable any observer to determine on the spot whether the savage he has caught, *primá facie*, seems to belong to one or other of the classes represented in the columns. I shall also make a smaller list of English words, a translation of which I would recommend to be sent with each account of a tribe or race, speaking a language in any degree peculiar.

It should be observed that it may not unfrequently happen that men who seem to speak but a rough jargon of some well known language may, on close observation, be found to use peculiar terms for some of the most familiar objects, and that these latter may be invaluable as containing the remnants of their original language, all but absorbed in another which they have for the most part adopted. Especially will such words be valuable, if they can be in any degree identified with those in any of the Aboriginal Vocabularies.

Grammatical structure is somewhat more difficult of observation, and so far as I know, the general structural character of all the modern Indian languages is in a considerable degree similar. I mean that there is no such radical difference of formation as there is between Hindee and Arabic. But those who can give a little attention to the subject, might supply small grammars of declension, conjugation, and derivation, which would be eminently useful. And on the Eastern Frontier, the distinction between Indian and Indo-Chinese grammatical forms might probably be readily marked.

3. Religion. There is so much similarity in the religions of so many rude tribes, that there may be doubt whether such worship as that of the Sun, Moon, and the lord of Tigers represents a wide spread religion, or merely a coincidence of very obvious ideas repeated again and again; but it is worth noticing these ideas, in the hope that some

substantial inductions may be formed from putting together many observations.

And among the more civilised races, I think it not improbable that an accurate observation of the prevalence of Sivite and Vishnuite ideas respectively, among particular tribes and castes, may be found to have an ethnological significance. I cannot help thinking that these two forms of modern Hinduism may in fact represent entirely different religions derived from widely different sources, and that while the Vishnuite faith came from the north, the Sivite may have had some other origin, and may be the special property of races which of old peculiarly affected it. Sivite monuments certainly seem to be marks of a very old faith in the greater part of India, and the essential element of it, the reverence for and deification of the procreative power, seems to be the same idea of natural progression which is carried on by the Buddhist doctrine of gradual perfectibility (raising man almost to the rank of a god) in opposition to the Vishnuite or Vedic creed of a separate creation of gods and their occasional incarnation in the form of man. If then pure Sivites, Buddhists, and Jains are in some way connected, and they all prevail most in the West, who are those who brought their doctrines there? and whence did they come?

4. **Laws.** I believe that, laws are among the most persistent ethnological marks, and that, as such, they have been too much neglected. Caste, and Marriage as a sacrament strictly limited by caste, seem to be Arian institutions. Arian are strict rules of inheritance, resulting from that sacred form of marriage and subject to none of the caprices of Mahommedan and similar laws. Arian is the private property in land, as distinguished from the Tribal; the property first of the village—then of the family—then of the individual; and a consequence is, the attachment of the Arian to his native soil. Especially Arian is the form of what we call constitutional, as opposed to patriarchal and arbitrary government. The Indian village or Commune is a constitutional unit, common to all the Arians. A main distinction, as I think, between two great classes of Arians is to be traced in the constitution of these Communes—Aristocratic among the one—among the other democratic, and recognizing as equals all free citizens, to the exclusion of Helots only.

Among the non-Arians, on the other hand, the rule of the Chiefs

seems to be patriarchal and arbitrary—property in the soil is tribal rather than individual. There is little local attachment to the soil.

The aboriginal tribes of India move from place to place, abandoning one location and taking up another in a light way; they are even ready to give up their land, to become labourers, and to emigrate in a way to which the Arians are by no means prone. They seem to have among themselves no caste, they eat anything and every thing. Marriage is, I fancy, but a loose tie. On all these points, however, we want much information.

5. Manners and mental characteristics. Under this I must include so much that I cannot attempt to detail it. Suffice it to say, that any information regarding the temperament and bearing, the intelligence, the customs and habits, the amusements and the ceremonies of little known tribes, may be in many ways most useful.

It is patent in India to the most superficial observer that, owing to the peculiar institution of castes, mere vicinage (even lasting many hundred years) has not, as in Europe, led to the welding of different races and tribes into proper local nationalities: that, in fact, in the same locality many different races exist together without complete intermixture, while a single race may frequently be traced through many different provinces and countries, always retaining its own peculiarities under a great variety of circumstances and in contact with many varying races. On the other hand, language can never be exclusive, it must be the means of inter-communication between man and man, caste and caste, without distinctions of race or creed. Hence, however much by religion and race a tribe may be segregated, if it be politically and to a great extent socially united with other peoples, it almost always in the end adopts their language, or a common language is formed by intermixture. That is the ordinary state of Indian society. In the business of life, the different castes are united in one society; some are in the upper, some in the lower strata; one is the lord, another the priest, another the free cultivator, another the hewer of wood and drawer of water; but still they form one social whole. Farther, although the rules of caste and marriage may hinder the inter-communication of blood, it cannot but be that in the long course of time, during which different tribes live in the closest intercourse, there must be some irregular percolation from one

to the other; in the course of thousands of years, something of the blood and features of one will be infiltrated into the other.

Thus it has happened that in India there is a sort of double classification of the people, similar to that which we sometimes see in rocks in which there is a double stratification, one line of strata running say horizontally, and another line crossing the same rock say vertically. When we trace a tribe or caste from one Province to another, we shall find that in some things it retains the class character, in others it varies according to provincial character, the latter chiefly prevailing in point of language.

I propose to trace, so far as I can, the different tribes and classes throughout India, irrespective of local nationalities, and to some extent irrespective of language. I had thought that I might afterwards, when that is completed, remark on the quasi-nationalities created by the use of special languages and the social specialities of particular provinces; but I find that our information is as yet so imperfect, that I prefer to leave this latter task to another day. I shall merely make some casual remarks on language and a few other national features, as they occur in the course of my narrative.

Till we have accomplished an Ethnological Geography, whether Tribal or National, I shall for the most part use the ordinary terms of our Modern Political Geography, and speak of the Punjab and Scinde, Bengal and Mysore. But for facility of reference, I must make one or two explanations. I shall speak of Hindustan and the Hindustanees as the terms are applied by the natives, to the whole of the great Central region of Northern India from the Punjab on one side to Bengal on the other, and from the Himalayas to the Southern declivities of the Satpoora Range running across India in about the parallel of 22° Lat. I include in Hindustan, Bahar, (confining the term of Bengal to Bengal Proper) as well as Oude, Rajpootana, and Malwa. South of Hindustan to the West is the Maratta country, which may be roughly indicated as bounded by a line drawn from Nagpore to Goa. And farther South are the Southern countries, sometimes called Dravidian, first the Telinga or Telugu country to the East, the Canarese to the West; beyond them again the Tamil country to the East, the Malabar or Malayala country to the West.

As respects the physical features of these countries, it will be remem-

bered that the whole of Bengal proper, the N. W. Provinces and Oude, the Punjab and Scinde, with part of the adjoining desert country, form a great semi-circular plain in which there is no place of refuge (with little exception) for remains of aboriginal races; in all these countries the modern races live together as one social whole. But throughout Central and Peninsular India, while the most open plains and best cultivated parts of the country are similarly inhabited, there are scattered about, over every province, hills and jungles giving cover to aboriginal tribes which hold themselves aloof from the general population, and are very different in language, manners and other particulars.

It is well known that the great plain is bounded on the north by the line of the Himalayas, rising almost suddenly in great and rugged height, but yet habitable for a considerable distance inland before the snows are reached. That boundary is so uniform that more need not be said respecting it, except as regards the northern extremity of India. There the plain is not at once succeeded by the Himalaya. The range called the Salt Range runs across from Jhelum to Kalabagh on the Indus, and thence to the Affghan mountains, cutting off as it were and enclosing a sort of triangle, and supporting a somewhat elevated country something of the character of the Peninsular portion of India, and lying between this Salt Range and the Himalaya. The Salt Range, it will be presently seen, is an Ethnological boundary of some interest.

I now commence my survey according to Tribes and Castes.

First, I take as a great division the black aboriginal tribes of the interior hills and jungles. There can, I suppose, be no doubt that they are the remnants of the race which occupied India before the Hindus. I need not here go into any question, whether any portion of them had received any civilization from any other source. It is enough that all these tribes have many ethnological features in common. They are evidently the remains of an element, the greater portion of which has been absorbed by, and amalgamated with, the modern Indian race, and which, mixed in various degrees with the high-featured immigrants, has contributed to form the Hindoo of to-day. In the South their speech still forms the basis of the modern languages. If proof were wanting that the predominance of Caucasian

features has been attained, in a great part of India, but gradually, and that it is within the historical period that these features have altogether preponderated, it is only necessary to look at the ancient sculptures of the South and West. Take for instance the caves of Elephanta near Bombay. Who, looking at the faces there cut in stone, and observing the universal thick lip and peculiar feature, can doubt that when those were cut, the non-Caucasian element was still large even among the higher classes ?

My scheme, however, is not to separate any of the tribes or castes of modern Indian society, and to designate them as aboriginal. All those people who have been either completely or partially amalgamated into Hindoo society, whether as proper Hindoos or as Helots and outcasts, I regard as coming within the designations of ' Modern Indians.' I shall class as Aborigines only those tribes which still live apart, forming communities by themselves, under their own leaders, and often speaking their own peculiar languages.

As Modern Indians again I class together all the high-featured northern races, and all the various tribes, castes, and nationalities formed by them after absorbing so much of the aboriginal element as has been amalgamated with them, whether they are now Hindoos, Mahomedans, or of any other religion. Of course they are mainly Hindoos. I draw no wide ethnological line between the Northern and Southern countries of India, not recognising the separate Dravidian classification of the latter as properly ethnological. It seems to me that among all the Hindoo tribes the Arian element now prevails, and that the presence, more or less, of the aboriginal element is only a question of degree. As a question of degree, I do not think that there is, at any geographical parallel, any decided line. It is remarked by Max Muller that languages are seldom properly speaking mixed. Vocables may be mixed, but a single grammar and structure usually prevails. Therefore the change from one language to another must in so far be sudden. It is still, I believe, open to dispute whether the grammar of the present languages of Northern India is of Sanscrit or of Aboriginal origin ; but at any rate this we know, that in the North the Arians gained so rapid and complete an ascendancy as to introduce their own radical words, numerals, &c., and to render the language essentially Arian, while in the South the Aborigines held out

longer, the tide of Arian immigration was more gradual, and the Aboriginal grammar and radicals formed the mould which was only filled up by a large over-lay of Arian words. The change then of language takes place, where passing southwards we exchange the Maratta for Telugu and Canarese. But looking at the people, we see no radical change of feature or characteristics. The last of those who are more properly Arian in language, are not essentially superior to the first of those whose language is by its structure classed as Dravidian. The Marattas who are classed as Northerners (though they probably take their name and much of their blood from the aboriginal Mhars and such like tribes, whose features survive in their monuments) have no decided advantage over their Canarese neighbours; on the contrary, the Canarese of Belgaum and Dharwar are deemed superior to the Marattas of the adjoining districts. And to a traveller in Mysore and most of the Southern countries, the general features and appearance of the people is, I think, not very greatly less Arian than that of the lower classes of Hindustancees. The truth I take to be, not only that in a mixture of races there is a tendency of the higher, more marked, and more prominent type to predominate, but also that it may well be that, although the people speaking a Dravidian language in the South, may always by force of numbers have linguistically prevailed over each separate batch of immigrants, and so far annexed them, still by successive immigrations, notwithstanding a Dravidian form of speech, the Arian blood has come in reality greatly to prevail. The mere fact that they are recognised as Orthodox Hindoos, seems to imply the Northern origin of all the better castes in the South, and that is their own account of their origin. I have no doubt that the Southern Hindoos may be generally classed as Arians, and that the Southern society is in its structure, its manners, and its laws and institutions an Arian society. After all, in their main characteristics, the Southern people are very like those of the North.

Among some of the inferior tribes of the South, the remains of the thick lips, the very black skin, and other features may, as I have said, still be traced, but, colour perhaps excepted, the aboriginal features are probably gradually wearing away.

Notwithstanding the identity in the main of the North and the

South, it will be seen when I come to details, that the change of language very much puzzles and baffles me in the attempt to trace the tribes and castes from North to South, and in fact causes a substantial gap in the contiguity of my survey, which I trust that others will fill. To return to a geological metaphor, there is as it were a serious *fault* at the point where the change of languages takes place. A similar series of strata goes on upon the other side, but I can't exactly identify the particular veins and say which is which. The same series of classes with similar characteristics prevail in the South, and, knowing that they must have come from the North in a continuous stream, one feels sure that they must be identical with Northern congeners. It remains for those who have an intimate knowledge of the country on either side of the Fault to connect the broken links. Meantime, with the exception of the Bramins (who may be traced all through India), I must notice the people of the Southern countries separately.

Commonly as the term is used, it may be well to say a word in justification of the use of the term 'Arians' as applied to all the Northern people. Not only are they known by the Southerners as Aryas, (see Buchanan,) but in fact I believe the term to be the correct one. I am aware that some have set down the Jats and others as Scythians and Turanians. I have no intention of quarrelling with any one who chooses to call them Scythians, for that is a very wide and uncertain word, which may have been applied to Germans as well as to Jats. But if the word Turanian is applied to Punjabees, in the sense of expressing that branch of the human race which we call Mongolian, the squat, flat-faced, peculiar eyed, beardless people of Central, Northern, and Eastern Asia, then I say that the term is wholly inapplicable. Anything more unlike Mongols than the tall, handsome, high featured, long bearded Punjabees it is impossible to imagine. To say, on the strength of some obscure similarity of names, that any of these people are Mongols and Tartars, is not only as unfounded as the connection between Monmouth and Macedon, but is opposed to the most palpable physical facts. It would be about as reasonable to say that the people of Tamworth are really Negroes of Timbuctoo, because Tam and Tim are clearly the same word. An Englishman is not more unlike a Negro, than a Punjabee is unlike a Mongol.

Assuming then that the North-Indians are what we call Caucasian in feature, the only question would be whether they may be in any degree Semitic. This there seems to be no ground for supposing; there is no radical trace of Semitic language, and we nowhere trace any considerable immigration by land of Arabian or other Semitic tribes. That being so, I hope that I may properly call the North-Indians Arians, and extend the title to all those Indians in whom Arian features predominate, even where they have been softened down and otherwise qualified by intermixture.

Although I believe any division of the Northern tribes in India into Arian and Turanian to be quite out of place, I have long had an impression that the result of a thorough examination may be to divide the Indian Arians into two classes; the earlier Arians, the descendants of the most ancient Hindus, a people acute, literary, skilled in arts, but not very warlike, and rather aristocratic than democratic in their institutions; and the later Arians, warlike people—possibly once Scythians—democratic in their institutions, and rather energetic than refined and literary. War does not seem to have been one of the earliest arts; we are told that the earliest Egyptians have left little in their monuments which suggests that art, and it may be that the earliest Hindus had little occasion for it, meeting with but simple and peaceful savages. The later Arians appear, in my view, in their manners and institutions more nearly to resemble the German tribes, and perhaps to them might more properly be applied the term Indo-Germanic. The earliest Hindus appear to have had an intimate connection with the hills immediately adjoining India on the North-west, and there may well have been gradual immigration from the hills to the plains. But at a later period, when the people in possession of the North of India had acquired considerable power, it seems hardly possible that large bodies of conquering immigrants should have found their way to India by Cabul and the Khyber Pass. Those defiles are far too difficult to be forced by strangers in large bodies accompanied by women and children. The Affghans, and those who have ruled the Affghans, have had the command of the direct route; but if Rajpoots, Jats &c. came as immigrant peoples, they probably came by the route of the Bolan, occupying the high pastoral lands about Quettah, and thence descending into the plains below. We shall find accordingly that the Jats

(whom on this theory we may suppose to have been the latest comers) occupy just the area which would tally with such a mode of immigration.

In physical appearance I would divide Indian Arians into two classes, as far as we can call that a division which is only a question of degree. The people of the extreme north, the pure Arians, large, fair, high-featured, I shall call "High-Arian" in type. The prominence and beauty of their features is remarkable. The brow is remarkably high and well shaped; the nose connected by a high bridge with the high brow is also well shaped, sometimes straight, more often slightly curved; the eyes are very fine, the lips thin, mouth of a good shape, the beard long and full. The type once seen cannot be mistaken. The prominence of the brow in adults somewhat conceals the eye, but in the children it is something marvellous. On the other hand, the more subdued features, more frequently approaching a low and snub-nosed type, and resembling those which are common among the lower classes in Europe, are in India generally accompanied by a shorter (but still pretty robust) form, a skin darker (but still more brown than black), and an appearance altogether inferior, but yet not aboriginal in its style. This I shall call the "Low-Arian" type.

In addition to the two main divisions, of aborigines, and modern Indians, I propose to put under a third division, those whom I shall generally describe as "Borderers," that is, the tribes on the borders, whose blood and manners show the influence of immigrants of races other than those already noticed. These meet and mix with the native populations, and form some marked classes. On the West Coast there has been a considerable immigration of Arabs and others; the same has been the case in Lower Sindh. Along the whole line of the Himalayas, and on the whole of the Eastern Frontier, Turanian races meet the Indians.

Thus then I have three main classes:—

1. Aborigines,
2. Modern Indians, and
3. Borderers.

The 2nd are of course by far the largest and most important class.

Besides making the distinction among modern Indians of high and low Arians, there are one or two other points which I would notice, before going into details.

I should like to class Hindus as High and Low Hindus. There is a full-blown style of Hindus (principally Hindustanees) who have adopted to the full all the modern Hindu superstitions and observances, who are very particular about their cooking and such matters, and in consequence generally eat but one large meal once a day, whose widows may not re-marry, and who are in a continual state of anxiety about the rules of their caste. These are high Hindus. There is another class of Hindus, much less particular, whose religion and religious observances sit very easy upon them, whose widows re-marry, and whose prejudices do not prevent their taking good wholesome meals as often as they can. Such are the Punjabees, some of the Hindustanees, and I believe a good many of the Southerners. These I would call low Hindus.

With respect to caste, whatever there may once have been, there is now no proper Military caste. The fighting and dominant tribes are, it may be said invariably, in the main Agricultural and are classed as such. Why the old Vaisyas are sometimes said to have been the Merchant class I do not understand. It is clear that they were the body of free people, whose duty it was to till the land, keep flocks, carry on trade, and many other things besides. The Soodras were the Helots, "whose duty is expressed in one word, viz., to serve the other three classes," evidently the conquered race. Now-a-days it seems to be considered that, except the Brahmins, almost all are Soodras, that is, all have more or less intermixed with the lower races and lost their purity of blood. Hindu Society then has lost its former great divisions, and has been split up into an infinite variety of decent castes of mixed parentage, who have absorbed the old Soodras, as well as the Vaisyas. Under them again new tribes of Helots are found, probably tribes more recently conquered.

The Agricultural tribes may, for the most part, be divided into three classes:—

1. Those whose proclivities were originally Pastoral, and generally somewhat predatory.

2. Agricultural tribes in the proper sense, that is, Farmers—men who both cultivate the soil on a large scale, and keep cattle and waggons when the country is favorable to that kind of Farming. These tribes are also most frequently those who have the greatest

Military vigor, and most democratic constitution, and generally occupy the dominant position in the country.

3. The gardening tribes, *i. e.*, those who do the smaller and finer farming and kitchen gardening. These are generally peaceable and unmartial people.

I shall not always exactly follow this order, but shall take first the tribes who are politically most important.

The Mercantile tribes I shall notice separately, and then the Writer tribes, where such tribes exist. When I speak of literate occupation, I mean exclusive of mercantile business, that being almost everywhere in the hands of mercantile castes. Next come the Artizans, and finally the Helots and inferior classes.

#### THE ABORIGINES.

In giving any general description of the Aborigines, I must premise that it is by no means to be supposed that all or most of the individuals of the race will correspond to the description. The fact is that the Aboriginal tribes now remaining are but like scattered remnants of a substance floating here and there in a mass of water, into which they have been all but melted, and in which they are on the point of disappearing. By far the greater part of their substance has already commingled in the fluid around them, the remainder is saturated with it, and it is only in the very kernel and inner centre of the largest lumps, that something like the pure original substance is to be found. There is not in Peninsular India any very large tract of very high and difficult country; the Aboriginal tribes are for the most part not collected in any great masses supporting one another, but are found in small and detached tribes here and there, wherever a bunch of hills or an unhealthy jungle has given them a refuge. Even in these retreats, they are everywhere closely surrounded by, and to a considerable extent penetrated, or as I called it, saturated with an Arian element which modifies both their features and their language.

Another circumstance has perhaps almost as much contributed to modify many of these tribes. There seems to be no doubt that at points in Indian history, where one dominant race has given way and before another has been fully established, tribes of hardy aborigines from the hills, accustomed to the use of weapons in the chase and

probably to a good deal of robbery, have come down on the enervated people of the plains and valleys, and have established a temporary dominion over considerable tracts of country. Just as on the departure of the Romans and before the establishment of Teutonic rule, the Picts and Scots came down on the cultivated portions of Britain, so it seems certain that, at periods long subsequent to the glories of the Solar and Lunar Rajpoots, Aboriginal Bhurs and Cheroos established considerable principalities in parts of Oude and of the Benares and Behar Provinces. So also Bheels, Mairs, and Kolees seem to have had at one time considerable power in Rajpootana and Goojerat. In comparatively modern times, the Bedas or Beders (whose name is I believe really identical with that of the Vedahs or Vedders) seem to have established considerable power in the South, and the Gonds in Central India acquired quite a wide dominion. Under such circumstances, the savage conquerors are generally themselves socially conquered, and the tribes so situated, while gaining some civilisation, lose much of their peculiarities of blood and feature, and more of their language.

By far the largest tract in which the Aboriginal tribes prevail, and may be said to form the mass of the inhabitants, is that extending through the hilly country from the western and southern borders of Bengal, Behar and Benares to the frontiers of the Hyderabad and Madras territories, and from the Eastern Ghats inland to the civilised portions of the Nagpore territory; but even in this tract it appears that there are evident monuments of old Hindoo civilisation, showing that Hindoos, or at any rate Sivites, had at one time a far greater hold on much of this country than they now have, and that probably after being partially civilised, it was gained back by the Aborigines. Even now this country is intersected by settled and cultivated tracts. Hindoos are scattered about it, and there is an admixture of Hindoo blood. Still, in all this part of the country, Aboriginal tribes muster very strong, and they preserve their language, their manners, and their peculiarities much better than elsewhere. It is, however, as I have said, only in the heart and kernel of the best preserved tribes, that we must look for the real original characteristics existing in a palpable and little-diluted form. In less pure specimens, they will be found less distinct. My impression is that, if we look carefully, they will seldom be altogether wanting. The

*thick-lipped* expression of countenance lingers long. The Gond Raja of Nagpore is of a family for generations civilised and Mahommedan, doubtless of very far from pure Aboriginal blood, and rather fair-skinned, but even in him I noticed the thick lips as prominent as in an African. Major Tickell seems to describe the 'Hos,' who are identical with 'Lurka Coles' and closely allied to Moondahs and Sontals (one of the ugliest of races), as handsome; but everything is comparative, and I suspect that this beauty is of the same kind as that which enthusiastic African travellers are constantly discovering in Negro tribes. The Hos of the border land have probably much intermixed with Ooriahs, and are less ugly than their congeners are always described to be.

Setting aside then the numerous half-breeds, borderers, and people of imperfect type, I take it that the general physical type of all the purest Aboriginal tribes, is that which is commonly known as Negrito. They are small and slight, *very* black, face broad and flat, the thick lips already mentioned very prominent, noses broad and nostrils wide, beard scanty, hair very abundant and tangled, of a shock-headed appearance, sometimes curly or even woolly. The peculiar Mongolian or Chinese form of the eye is not conspicuous, and altogether the features and the face are rather what we best know as African than Mongolian. This description crops up everywhere in all the various descriptions of Aboriginal tribes. I have not collected all these testimonies, but I will give one or two on which I can lay my hands. Col. Dalton says, "The Jushpore Oraons are the ugliest of the race, with foreheads 'villainous low,' flat noses and projecting maxillaries, they approach the Negro in physiognomy." And again, "The Kaurs, next to the Jushpore Oraons, are the ugliest race I have seen, dark, coarse-featured, wide mouths and thick lips." In a note which he was good enough to send in answer to some inquiries which I made, he adds, "The Oraons have more of the African type of feature, and I have seen amongst them woolly heads." An isolated tribe on the East Coast, called 'Chenchwars,' are described in similar terms, and said to be "just what you might suppose to result from the crossing of the Malacca Aborigines with the common people of this country," the Malacca Aborigines being very marked Negritos. The Savage Gonds in the forests east of the Wyngunga seem to be of a similar type. So

in the papers with which I have been favoured from Bombay, I find that Major Keatinge, describing the three tribes of Gonds, Koors, and Bheels who meet about Asseerghur, says, "All three tribes are very black, with a decidedly African expression when met in the centres of their country." And Capt. Probyn, speaking of the more civilised Gonds who are now, he says, finer and fairer, still adds, "with somewhat African features." Major Keatinge adds what illustrates that which I have already said, "On the outskirts of their country, their features are much modified, showing plainly that they do not succeed in keeping their blood pure. The Chiefs have generally made it a point to get women of other castes into their households, and I have consequently observed that none of them have the national features."

In the South, the Chermars of Malabar are described as "very diminutive, with a very black complexion, with not unfrequently woolly hair." And of some of the tribes of the Kodagherry hills it is said that "flattened noses, dark complexion and large white teeth filed into the form of a saw give them an African appearance." The Nagadees are said to be "in complexion invariably of the deepest black, their hair thick and curly, their features brutish, their forms diminutive." That the type which I have described prevailed among the Aborigines generally in ancient times, is evident from the Purans, where they are described in extremely uncomplimentary terms as 'vile monsters,' 'allied to monkeys,' 'as black as crows,' 'of flattened features and of dwarfish stature.' Their long thick matted hair is also particularly mentioned.

The ancient Greeks also describe the South-Indians as like Ethiopians, and it is difficult to assign any other country to the Oriental Ethiopians of Herodotus.

It may be stated, as a physical peculiarity of the Aboriginal tribes, that most of them seem to have a remarkable power of resisting malaria, and thrive in the most malarious jungles where no other human beings can live. This may, however, be the result of long habit; some tribes inhabiting healthy localities sicken easily enough elsewhere.

The languages of the Aborigines seem to have all this much in common, that they are of the structure described as Turanian. They are neither like the Monosyllabic Chinese on the one hand, nor on the

other like those Arabian and African languages which seem to form their changes by variations in the body of the word. The Indian Aboriginal languages, in common with the Hindustanee, the Turkish, and some Arian tongues, seem to form declensions, conjugations, and derivations, and to supply the place of what we call 'prepositions' by *post-positions* and *post-inflections*. The verb or governing word comes at the end of the sentence, instead of at the beginning as in English, somewhat thus, our order being just reversed.

|       |             |             |
|-------|-------------|-------------|
| Rem   | acu         | tetigit     |
| Cheez | sui-se      | chuha       |
| Thing | needle with | touched he. |

The word 'Turanian,' as applied to an immense class of languages, does not, however, imply any immediate connection with Thibetans or Mongolians, from whom the Indian Aborigines are physically so world-wide asunder. It is used in that very wide sense which includes not only all the Mongolian races, but all the Polynesian races, and all the Negritoes of the Indian Archipelago, Australia, and Van Diemen's land. A few vocables are said to be found, common to the Dravidian tongues and to some other Turanian languages. But the greatest resemblance is said to be not to the nearer Mongolians, but to the most distant Finns, and it is at the same time admitted that there are at least as great indications of a special connection with the Australian Negritoes. It may then generally be said, that both in physique and in the structure of their language, the Aborigines present a type analogous to that of the Negritoes of the South Seas, Papuans, Tasmanians and others, as well as to the nearer Negritoes of Malacca and the Andamans.

That which I have already said of the general character of the laws and institutions of the Non-Arians as distinguished from the Arians, is all that I can give as common to all these tribes. On this and many other points, we require much more information.

One tribe only I must except, as quite without and beyond the general descriptions of the Aborigines which I have given, viz. the Todas of the upper plateau of the Neilgherry hills. They are not properly Hindoos, but no one who sees them, would for a moment suppose that they belong to the Negrito races. They are evidently Caucasians of a high type. In truth they are but a very small tribe; the

common tradition and consent of the country makes it clear that they came as conquering immigrants to their present position at a comparatively recent period, and their pastoral habit renders their migration easy. Their language, so small a body may well have almost lost during their wanderings among Dravidians. They may be anything Caucasian, and from anywhere; ordinary Aborigines they are not. It has been said, that in their speech some words have a resemblance to the Brahui dialect, but personally they do not seem to resemble Brahuis, they are rather like Greeks.

The points of structure which I have given, as common to all the Aboriginal languages, are, it will be observed, of the widest character. And this brings me to the fact that by the test of language the Aboriginal tribes may be divided into two great classes, having very few vocables in common. The first great division is that of the tribes speaking dialects radically allied to the civilised languages of the South, commonly called the Dravidian languages. These then I shall call the Dravidian Aborigines. There is no doubt that the wild tribes of the southern hills speak wild and primitive forms of the southern languages. The Carambers seem to be ancient Tamil speakers, the Maleasurs of the Western Ghats approach nearer to the Malayala. The Burghers and Kotahs speak a primitive Canarese, the Ramooses, a language which seems to be for the most part Telagoo.

The Gond language is as clearly Dravidian as Telagoo or Tamil, and the Gonds are so considerable a people that the Gondee might almost be added to the list of regular languages of the southern type. The name Khond is so like Gond that, next neighbours as they are, one would almost suppose the words to be the same. They are said to be different, but at any rate the Khonds also are shown by their language to be clearly Dravidian. More distant is the tongue of the Oraon tribe, to whose physical characteristics I have already alluded, and who are now found among tribes of the other division (to be presently noticed) in the Chota-Nagpore territory. But the radicals and main features of the Oraon language leave no doubt that they are of Dravidian stock—a circumstance which does not surprise us, as we learn that they are comparatively recent immigrants from the west into their present locations. East of them again, in the Rajmahal hills, we have the last of the Dravidian tribes (so far as has yet been

ascertained), speaking a language akin to that of the Oraons. Those hills form a kind of knot at the extreme eastern point of the hill country of Central India. It was known that the people were entirely different from their neighbours the Santals. The latter cultivate the lower lands, and it may at first sight seem surprising that the higher grounds should be in the possession of more recent settlers of a distant southern stock. The fact, however, seems to be explained by the plundering habits of the Rajmahal hillmen. They seem to have occupied those hills as a kind of stronghold, from which they could conveniently plunder the plains around them.

The greater part of the Chota-Nagpore division and adjoining tracts is occupied by tribes whom I take as representative of the second or northern division of the Aborigines. There are 'Lurka Coles,' 'Hos,' 'Bhoomiz,' 'Moondahs,' and Santals, and wilder tribes of the border hills, all speaking dialects of a language very different from the Dravidian. In fact, so far as vocables go, no substantial connection can be traced. Max Müller speaks of these tongues as quite unconnected with any other. Still I venture to think that there seems to be some similarity of structure between them and the Dravidian languages. Major Tickell has published in the *Journal of the Society* a grammar of the Hos or Lurka Col language; and I note the following as a few of the peculiarities common to it and to the Dravidian tongues, as the latter are set forth by Dr. Caldwell.

First, there is the general coincidence of structure, which I have already noticed as common to all the Aboriginal tongues as well as to Hindustanee, Turkish, &c. In this respect, the northern Aborigines do not differ, and they similarly use postpositions, &c.

Further. In the Dravidian tongues there is no regular gender, all inanimate things are neuter, and the terms male and female are prefixed when necessary.

It seems to be the same in the northern aboriginal tongues.

Adjectives do not decline, nor are there degrees of comparison.

It is the same in the northern tongues.

There are two forms of the first person plural, one to include, and the other to exclude the person addressed.

This peculiarity also is found among the northern tribes, as well as in the Australian tongues.

Relative participles are used instead of relative pronouns in both classes of languages.

The northern tongues seem to be considered more highly inflected than the Dravidian, and they have a regular dual form which the others have not. The verbs have no passive voice.

It would seem to imply a higher organisation in the northern aboriginal languages, that the vocabularies show them to be more complete, and less to borrow from their neighbours all words beyond the very simplest. For instance, in the matter of numbers, while the Gonds do not go beyond ten, the Oraons beyond four, nor the Rajmahalees beyond two in Dravidian numbers, (borrowing all the rest from the Hindce,) the Coles and Santals count up to high numbers in their own tongue, only using scores instead of the decimal notation of hundreds, as do many Arian tribes. I have seen it stated that the Dravidian Khonds count by dozens.

Max Müller remarks that savage tribes, with no letters to fix their tongues, alter their speech much more rapidly than civilised nations; and it may be that, when we have two groups of people adjoining one another and with a general physical similarity, such a general structural resemblance of language as I have noticed may mark a remote common origin, even when the community of vocables can no longer be traced. But at any rate, the difference is now so wide as to establish, as I have said, two distinctly marked groups.

The generic name usually applied to the Aborigines of the hill country of Chota-Nagpore, Mirzapore and Rewah is 'Coles' or 'Koles.' Europeans apply the term to the Dravidian Oraons as well as to the others, but perhaps erroneously. It is difficult to say to which tribes the name is properly applied, for most of them have other distinctive names. But in the south of the Chota-Nagpore country, about Singbhoom, &c. it is certainly applied to the 'Lurka Coles,' and I can myself testify that on the Mirzapore-Jubbulpore road, the Aborigines are called by the natives Coles or Kolees, which they volunteered to explain to me to be the same word "which you call Coolce." On the Bombay side again a very numerous class of Aborigines are styled Kolees. In the Simla hills also, the inferior people are known as Kolees. Altogether I have myself little doubt that the ordinary word Coolce, as applied to a bearer of burdens or labourer, is the same word,

and that in short it is the word generally applied by the Northern Indians to the Aboriginal tribes, most of whom they reduced to the condition of Helots.

There seems to be good reason to suppose that the original form of the word was 'Kola' or 'Kolar.' In fact, India seems to have been known to the ancients (who approached it coastwise from the West) as Colara or Coolee-land (*Asiatic Researches*, Vol. IX) and the people as Colaurians. If Kolar be the original form of Kolee, it would seem not improbable that, as in the mouths of some tribes by dropping the 'r' it became Kola or Kolee, so in the mouths of others, by dropping the 'l' it would become Koar, Kaur, Koor, Khar or Khor, a form which would embrace a large number of those tribes as now designated. I propose then to call the northern tribes Kolarian or Coolee Aborigines.

One may see frequent allusion to Kolarees or Collieries in the south of India. It appears that the word there used is properly 'Kallar.' In the Canarese language, the word 'Kallar,' it seems, simply means a thief or robber, and hence some of the predatory Aborigines of the hills, are designated Kallars or robbers, just as the thieves of Central Asia are called 'Kazaks' or 'Cossacks.' The word is applied so differently from that of Coolee, that there may fairly be doubt of its being the same. But the subject is worthy of farther inquiry, and if it prove that in fact the two words are identical, the term Coolee or Kolarian must be applied to the Aboriginal tribes generally, not to one division of them. Meantime, however, I apply it to the Northern tribes only, but I confess I have misgivings whether the more general sense may not prove to be the true one.

Beyond the difference of language, I am unable to state with confidence any very marked features distinguishing the Dravidian and Kolarian groups of tribes (each taken as a whole) from one another. But a marked difference in habits, manners, and national characteristics, has been found to exist where the two classes are in the closest contiguity. The Santals and Rajmahalees are known to present a marked contrast, and on the Chota-Nagpore plateau I am told that "the difference is so great, that they appeared to be quite another nation," and "their customs, appearance, even manners, are very different." Of these differences we have not the details, but I hope that they may be furnished in Col. Dalton's promised paper on the Coles.

The Kolarian Santals are a very ugly race, and I gather that their neighbours, the Dravidian Rajmahalees, have rather the advantage of them in this respect, but these latter have probably kidnapped a good many Arian women from the plains. I have fancied that I have noticed in some of the 'Dhangar' labourers in and about Calcutta, a peculiar little 'pique' 'retroussé' sort of nose, as distinguished from the flat broad-nosed features of the Santals, but this scarcely amounts to an observation. It may be noticed that in the passages which I have quoted in regard to the general type of the Aborigines, the African style was more especially attributed to Dravidian Oraons, Gonds and Chenchwars, &c. The Kolarians, Kours, Khairwars and Koors, are also represented as only one degree less ill-favoured; so, on the whole, I imagine that in point of personal appearance there is not much to choose between the two groups. Ethnographers seem to distinguish the Negritoes of the Southern Seas into two groups, a woolly or curly-haired group, and a straight-haired group; perhaps there may be found to have been some such division in India.

The Santals and most of their immediate congeners, are certainly a more simple, mild, and industrious race than the Rajmahalees, Gonds, Khonds, and Southern Kallar tribes; but again the Lurka Coles seem to be warlike, and the hill Khorewahs are described as wild savages, armed with battle axes and bows and arrows. On the whole, I should rather imagine that the Kolarians are more frequently good Coolees, and the Dravidians oftener troublesome Kallars.

The descriptions of the Aborigines as a good-natured people, ever dancing and singing (in a way that reminds one of the pleasanter descriptions of the Negroes,) I find to be applied to the Kolarians,—Santals, Moondahs, Khorewahs, &c.—more than to the Dravidian tribes.

As respects religion, although the indications are too slight for any confident generalisation, the accounts of the Kolarian creed seem pleasanter than those of the Dravidian beliefs and rites. The latter seem to deal in demonology, fetishism, frantic dances, bloody and even human sacrifices, in a way which reminds us of the worst African types; while several different accounts of Northern Aborigines, in widely different parts of the country, represent them as reverencing in an inoffensive way the sun, moon, and Lord of tigers, and mild and innocent Bhoots or household spirits. The superstitious belief in tigers' claws

as a charm, is shared with the Aborigines by all the Hindustances. Another practice of the Aborigines the latter also have in hilly tracts, the heaping up cairns of stones at particular points, and tying bits of rag to a particular tree as votive offerings. This last may be seen anywhere, and these practices are probably very widely spread.

If there really be such a distinction between the Dravidian and Kolarian religions as that at which I have hinted, it is very like a similar distinction in Africa. In a work on South Africa by the Rev. Mr. Grout, we are told that the gods of the Hottentots are above, the sun, moon, &c. while those of the Kaffirs and more war-like Negroes south of the line are *below*, demons and evil spirits. Among some of the latter too are seen the horrid rites and bloody sacrifices. It strikes me that there is some resemblance in appearance between Hottentots and Santals.

A curious testimony to the ancient rights of the Indian 'Boomeas' or people of the soil, is the practice in many parts of Central India where Hindu chiefs are dominant, that a new chief on his accession receives the *teka* or investiture from the blood of an Aboriginal Kole, Gond or Bheel.

I proceed to mention the various tribes in detail, so far as my imperfect knowledge of them permits.

The Aboriginal tribes now living apart from the general population in the South of India, appear to be very small and scattered. They are there for the most part absorbed in the general social system. Pariahs and others, as is well known, merely form a lower social grade. The robber tribes, Beders and such like, seem for the most part to have robbed themselves into a respectable and even aristocratical position. The Beders in some parts of Mysore now form a considerable portion of the population, and they have many Polygarships. There seems to be some doubt whether the Badagras and Kotas of the lower Neilgherry hills are properly Aborigines, they being, it appears, immigrants in those parts, and the Carambers the true Aborigines. I have not been able to meet with any very connected or detailed account of the thoroughly Aboriginal tribes of the hills and forests of the Neilgherries, Pulneys, and Western Ghats. The word *Malcasur* seems to mean simply a hillman, and the more proper tribal designations appear to be Carambers, Irulars, Puliars, and Veders. These seem to

be tribes in the very lowest stage of savageness, with in fact scarcely any agriculture, mere men of the woods. They are represented as of very diminutive stature, with thickly matted locks and supple limbs, living under trees in caverns or in the rudest wigwams, keeping sheep or collecting forest produce, very stupid but also very mild and inoffensive, except that they have a great reputation as sorcerers, and themselves believing in a religion of demons and witchcraft, are by their neighbours believed to be highly gifted that way. Altogether they seem to be very inferior to the simple but sturdy and industrious Coolees of the north.

The Chenchwars, already mentioned, and several very petty and isolated tribes exist in the Eastern Ghats about and north of Madras. I can only give the names of "Chendaur's" and "Yende" as near the Kistna and Pulicat Lake. Allusions seem to be made to the existence of Aboriginal or quasi-Aboriginal tribes at different points in the Western Ghats and Coasts; the name of "Chermars" and "Neade" are mentioned in Travancore and Cochin, but they are no doubt the same as Chermars and Nagadees, the slaves of Malabar. The Dhers and Ramooses of the centre and west of the Peninsula seem to be mixed with the general population. On all these points more precise information is much required.

It is not till we cross the Godavery to the north, that we come to the country really held by the Aborigines.

In the highlands between the Godavery and the Mahanaddee, the savage Khonds, notorious for their human sacrifices, are to the East, the barbarous and less known tribes of Gonds to the West and more in the interior.

The Khonds appear to be in contact with Hindus and to have some of that race among them. Their blood is probably somewhat mixed, and they are not described as so ugly and ultra-Aboriginal as some other tribes.

Of the Gonds of the forests of Bustar and thence running up towards the Wyngunga we know very little, except that they are extreme savages, black, ugly, barbarous and dangerous. The name "Marees" seems to be there applied to them, and they appear to be nearly independent, owing a scant allegiance to chiefs whose blood is for the most part Gond. From thence the Gonds extend a long way North, and

occupy a broad tract east and west wherever the country is jungly or hilly, but becoming more and more civilised and more dominant over others as we go northwards. The valley of Sumbhulpore may be taken as for the most part marking the division between the Gond country on one side, and that of the Aborigines of northern stock on the other.

On the east the Gonds, under the name of Gours, extend into the borders of the Chota-Nagpore agency in Oodeypore and Sirgoojah, but they are there much Hinduised and have lost their language. The Raja of Sirgoojah, though pretending to be a Rajpoot, is suspected to be a Gour; at any rate the Gours are there the dominant tribe. Thence westward along the line of the Sautpoora hills, through all the hilly country of the districts of Mandla, Jubbulpore, Seonee, Chandwara, Baitool and Hoshangabad, in fact in some degree to the neighbourhood of Asseerghur, the Gonds predominate. In the wilder parts, they speak their own Aboriginal language, and seem there to be a simple and not intractable people, following both pastoral and agricultural pursuits. In the older maps, the name Gondwana is given to a wider tract of country in this part of Central India, being that which was in modern times rather politically than ethnologically Gond. The Gonds (in a somewhat civilised form) were in fact for some time masters of all this part of the country, including the open and cultivated tracts about Nagpore, Raepore, Jubbulpore; &c. and perhaps as far as Ellichpore on the one hand, and on the other to the south of the Godavery, where some of them are found among the ordinary Telinga population. Deogurh in the Sautpooras was the chief seat of their power. They immediately preceded the Marattas. These latter ousted them from the open and valuable tracts, and they do not now form any considerable part of the population of the plain country, but they maintained a feudal dominion in much of the hilly country; and to this day not only the chiefs and large zemindars of the Sautpoora range, but most of the men of considerable position in parts of Saugor and other districts north of the Nerbudda are, I understand, Gonds, diluted or improved Gonds as the case may be, (most of them wish to become Rajpoots, and others have become Mussulmans), but still Gonds.

Following up the Dravidian tribes, we next come to the Oraons, now located in the midst of Kolarian tribes and much mixed up with

them. The Gonds or Gours have been mentioned as found in a not very pure form in the west of Oodeypore, and Sirgoojah of the Chota-Nagpore division. In the highlands to the east of those states and of Jushpore, the Oraons are found. Col. Dalton mentions them as forming the greater part of the population of a considerable portion of the Jushpore highlands, and it is these whom he describes as the ugliest of the race. Thence eastwards the Oraons have pushed themselves into the proper country of the Moondahs (of Kolarian race) in the plateau of the Chota-Nagpore district and adjoining country. They must have been strong, to effect an ingress to a country not originally their own, but I do not understand that they are now at all dominant over the others. In fact they seem to have very much adopted the habits of the Kolarians, among whom or in contact with whom they live, are industrious and laborious, and as much as the others contribute to the supply of the labour market of Bengal. I understand that they form a considerable proportion of the Calcutta *Dhangars*; that last term being one the proper meaning of which I cannot ascertain, but which, so far as I can learn, is applied generically to the aboriginal labourers in Calcutta.

Separated from the Oraons by a considerable space (principally of lower but still more or less hilly country, occupied by mixed tribes of Kolarians, Hindustanees, and Bengalees), are the Dravidian Rajmahalees, whose proper tribal name, I have not ascertained. They are sometimes called Maler, but that is merely the Dravidian form for mountaineers, the word applied to so many of these tribes.

These are the men who are well known in connection with Mr. Cleveland's endeavours to tame and reform them. They seem to have been in those days terrible depredators. That all the parts of India adjoining the Central hills, both at this point and throughout a considerably wider range, were in times of anarchy dreadfully subject to injury from the hill-men, is still attested by the numerous and extensive 'ghatwallee' tenures held all along the foot of the hills and about the Ghats and passes. They are particularly numerous in the Bhaugulpore and Beerbhoom districts, adjoining the Rajmahal hills on either side. Such estates pay little or no revenue, but are held on the condition of guarding the passes against hill robbers, murderers, and cattle-lifters. The hill-men have been successfully reclaimed,

I believe that they cultivate quietly, and there appears to be now little complaint against them. Organised and serious raids on the plains are, I understand, unknown. The Rajmahal men are those who were enlisted into the British military service to form the local corps known as the Bhaugulpore Hill Rangers; but when the usually quiet Santals were impelled by a sense of wrong to a headlong sort of rebellion, the other (and it was supposed more military) race forming the Rangers, when opposed to them, by no means distinguished themselves, and they have since, I think, been disbanded.

I now pass to the Kolarian tribes. The more civilised and numerous tribes of this race, occupying an extensive country about 150 miles west from Calcutta, and known as Moondahs, Bhoomiz, Hos, and Santals, speak languages so nearly identical, that they may all be regarded as Sub-divisions of one people. They are in fact very like one another in many ways. They occupy most of the British districts of Chota-Nagpore, Singbhoom, Maunbhoom, and the hilly part of Bhaugulpore (Rajmahal hills excepted) now known as the Santal Pergunnahs; also parts of West Burdwan, Midnapore and Cuttack. They are a simple industrious people, and are reputed to be remarkably honest and truthful. Their country is healthy and, unlike most aboriginal tribes in most parts of the world, they seem by no means to be dying out, but multiply and supply the labour market. Partly on account of the cheapness of labour in their country, partly on account of their tractable disposition and freedom from all caste and food prejudices, and more especially, I think, because of that want of attachment to the soil which distinguishes the Aboriginal from the Arian, they are much sought after and highly prized as labourers. Many of them are settled in the service of Bengal Indigo-planters; they are very well known as labourers on the Railways, roads, and other works of Western Bengal; and they are now, I believe, the favourite material for emigration to Assam. Unfortunately, however, coming from a healthy high and dry country, they have not that capacity for resisting malaria for which the wilder tribes are remarkable, and seem to die very rapidly.

In the Chota-Nagpore country, the 'Moondahs' seem to have so far adopted Arian manners, as to live together in considerable villages, instead of apart in detached houses or isolated hamlets, according to

the common practice of these tribes; but I am told that so great is their instability and want of attachment to any particular spot, that not unfrequently, on some petty quarrel with their zemindar, a whole village will abandon their houses and seek other locations, or put themselves under the guidance of a Coolee recruiting-agent. The Hos and Bhoomiz\* of the lower parts of Singbhoom and Maunbhoom, seem to be tolerably civilised. The Santals, though geographically near the plains, seem to be among the most shy and socially-isolated of the race. They cultivate the lower lands of their country, but seem to have kept very much to themselves, and to prefer locations surrounded by jungle and segregated from the world. They too, however, have now taken much to labour for hire, and they must have become intimate with Europeans. In the case of these people is to be found practical illustration of a truth of wider application in India, viz. that in a mere pecuniary and commercial point of view, tact and scrupulous fairness in dealing with the natives are more effectual than all other means, and go farther than any laws and any administration. I believe that certain of the Railway Engineers, who have gained the special confidence of the Santals and allied tribes, construct the railway mile for mile infinitely cheaper than any others.

On the borders of the hills, a set of half-breeds seem to be not only by profession Ghatwals, but to constitute a sort of caste under that name.

I have alluded to the language of these Kolarian tribes. One would hope or expect here to find the origin of the non-Arian elements of the Hindee and other northern languages. This, however, has not yet been so. It is difficult to distinguish between words borrowed by the Aborigines from the modern Hindustanee or Bengalee and those of a common origin. A few of the words in Hodgson's lists are like Hindee, but most of them seem to be Arian words. Some words seem to be used throughout India as 'Donga,' a boat, and some are words of much wider use as 'Ka' 'Kahee' or 'Kova,' a crow and 'Pussi,' a cat. It is then no doubt the case that the very brief and imperfect vocabularies of the Kolarian tongues yet published, have not shown an immediate connection with any other known language. More

\* Bhoomiz, I believe merely means 'people of the soil' from *Bhoomi*, being nearly the same word as the Persian 'Zemindar.' What the Hindoo-tribes are to the Mahommedans, the aborigines are to the Hindoos.

minute inquiry would be very desirable. Besides a more exact and full grammar, I think it would be well to separate out from the Hindee a list of non-Sanscrit words of common use, (and which are not also common to the greater part of the world, such as "*kowa*," a crow, and some of the universal Turanian words), and having thus got what I may call a *Hindee proper* vocabulary, to compare it carefully with the dialects of the Santals, &c.

In addition to the semi-civilised tribes which I have mentioned, nearly the same language is spoken by the wilder Lurka Coles of the hills to the West of the Singbhoom district. North of these latter again, in the highest hills to the North of Jushpore, and in those between Sirgoojah and Palamow, Col. Dalton mentions a considerable tribe called Khorewahs, who speak much the same language, whose manners and habits are the same, and who are evidently of the same stock, though much less civilised; some, he says, utterly savage and almost Nomadic. They are said to be of small stature, but better looking and lighter than their neighbours, the Dravidian Oraons, with shaggy heads of hair and some beard.

Mention is made of some other very wild tribes scattered about the Chota-Nagpore division, Kherrias (who are a mystery even to Col. Dalton), Bendkurrs and Birhores in the south of the division, and Bhuhars or Boyars (not to be confounded with very different Bhuyas to be subsequently noticed) in the north; but the languages and affinities of these tribes have not been ascertained sufficiently to place them. They are described as "regularly wild inhabitants of the hills and jungles, who have no fixed villages, but move about from place to place, burning down the jungles, sowing in the ashes, and after reaping what is produced, going elsewhere."

On the Sumbulpore borders, the Coles, intermixed among the Gonds, are said to be known as "Kirkees."

Mr. Samuells mentioned a wild tribe in the jungles of Cuttack, whom he calls 'Janguas,' perfect savages, small, slender, nearly naked, and horrid in appearance. They speak a strange language, and he gives a few words, some of which seem like the language of the Santals, &c, as 'Minnah,' one, and 'Bana,' two.

The Aboriginal tribes near Cuttack strike a bargain by breaking a straw.

In some places the word 'Soor' or 'Sourah' seems to be used, as if the same as 'Santal;' and Mr. Stirling, in an article on Cuttack, (in the Asiatic Researches) enumerates 'Santals' and 'Soors' separately among the tribes of Coles. It would seem then as if Soors or Sourahs were a tribe of Santals on the borders of the Cuttack division. But the Soors under the hills north of the Mahanaddee, while described as small, mean, and very black, and like the Santals naturally harmless, peaceable and industrious, are also said to be without moral sense and ready to cut firewood or other men's throats indifferently, an accusation not, I think, brought against the Santals.

Again, Macpherson tells us, that the hill tribes *south* of the Khonds, and running up to near the Godavery, are *Sourahs*. That is quite a different location, and I have not found any farther account of these Sourahs. Caldwell says that the Tamil people were anciently called 'Sorahs,' but as they are the most Dravidian of all the southern people, they can hardly be allied to the Kolarian Santals, and the word must be different. The whole subject requires a good deal of fresh light.

Passing north, I have till now reserved, for separate notice, the tribes chiefly prevailing in the district of Palamow, the hilly country of Mirzapore and Rewah, and the borders of Benares and Behar. These are the Aboriginal tribes most directly in contact with the modern Hindustanees, and there is this difficulty about classifying them, that I have not been able to ascertain their original language. They now generally speak some sort of dialect of the Hindee, and are more mixed with the Hindustanees, perhaps I may say generally more civilised, than the tribes located farther in the interior of the hills. The principal tribe of these parts are called 'Kharwars' or 'Kharawars.' There is also a widely spread tribe of 'Rajwars.' A division of the Kharwars are called 'Bhogtahs.' The Kharwars seem to be altogether the dominant tribe of Palamow and Singrowlee (the Mirzapore hill country). Both Kharwars and Rajwars are also found in considerable numbers westward, in parts of Sirgoojah and Jushpore, while to the north-east, in the parts of the plains adjoining the hills, they are numerous. In the Gya district, near the hills, the Rajwars are the chief labouring class. They live in the

villages as a kind of serfs and bearers of burdens, carry palanquins, and when out of employ, are apt to be thieves and robbers. A little farther west, the Kharwars seem to perform the same functions; they are mentioned by Buchanan as in the outskirts of the Patna and Arrah Districts. On the road from Mirzapore to Jubbulpore, where it passes through Rewah, &c., the palanquin bearers and coolies are Aborigines. When I passed that way some time ago, not having then gone into the subject, I did not ask the particular tribe, nor have I since been able to ascertain it, but in all probability they are Kharwars.

All these people have in their faces unmistakeable marks of their aboriginal origin. But they speak Hindee. This then brings us to the difficulty about language. Col. Dalton is not aware of any Aboriginal language spoken by the Kharwars. I have had the impression that in the Mirzapore district they spoke their own language; and Capt. Blunt, who in the last century made a remarkable journey from Chunar right through the hills to the Godavery (see *Asiatic Researches*, Vol. 7), almost at the outset of his journey mentions the Kharawars of the Singrowlee hills as very savage, and speaking a separate and quite unintelligible language. But the Rev. R. C. Mather of Mirzapore, who has been good enough to write for me a note on the subject (of which I have already made use), and who refers to a tour made by the Rev. Mr. Jones, is unable to say that any aboriginal language exists in these parts. He says that both the Kharwars and another similar tribe, locally called 'Majhwars,' speak the Hindee, or at least understand it when spoken. It would be very interesting to ascertain if the remains of an original language exists among these people, for with them more especially we should expect to find the non-Aryan Hindee roots. If aboriginal tribes so situated have no separate language of their own, it may arise from either of two causes; either they may have abandoned their own language and adopted that of the people who are flooding over and as it were submerging them; or the fact may be that, in its most radical parts, the language of these latter having been the same as their own, an influx of vocables on this common basis may altogether obliterate the landmarks by which languages are distinguished. Till however, this is cleared up, I think that we must on other grounds

class the Kharwars, &c. with Kolarians rather than with Dravidians. Mr. Mather, quoting Mr. Jones, says that, passing on from the Kharwars, he came to the 'Oraons,' in whom he found "the difference from the Mirzapore Hill people to be so great, that they appeared to be quite another nation." In fact, the Oraons are now a good deal interposed between the Kharwars and Kolarian Moondahs, but Col. Dalton also says that the Kharwars and Oraons, though in contact, are very unlike one another in language, appearance, manners and customs. The Kharwars, he says, are not quite so African looking as the Oraons, but some of them seem to be not much better favoured. A long connection with the plains would best account for the adoptions of the language and some of the manners of the plains-people by the Kharawars and Rajwars. And here the question has suggested itself to me, whether they may not perhaps be identified with the Cheroos and Bhurs, those aboriginal tribes whose dominion in the plain country to the north of these hills is matter of history, who seem certainly to have come from and to have gone to the country now inhabited by these tribes, and who from this point of their history almost or wholly disappear. Buchanan seems to speak ambiguously, sometimes classing Kharawars and Cheroos together, sometimes treating of them as separate. While mentioning the Cheroos as nearly extinct in the plains, he speaks of them as still existing in numbers in the high country within the hills. In the accounts of the latter country, on the other hand, I find no mention of either Cheroos or Bhurs under those names. Farther inquiry seems necessary. Our use of Roman letters applied to native names is very uncertain, and if we could suppose the C in Cheroo to be pronounced hard as in Cole, Cheroo would become Kheroo, and Kheroo would be not very different from the Khara of Kharawar (the 'war' is a mere termination), while Khara might again be connected with the name of the Kolarian Khorewahs already mentioned, and with the *Koors*, equally Kolarian, to be subsequently noticed. Again, the Bhurs are more commonly known as 'Rajbhurs;' may not Rajhbur have been corrupted into 'Rajwar?'

The present dominant position of the Kharwars in a considerable country would seem much to tally with the idea of their representing the tribes once so famous. Both the Rajas of Singrowlee and Jush-

pore are Kharwars, however they may claim an origin from Rajpoot foundlings, and they are the people who most affect what Col. Dalton calls 'refining into Rajpoots.' Although many of them may have achieved a good deal of improvement in their blood and appearance, they are not originally a handsome race, for Col. Dalton expressly tells us that in the more remote parts, the Kharwars of Palamow, and especially the Bhogtahs, are very ugly and ill-favoured. Like the other aborigines, they have no proper caste and eat anything.

I leave, for separate notice, a very numerous tribe all along the borders of Bengal, Orissa, and part of Bahar, called Bhuyas, whose connection with the races above described is not clear.

In this region of India, it only remains to mention one more Aboriginal tribe, called Kauras, found in the extreme west of the Chota-Nagpore Agency about Korea, Oodeypore, and the adjoining parts of the territory of Nagpore proper, the Pergunnah of Korbah of Chatteesgurh. They are described as a very industrious thriving people, considerably advanced in civilisation. They now affect Hindoo traditions, pretend to be descended from the defeated remnants of the Kooros who fought the Pandavas, worship Siva and speak Hindee, but in appearance they are ultra-aboriginal, very black, with broad noses and thick lips, and eat fowls, &c., bury most of their dead, and contemn Bramins; so that their Hindooism is scarcely skin-deep.

From the last mentioned point westward, through a broad tract of country, the plains are occupied by the ordinary Indian Arians, the hills and forests by the Gonds (who here in the centre of India meet the Hindustanees on the North, the Telingas on the South, and the Marattas on the West); and we do not again come to Kolarian Aborigines, till we get in fact to the West of India. There is then a hiatus, as respects the Kolarians, of four or five degrees of longitude, where by the advance of the conquering Gonds they have probably been split asunder. It somewhat singularly happens that the first people of this race whom we come to in the West, bear as nearly as possible the same name as the last we left in the East. The latter were called 'Kauras.' In the Western Sautpooras, in the hills about Gawalghur near Ellichpore, and thence towards Indore, is a tribe called 'Coour' or Koor Koos. These people speak an undoubtedly Kolarian language. The name is sufficiently near to *Gour* to cause them to have been

sometimes confounded with their neighbours, the Gonds, but the difference is clear. In the notes with which I have been favoured from Bombay, Major Keatinge mentions them as "a tribe of Gonds calling themselves Koor Koos," but he goes on to distinguish them from the Gonds, mentioning the geographical location of each, and adding that the two tribes keep themselves separate, do not intermix, and that each has a separate language of its own. He does not give particulars of the language, and it is from a paper on which I stumbled in an old number of the Society's Journal, and which does not appear to have been previously much noticed, that I have been able to identify this tribe with precision. Dr. Voysey, writing at Ellichpore so long ago as 1821, also at first calls them Gonds, but he goes on to say that they are also called 'Coours,' and that the Gonds consider themselves a distinct tribe from the Coours and neither eat nor intermarry with them. He then gives a small list of Coour words. This was taken long before Hodgson's vocabularies were published, and the two seem never to have been compared. I have compared Dr. Voysey's list with Hodgson's lists of words of the Kolarian tribes of Lurka Coles, Santals, &c. and find a remarkable coincidence. For instance, take the numerals.

| Coour.            | Hodgson's Coles, &c. |
|-------------------|----------------------|
| 1. Mea, .....     | Mi.                  |
| 2. Bariah, .....  | Barria.              |
| 3. Aphe, .....    | Apia.                |
| 4. Aphoon, .....  | Apunia.              |
| 5. Munea, .....   | Monaya.              |
| 6. Turrume, ..... | Turia.               |
| 7. Aya, .....     | Iya.                 |
| 8. Ilhar, .....   | Irlia.               |
| 9. Arhe, .....    | Area.                |
| 10. Gyl, .....    | Gel.                 |

And again.

|        | Coour.   | Hodgson. |
|--------|----------|----------|
| Man,   | Hoko,    | Ho.      |
| Water, | Da,      | Dah.     |
| Fire,  | Singhel, | Sengel.  |
| Tree,  | Darao,   | Daru.    |

|        |       |      |
|--------|-------|------|
| House, | Oah,  | Oa.  |
| Mouth, | Ah,   | A.   |
| Eye,   | Meht, | Met. |

In fact, of the first nine of Voysey's words which are also given by Hodgson, seven are identical, a circumstance very remarkable, seeing how far these illiterate tribes are separated from one another. None of the words correspond with the Dravidian synonyms, so there can be no doubt that we have traced the Kolarians so far.

Immediately beyond the Koors, from Asseerghur westwards, we are in the Bombay Presidency.

As I cannot ascertain that Mhars and Mangs and Ramooses now live as entirely separate tribes, I may at once say that, so far as my information goes, the Bombay Aborigines are (for my present purpose) all comprised in the two tribes of Koolees and Bheels. These tribes are scattered over a great portion of the Presidency, and in some parts, the Koolees especially, seem to live as a part of the general population. But the Koolees in part, and the Bheels more generally, are still found in portions of their original seats as distinct tribes, and they both seem to be numerous. Their name, position, and character seem to mark the Koolees as Kolarians. But beyond this, the more precise test of language is unfortunately wanting. I have not been able to find that these tribes have now any aboriginal languages of their own. They are generally said to speak dialects of the civilised languages of the neighbouring countries. In one or two places allusion is made to the existence or supposed existence of a Bheel language in remote jungles, but I have not found any precise indication respecting it.

I was at first inclined to conjecture that the separation into two tribes of Koolee and Bheels, and perhaps the more predatory character of the latter, might point to a division of race; that the Bheels might be Dravidians. I find, however, that the general opinion of those qualified to judge seems to tend to the belief that there is no essential difference between the two tribes. Forbes in his *Ras Mala* says: "Koolees or Bheels, for though the former would resent the classification, the distinctions between them need not be here noticed." Capt. Probyn says, "I think there is no actual difference between Koolees and Bheels. Their religion is the same." Mr. Ashburner:

“There is no real difference between Bheels and Koolees; their habits, physiognomy and mode of life are the same, modified by local circumstances.” And the Rev. Mr. Dunlop Moore says, “Koolees frequently marry Bheel wives.” Other authorities, however, say that they do not intermarry. They both seem to claim a northern and not a southern origin, pointing to the hills of Rajpootana and the north of Goozerat. The Bheels say that they were originally called Kaiyos; Sir John Malcolm says that they are related to the Meenas of Rajpootana, and once ruled in the Jeypore country. Forbes again tells us that the Koolees were originally called Mairs; while in Rajpootana, Col. Tod speaks of Mairs or Meenas as one race.

The Rev. Mr. Dunlop says that, though these tribes speak the same languages as their neighbours, “certain words are universally recognised as peculiar to Koolees as well as Bheels.” He only instances one word written in a character which I can read, and that is ‘Bhoro’ or ‘Bhoro,’ the *head*. As I write, I have turned up the word *head* in Hodgson’s vocabularies, and find that the Kols, Santals, Bhumiz and Moondas use the word ‘Bu,’ ‘Buho’ or ‘Bohu’ which seems to be the same word. The Dravidian words for head are entirely different.

It would be in many ways very interesting and important to rescue any remains of aboriginal words or aboriginal dialects of these tribes, and especially to find whether among them can be traced any non-Aryan radicals of the Goozerattee, Maratta, and the Hindee dialects of Rajpootana.

Though probably in the main of the same class and similar origin, the Koolees and Bheels are now quite distinct tribes, and there is this considerable difference that the Koolees have come much more into contact with Aryan blood and civilisation, are in appearance generally much more Hindooised than the others, and consider themselves altogether a higher class. As has been said, both tribes are now much scattered over many parts of the Presidency and in places a good deal intermixed, but their proper locale seems to be as follows. The Koolees are the Aborigines of Goozerat (where they now live in considerable number), and of the hills adjoining that Province. The hills east of Goozerat are called ‘Kolwan’ and seem to be the property of Koolee tribes, just as in the Chota-Nagpore

territory the country of the Lurka Coles is called "Kolhan." The Bheels are the proper possessors of the hills farther in the interior and east of the Koolees, there occupying both the Sautpoora and the Vyndia ranges, and extending into Rajpootana. In the latter direction and about the Vyndians some of the tribes claim to be crossed with Rajpoots, and these are called Beelalahs. The Bheels are numerous in Candeish, and are found in some parts of the adjoining Deccan. They sometimes find their way to the Coast where they are stated to be known as 'Dooblas' or the "Kala Pooruj" or 'black men.' The Koolees seem to be scattered down the Coast country nearly as far as Goa, and north again into the 'Thurr' and the neighbourhood of Scinde. While the wilder Koolees of the hills are like the Bheels, the mass of more civilised Koolees are said to be not only fairer and more Caucasian in feature, but also more sly and cunning and less truthful. A large proportion of both races have been much diluted in point of 'aboriginality' of feature by intermixture, but the Bheels less than the others. Many of the Koolees live in villages and adopt some Hindoo practices. They are stated to average about 5 feet 3 inches in height. Though most of them are now quiet agriculturists and labourers, they were not always so. The wilder tribes of the race are still predatory, and Forbes mentions the Koolees as by far the most numerous of the arm-bearing castes who in former days, living in the hills between Goozerat and Rajpootana, disturbed the country. He describes them as of diminutive stature, with eyes which bore an expression of liveliness and cunning, clothes few, arms bow and arrows, habits swift and active, bold in assault, but rapid in flying to the jungles, independent in spirit, robbers, averse to industry, addicted to drunkenness, and quarrelsome when intoxicated; formidable in anarchy, but incapable of uniting among themselves. This description seems exceedingly well to apply to the wild Bheels of modern days, whom indeed Forbes classes with the Koolees.

Many of the Bheels are so independent and so much apart in their own hills and jungles, that it seems very strange that they should have no language of their own; I think that the search for such a language, or the remains of it, should not be abandoned without very careful inquiry.

I have not been able to ascertain whether there are any of these aboriginal tribes in the Kattywar hills, or who are the aborigines of Kattywar. I have not met with any precise mention of them. Lassen in his map places Koolees (Kolas he calls them) in the centre of Kattywar. He had probably some authority for doing so, but more precise information on the point would be desirable.

North of the Bombay country, in the Aravallee range running towards Ajmere, is the country of the Mairs or Mhairs, with whom I have said that the Koolees claim kindred, and whose name also suggests the question whether they may be related to the Maratta Mhars. Tod says that Mhair means Mountaineer, from 'Meru' mountain. The modern Mhairs are probably a very mixed race. Col. Dixon, who is avowedly enthusiastic in their favour, makes them out to be rather good-looking, and tells the usual story (as told by the chiefs to him) of their descent from Rajpoots. They admit to have taken a few Bheel and Meena women. It is probably the case, as Col. Dixon says, that for hundreds of years they have been recruited by Hindustanee refugees and rascals of all sorts. Though now out of the way, it must be remembered that Ajmere was, under the emperors, one of the chief seats of Mahommedan power.

The Meenas constitute a large portion of the population of Rajpootana, especially in the Jeypore country between Ajmere and Dehli. I have said that they are supposed to be related to the Mhairs, and they are called the aborigines of the country, but I doubt if they are so in the sense in which I am now dealing with separate aboriginal tribes. In Upper India, out of their own country, these Meenas are principally known as dacoits; and of those that I have seen in that capacity, my impression is, that they were not small and aboriginal-looking, but fine powerful men. I suspect that if originally a half-breed derived from aborigines, the Meenas are now members of the ordinary Indian society, and that Aryan features predominate in them. Farther information, however, is required.

I am not aware of any aboriginal tribes in Bundelcund. In a recent Archæological paper read at a meeting of the Society, mention was incidentally made of "the wild Sherrias" found about the southern sources of the Nerbudda, and I also find mention of a tribe called 'Naikras' in the hills of Oodeypore, said to be like the Bheels,

but somewhat lower in the scale of humanity. I do not know whether these are really sub-divisions of the Bheels or separate tribes. In fact there may be many remnants of tribes in the jungles of Central India yet undescribed. I have now, however, noticed all the aboriginal tribes of the hilly portions of the Indian Peninsula known to me, with the exception only of the Bhooyas of the borders of Bengal.

In the plains, of course, we do not look to find separate aboriginal tribes, and those now classed as 'castes' will be afterwards noticed; but before leaving the subject of Koolees or Kolaries I may mention an assertion of Col. Tod that all the weaver caste throughout Hindustan are of this class, though they now call themselves 'Julahas' or Julahees. I do not know what is the ground for this assertion, but the weavers who have not turned Mahommedans are certainly sometimes or generally known as 'Korees' and considered to be low in the social scale.

There are no aboriginal tribes, of the character which I have been describing, in the Himalayas. The Koolees of the Simla hills and Domes of Kumaon are merely inferior castes living among the general population. Both in Kumaon and Nepal, there seems to be a sort of tradition or popular belief of the existence in some remote forests of a 'Ban-manush' or wild man of the woods, but I cannot find that any one has ever seen one of these creatures, or that his existence is really in any way authenticated. One can hardly say whether the story points to the recent disappearance of the last remnants of an ancient race, or whether it is merely a nursery tale.

It is not then in the Himalayas, but in the forests at their foot, that we must look for some aboriginal tribes. And here I must observe that I think the use of the term Sub-Himalayan by Hodgson, and (following him) by most other authorities, leads to a good deal of misapprehension, from an Indian point of view at least. We are in the habit of considering the Simla hills, Kumaon, and Nepal to be part of the Himalayas (and with good reason too I think), but Hodgson calls everything below the Snowy Range "Sub-Himalayan," and classes as 'Sub-Himalayan' people who live higher than the highest mountaineers in Europe, in the most precipitous mountains, 8,000 or 10,000 feet high; while the people really living under the hills are usually put in another class. I am now about to notice

tribes who have nothing whatever to do with the hills, but live in the forests and what is called the 'Terai,' at the foot. No two climates and locations can be more dissimilar than those of the hills and the Terai, and no races are more distinct in their habits, manners, and aptitudes than the people of the hills and those of the jungle belt below.

It may be generally said that there is no Terai or forest belt northwest of the Seharunpore district and the Dehra Dhoon; but thence eastward this belt stretches along the foot of the hills through Rohilcund, Oude, and the Bengal Frontier, up to Assam. A great part of it belongs to the Nepalese. A very interesting paper by Dr. Stewart on the Boksas, a forest tribe found in western Rohilcund and in part of the forests or Sewalik hills of Dehra Dhoon, was published in the Society's Journal last year. They are entirely confined to the forest tracts, where they enjoy a wonderful immunity from the effects of malaria. They never (says Dr. Stewart) settle more than two years on one spot, but after getting a little out of the soil, move to fresh locations. They are of short stature and spare habit, and in feature certainly Turanian of some sort, with broad faces, depressed noses, prognathous jaws, thick lips, and very scanty beard and moustaches, but in colour apparently not darker than the ordinary Hindoos of the country. They are fond of game and pigs, eat almost anything, have no caste, and are reputed to be very skilful in witchcraft. They have no separate language. They are simple, inoffensive, and good-humoured, but very ignorant and indolent. Their cultivation is very scanty and rude, but they also collect forest produce and wash for gold. They are supposed to be dying out.

I have seen mention of another small and savage tribe in the Rohilcund Terai called "Rawats" or "Rajis;" and passing westward we come to a very important tribe, the 'Tharoos,' who in fact occupy all the Terai from eastern Rohilcund all along the frontiers of Oude and into Goruckpore. They are in many respects very like the Boksas—in physical appearance and manners I should say extremely like—but they are much more industrious, and altogether a larger, more settled, and, one may say, less savage tribe. They, like the Boksas, keep exclusively to the Terai and forest, living where no one else can live. They are shy and timid, but frank and truthful, when you get hold of

them, and are very good cultivators in their own simple way. They are not particularly dark, and, in addition to the ordinary breadth and flatness of face, have a good deal of the Chinese-looking form of eye; so that it is difficult from appearance to say, whether they really belong to the Negrito, or to the Indo-Chinese stock. The fact is that though no two races can be more unlike one another than the slim, black, tangled-haired Negrito, and the stout, fair, lank haired Thibetan, yet when we come to half-breeds, the difference may not be so great. When the colour is softened or heightened, and the size increased or decreased to that of the ordinary Hindoo, and the hair reduced to civilised limits, there is the same appearance of breadth and flatness of face, and these latter characteristics are more apparent at a glance than any distinction between prognathous and pyramidal skulls. It would seem too that the Chinese peculiarity of eye is caused by the broad cheek bone common to both races, and perhaps it may be that while the eye being sunk deeper in the Negro and Negrito, and more covered by a more fleshy form of face its form is not so apparent, in the half-breed it is brought out, and the skin tightened by the high cheek-bone shows the Chinese-looking form of eye. I have noticed some of the Ghatwals on the borders of Bengal and Behar, who looked not unlike Goorkas. Thus then it becomes difficult to distinguish those tribes, on the northern and eastern frontiers, whose blood may be supposed to have become a good deal mixed by long contact with other races, and whose colour may have been softened by the cool, moist and shady climate of the Northern Terai.

I must also say that I think Hodgson has somewhat contributed to mix up the two races in our ideas, for in his enthusiasm to establish a connection between his Tamulians and the eastern races, he scarcely attempts to distinguish them, and classes as Tamulians, Bodos, Dhimals, &c. of whose connection with the Aborigines of the South of India there does not seem to be the slightest evidence in language, and who in appearance are as different as can be.

To return to the 'Tharoos;' as I said their appearance might leave doubt of their origin, and unfortunately they are not known to have any language of their own. Those with whom we have come more immediately in contact (including all those in eastern Rohilcund) certainly now speak Hindee, but the tribe is so large and important, that it

would be, I think, desirable not to give up without farther inquiry the attempt to find a Tharoo language, though it will be more difficult now that, by the transfer of the Oude Terai, the great mass of them, and all those least mixed with Hindustanees, are Nepal subjects.

In other respects the habits and manners of the Boksas and Tharoos certainly point rather to an Indian than a Thibetan origin. I saw something of the Tharoos before they were annexed to Nepal; and their general style suggests a good deal of resemblance to the Santals for instance. Mr. Robert Drummond, who has served both in Pillebheet and in Central India, and who knew the Tharoos well, tells me that in many ways they remind him very much of the Aboriginal tribes of the Central hills. They have the same simple ways and the same religion of Bhoots and familiar spirits. He also mentions a singular circumstance, that on looking over a map of the hill country of Bhau-gulpore (now called the Santal Pergunnahs), he was struck by the occurrence of many names which he had supposed to be peculiar to the Tharoos.

The claim of the Boksas to Rajpoot origin is of course ridiculous, but it is clear that all their traditions point to the south and south-west as the country of their origin, not to the northern hills. These tribes have in fact little intercourse with and no known congeners in the hills. The Boksas and Western Tharoos are separated from the Thibetan tribes by a great tract of very difficult country occupied by Arians; and though the Eastern Tharoos are nearer to Nepalese races who show Thibetan blood, it seems hardly probable that inhabitants of the hills should be driven out into the Forest below (of which the hill-men have a great horror); while, that Aboriginal Indians should be driven from the plains to the neighbouring jungles, would be probable enough. I am inclined to think that the Tharoos and Boksas are probably not Thibetan, farther than the accession of refugees and others from Nepal may have introduced a little of that blood. Dr. Stewart suggests the possibility that they may be akin to the Indo-Chinese races who occupy the lowlands near the Berhampooter; but though that may be possible, it seems to be a long way for emigrant tribes to find their way up to the Dehra Dhoon in countries where, for so many hundred miles, there is no trace of their congeners. On the whole, it seems more probable that they are Aboriginal Indians a good deal

diluted. I have not heard of the Tharoos serving as labourers, but if they are akin to the Dhangar Coolies now so much sought after, seeing their immunity against malaria, they would be very valuable to any one who could induce them to emigrate. As yet, however, they are very shy.

From Goruckpore eastward in the Nepal Terai and along the Frontiers of Bengal, I cannot learn that there are any Aboriginal tribes till we come to the neighbourhood of Sikkim and Kooch Behar. Those whom I have asked knew of none, and it is probable that if there were any, Hodgson would have mentioned them. Dr. Campbell of Darjeeling speaks generally of the population of the Nepal Terai as composed of a most varied assemblage of bastard Hindus.

The Kooch Behar people have become so Hinduised, that their original character cannot be distinguished with certainty. They call themselves "Rajbansees," as I think do several Hinduised Aboriginal tribes.

About this parallel we come upon the Meches or Mechis who form the chief population of the forests and Doars at the foot of the Sikkim and Bhootan hills, and a few of whom have recently settled in the extreme eastern portion of the Nepal Terai. I understand that these people are the same as the Bodos of Hodgson, who are of an Indo-Chinese family. I shall rank them and other similar tribes as 'Borderers,' and now only notice them for the purpose of comparison. They are described as very Mongolian or Indo-Chinese in feature, fairer than the Hindus and of a yellow tinge, taller and larger than the Nepalese cultivators, addicted to spirits and to smoking opium. They make small and temporary clearances in the forest and are proof against malaria. In an industrial point of view they are evidently much inferior to the Tharoos.

Dr. Campbell incidentally mentions among the lowland neighbours of the Mechis a tribe inhabiting similar tracts called '*Thawas*' whom I have not seen mentioned elsewhere. They seem (so far as one can gather from the slightest notices) to be more industrious and settled than the Mechis. Dr. Campbell seems to speak of them as a different race. It would be interesting to know whether these Thawas may not possibly be related to the Tharoos.

Also among the neighbours of the Mechis are the Garrows, whose main habitat is the hill country just within the bend of the Berham-

pooter as it sweeps round from Assam into Bengal, the extreme western portion of the range which separates Sylhet, &c. from Assam. More to the east are the Cossya hills, to the west those of the Garrows. While all the tribes of the eastern hills are Indo-Chinese, I am inclined to suspect that the Garrows alone are Indian Aborigines, more or less mixed it may be. They seem to be quite distinct and different from the other tribes of the neighbourhood, and several officers, to whom I have talked, agree in thinking them more in the style of Coles and Bheels than of Indo-Chinese. I have not found any very exact description of them, but gather that they are small and dark, savage and troublesome. That they should belong to the Aboriginal races of India, is *primâ facie* by no means improbable, seeing that their hill country is, as the crow flies, scarcely more than 150 miles distant from that of the Santals and Rajmehalees, as may be seen by a glance at any map. There is a kind of straight between the eastern and western hills through which the Ganges and Berhampooter run before expanding in the broader Delta of Southern Bengal.

The little that is known of the language of the Garrows has not sufficed to connect them with any of the Aboriginal tribes mentioned by me, but it also seems to show that it is radically different from the surrounding Indo-Chinese dialects. It seems especially desirable to know something more of the Garrows and their language.

I have kept to the last the Bhooyas or Bhooyians, because they seem to belong to both sides of Bengal, to West Bengal and Orissa on one side, and to Assam on the other. I have not met with any detailed account of their position in Assam, but I imagine that there can be no better authority than Col. Dalton who intimately knows both Provinces, and he, while describing them in the western hills, distinctly states that they were once the dominant race in Assam. It is always necessary to be cautious in dealing with names of this sound, since, as I have already mentioned, 'Bhoomea' means 'man of the soil,' and I believe that the word earth or soil also takes the form Bui. The Bhooyas have no immediate connection (that is looking only to the name) with either the Bhumiz or the Boyars. But Col. Dalton no doubt looks farther than this; and indeed he goes on to notice a considerable connection between Assam and the west both

in races and in language. The Bhooyas in the west seem to be numerous. They appear to be the original occupants of much of the lower country to the south of the Chota-Nagpore plateau, great part of Singbhoom and Bonai, and the borders of Orissa. From a portion of their country they have been partly driven and partly they are dominated over by Coles, themselves probably impelled south and east by pressure from the north and west. They are still very numerous in all the districts and petty states hereabouts, and are found more or less all the way across the lower hill-country to the borders of Behar. Col. Dalton calls them a dark complexioned race, with rather high cheekbones, but not otherwise peculiar. They have no language of their own, but speak Oorya on the Ooriah borders, Bengalee on the borders of Bengal, and Hindee farther north. They are now somewhat Hinduised, but have still priests of their own and traces of an old religion, which seems even down to recent times to have included human sacrifices. Major Tickell speaks of the Aboriginal Bhooyians who preceded the Coles in lower Singbhoom as "an inoffensive simple race, but rich in cattle and industrious cultivators." The descriptions of Col. Dalton and Major Tickell seem to suggest a resemblance in appearance to the Ooryahs, among whom high cheek bones seem to prevail with good features and straight hair. The Bhooyas whom I have seen in the hills towards the Bahar border seemed to have a larger dash of the black Aboriginal type. Seeing how far these Bhooyas are spread to the west, I was curious to know whether they might be related to the Buis, a tribe of Telengana and Central India who serve all over the centre, south, and west as palanquin bearers and domestic servants, and from whose name is, I believe, the most authentic derivation of the widespread word '*Boy*' as applied to a dark servant. Travelling from Nagpore towards Jubbulpore I observed that I changed the Buis of Central India for the Kahars of Hindoostan. Col. Dalton did not know whether there was any connection between Bhooyas and Buis. But quite recently, making a trip through a part of the Chota-Nagpore country, I found that the palanquin was carried by Bhooyas there and below the hill country till I got close to Gya, and I ascertained that they had no connection with the Hindoostanee Kahars by whom they were then relieved, but were considered to be a wholly different race. I cannot

help thinking that the Bhooya palanquin bearers of Chota-Nagpore may be the same as the Buis of Nagpore Proper. At any rate it might be worth inquiring. These Bhooyas or Bhoosians have been reputed to be the Aborigines of Bengal, and if that be so, it would quite account for their being found both in Orissa in the west and in Assam on the east. The difficulty is that there seem to be no such people now in Bengal, nor have I been able to identify them with any caste under another name. If, however, one travels in a palanquin from the Chota-Nagpore country into Bengal or Orissa, the bearers will be relieved not by Kahars as in Hindoostan, but by Gwallas or cow-keepers. These Gwallas do the work of palanquin-bearing and domestic service in Bengal, functions not performed by Gwallas so far as I know in any other part of India. An Aheer or up-country Gwala would never dream of such work. In fact the Gwallas in Bengal take the place of the Buis or Boys of the centre and south of India. They are now the most numerous Hindoo caste in Bengal and especially in Orissa. As I said, Major Tickell describes the original Bhoosians as rich in cattle. May not the Hindoos have adopted them and turned them into Gwallas? I should also however mention that the lowest or sweeper class are called I understand in Bengal "Buimals," but I have not been able to ascertain the derivation of that word.

The Bengalees are certainly in many respects different from any other people of India, and if the Bhooyas are the Aborigines of a great part of Bengal, we may the more readily believe that they are in fact different from the Coolees and Dravidians who have gone to compose the Hindoostanees and Southerners respectively. Who they are, and where they came from, are questions which open out a wide field of inquiry. Can any Aboriginal language or words spoken by them be traced? may they have any dash of more eastern blood? Is the mode of carrying palanquins rather a Chinese than an Arian fashion?

If we knew something more of the Garrows and the Garrow language, they might possibly supply a link in the history of Bengal.

Another race mentioned by Col. Dalton, as found both in the West and in Assam, are the Kolitas, whose name might suggest some relation to Coolees; but they seem to be now considered rather high

caste and good looking Hindoos, so the name is probably not the same. In every direction, however, there is room for inquiry.

One word regarding a people in another quarter who have been classed with the Indian Aborigines, the Brahuīs of the higher parts of Belochistan near Khelat, &c. These people are set down as allied to the Dravidians upon, I think, the slightest possible evidence, but it is one of those things that, having once got into print, is in the absence of farther information repeated again and again, till it seems an established fact. Dr. Caldwell, in his amiable enthusiasm for his beloved Dravidians, and seeking to establish for them an aristocratic pedigree, without acknowledging obligation to the northern Hindoos, seizes upon the Brahuīs as the link to connect them with the more northern nations and goes somewhat into the matter.

The Brahuīs are described as a stout, squat, somewhat flat-faced people, fair, with hair and beards often brown if not red. That they have indications of some Turanian element both in feature and speech, may be at once admitted, using the word Turanian in its widest sense; but for the rest anything in greater contrast to the slim black Dravidian Aborigines, it is impossible to imagine. They are very remote from any Dravidian tribe, the nearest being the Gonds. Their language is not supposed to show any affinity to the Kolarians.

On the other hand, in one direction we have not far to seek for an explanation of the Turanian element in the features of the Brahuīs. The Hazarehs of the hill country near Ghuznee and Candahar have it in a more marked degree, and are without doubt of Mongolian blood. They seem to be in many ways like the Brahuīs, and we are told that at one time they possessed the country on the Khelat side of Candahar, and were nearer than they now are to the Brahuīs. That the latter have some of their blood, or may even be a branch of them driven to the hills by Belochees or Hindoos, would seem *prima facie* the most probable thing in the world. It is then only by the test of language that any Dravidian connection can be assigned to the Brahuīs, and in the case of people otherwise so dissimilar and so distant, the linguistic evidence ought to be very strong, to satisfy us. I have been unable to find a paper giving a list of Brahui words said to have been published by this Society, but Dr. Caldwell seems to sum up all the evidence on the subject. He admits that "the Brahui

language, considered as a whole, is derived from the same source as the Punjabee and Scindee" (in which no one ever suspected a Dravidian connection), but he goes on to show that the Brahui has also a Dravidian element in it. Now there are scarcely any two languages in which here and there words of similar meaning and similar sound may not be found, but so far as the vocabulary goes, Dr. Caldwell's list seems to show that he must have been very hard put to it. 'Khaff,' the ear, and 'pid,' the belly, seem to me at least as near to the Hindoostanee 'kan' and 'pet' as to the Dravidian 'kadu' and 'pir' or 'bir.' 'Kat,' a bedstead is, I think, distinctly a Hindee or Punjabee word. 'Dir,' water, seems to me as near to the Kolarian 'dah' as to the Dravidian 'nir.' 'Ae' or 'aji,' a mother or nurse, and 'pussie,' a cat, are words of world-wide use.

So also the pronoun 'ni' or 'nim,' thou or you, appears in some shape in every dialect not purely Arian, from Australia to northern Siberia and from Japan to Finland. I really cannot find above 6 or 8 words which Dr. Caldwell shows to be especially like Dravidian words, and to make out these, he picks and chooses from every one of the different Dravidian dialects and accepts some rather distant resemblances as 'pak' to go, Tamil 'pogu.' This much seems to me to prove nothing whatever.

Again, take his grammatical resemblances. Some seem to be too wide, applying to many other languages, and others too minute. The use of postpositions and the want of comparatives and superlatives in adjectives is equally a coincidence with Hindoostanee and many other languages, neighbours of the Brahui on one side. The expression of gender by separate words and of plurals by postfixes denoting plurality is equally common to many other languages, including the neighbour of the Brahui on the other side, the Persian, e. g. 'nar-gow' a 'male cow,' and *Aspahan* 'horses.' The genitive in 'na' seems just as like to the Hindoostanee and Punjabee 'ka' or 'da' as to the Tamilian 'ma.' The dative-accusative in 'e' is a familiar Hindoostanee or Punjabee form, thus instead of 'Mujh-ko do' Give me, it is constantly 'Mujhe do,' and 'Use maro' beat him, especially with the Punjabees. So also 'ten,' said by Dr. Caldwell to mean 'self' in Brahui, seems very like the same syllable used to give precision in Hindoostanee as "Use-ten do," which I should translate 'give to him himself.' At any rate 'ten' is found nearer at hand than the Dravidian 'tan.'

The copulative 'u' 'and,' most people would think palpable Persian, and not go all the way to the Canarese for it.

It comes then in my view to this that the only real appearance of analogy to the Dravidian class of languages in particular (as distinguished from the body of Turanian languages in general) is reduced to two numerals. In Brahui neither 'one' nor 'four' and upwards in the least correspond with Dravidian numerals, but the two numbers 'two' and 'three' as given by Dr. Caldwell do seem similar. He gives the Brahui two, '*irat*' and three, '*musit*' or '*muoit*' which bear comparison with the Dravidian two, '*eradu*,' '*irandu*,' '*randu*,' '*ranu*' and three, '*muru*' '*mudu*,' '*mundu*,' '*munnar*,' '*munu*.'

The Brahui one '*asit*' seems very like the Pehlevi '*achat*,' and the Brahui *irat* may come from the Pehlevi '*tarein*' two, the Caucasian '*ieru*' and the Georgian '*ori*.' If so the 'three' would be the only tie to the Dravidians left, and that is not very close. The ground of induction seems insufficient to connect such dissimilar people. My impression is, that if, instead of saying that the Brahui language is mainly Punjabee with a Dravidian element, Dr. Caldwell had said that it is mainly Arian (Indo-Persic) with a Turanian element, that would have been more correct. At any rate in so important a matter fuller inquiry is necessary.

### THE MODERN INDIANS.

I commence with the Bramins.

It is well-known that the Bramins as Priests are a necessary part of every Hindu society, and as Priests they are to be found wherever there are Hindus. In that character then it would be unnecessary to my purpose more particularly to trace them, for with their religious sects and tenets I do not deal. I shall only trace them for Ethnological purposes through the countries in which they form an important part of the general secular population. In fact, far from being restricted to the character of Priests, they are one of the most numerous castes in India, and probably that which follows the greatest variety of avocations. On the whole I should say that they are less prejudiced than any other of those whom I call full-blown or High Hindus. At any rate, whether it be that their character as keepers and expounders of the Law gives them greater licence, or that their intellect

is more varied and their necessities greater, they do in various places and under various circumstances turn their hands to very many odd jobs as it were. Throughout Hindustan they have almost entirely lost that function of Clerks and Bureaucrats of the community which they still retain to a great extent in other parts of India; and it will be as members of the ordinary agricultural populations that I shall most deal with them.

Beginning from the north, we first meet with the Bramins in that quarter to which all their traditions point, within the hills north of the Punjab. The first Indians encountered by a traveller from Central Asia would be these Bramins of this extreme North-West corner, occupying both the valley of Kashmir and the hills immediately to the west and south-west of it.

Kashmir is a Bramin country. The lower classes have long been converted to Mahommedanism, but they seem to be ethnologically identical with the Bramins, and tradition also asserts that they are of the same race. At the present day no other Hindu caste save the Bramin is known, nor is there any trace (so far as I could find) that there ever was any other in the country. The Bramin population is numerous, but it would seem as if, while the illiterate multitude adopted the religion of the ruling power, the better educated and superior class maintained their own tenets; and at this day the Bramins (or Pandits, as they are usually called) form quite a sort of aristocracy. They are almost all educated and exceedingly clever, and so, being to a great degree above manual labour, they are an excessive and somewhat oppressive Bureaucracy, which not only has ruled Kashmir under every successive government, but sends out colonies to seek a livelihood throughout Northern India. The Kashmir Bramins are quite High-Arian in the type of their features, very fair and handsome, with high chiselled features, and no trace of intermixture of the blood of any lower race. It may be partly race and partly occupation, but they have certainly a greater refinement and regularity of feature than the Affghans and others of a rougher type; with, however, a less manly-looking physique and a colour less ruddy and more inclining to a somewhat sallow fairness. The high nose, slightly aquiline, but by no means what we call Jewish or Nut-cracker, is a common type. Raise a little the brow of a Greek

statue, and give the nose a small turn at the bony point in front of the bridge (so as to break the straightness of line), you have then the model type of this part of India, to be found both in the living men and in the statues dug up in the Peshawar valley. There are also a good many straight noses, and some varieties as in all places, but much less departure from an ordinary handsome standard than in most countries. The figure of the ordinary working Kashmeeree is strong and athletic. But none of them are martial, and the Bramins are in this respect no exception. They rule by the brain and the pen, and not by the sword. It is this character that has gained them the favour of so many rulers of a different faith. Kashmere long belonged to the Cabul kingdom, but it was never in any degree colonised by Affghans, and is singularly free from any modern intermixture of foreign races. The fact seems to be that the valley never belonged to the Affghan nation, but was always retained as a Crown Appanage of the kings, who were very jealous of admitting into it subjects whom they might find it difficult to turn out again, and much preferred to govern through the Pandits. Others have to a great extent followed the same policy.

From a Hindu point of view, the Kashmir Bramins do not rank well. As they are Priests to no one but themselves, they are necessarily much more secular than Bramins who among other Hindus claim to be a priestly class, while they eat meat and are altogether loose in their observances, to an extent which makes them very far short of the modern Hindu standard. They are in fact not recognised among the modern Divisions of Indian Bramins, belonging neither to the 5 Gours nor to the 5 Dravidas, but forming a class apart. I have alluded to their attempt to claim the blood of all the Bramins higher in the sacerdotal scale, and suggested that it is more probable that the latter have sprung from and (in their sense) improved upon the Kashmeerees. In fact, the founder of the latter (Kashiyupa who drained the lake, colonised the valley, gave his name to Kashgar and Kashmere and to the people originally called Kashas or Kassias,) is still recognised by the Bramins and Hindus as the first of the seven Rishis, and even far away down on the west coast of India, the Bramins in general still trace their descent to Kashiyupa. I shall afterwards notice the name Kash as Khas occurring again and again in other parts of India, in a way which requires explanation.

The Kashmeerce Pandits are known all over Northern India as a very clever and energetic race of office-seekers. As a body they excel in acuteness the same number of any other race with whom they come in contact. Probably they are in no respect inferior to the Maratta Bramins, but they have not in Hindustan the same advantage as the latter have had in their own country among inferior races. The Kashmeerees, as foreigners among energetic races, have a much harder struggle, and though they get a good share of good things, they are nowhere dominant, nor have they usually risen to such high stations as many Maratta Bramins. The most conspicuous man whom I recollect was Raja Denonath, Ranjeet Sing's Financier and in some respects Chief Minister. Although the Kashmeerees seldom find their way as far as Calcutta, it is somewhat singular that in Bengal the first native to attain very high office is a man of this race, viz., Shamboonath Pandit, Judge of the High Court. Almost all the secular Pandits use the Persian character freely; they are perfectly versatile, and, serving abroad, will mount a horse, gird on a sword, and assume at a push a semi-military air.

The Kashmir language is separate and distinct, and the dress, manners, and fashions of the Kashmeerees mark them as in every way a distinct people. Of the language we only know that it contains a very large proportion of Sanscrit. The Institutions of the people have nothing of the democratic character.

In the hills also, between Kashmir and the Punjab, Bramins occupy the van (or perhaps we should call it the rear) of the Indian race to the west, though they have abandoned their Hindoo religion and become partly Mahommedans and partly Sikhs. They are in habits, language, and manners quite different from the Kashmeerees, and seem now to belong to a different nation. Their language is a dialect of the Punjabee (a very Pracrit tongue and certainly not borrowed from any Mahommedan race), while they are good soldiers and altogether more Punjabees than Kashmeerees. Beyond the Jhelum, the hill frontier is occupied by a tribe called Bambas, now Mahommedans, but originally Bramins; while on this side the Jhelum the hills are shared with other races by a numerous tribe of Bramin-Sikhs. The position of these men is curious. They became Sikhs long before the extension of Sikh power to those regions, and in a

much more complete sense than most modern Sikhs, abandoning all pretence of Hindoo religion and adopting to the full the Sikh reformer's tenets. Indeed they were converted during Mahomedan rule, and when 'Sikh' was really a religious rather than a political name. The fact probably is, that they found the country too hot for Bramins, but did not care to become Mahomedans, so adopted the alternative of becoming Sikhs, and so free from the trammels of caste. These men are very useful soldiers and servants, especially under Sikh rule. A good many of them have been introduced into Kashmir as a sort of military colonists, partly by a Hindu governor under the Affghans, and partly by the Sikh rulers; but they remain quite apart from the Kashmir Bramins. One of the best native officers in the Punjab force, who is himself of this class, told me that the *Bambas* are without doubt Bramins under a corrupted name. He says that to this day the Sikh Bramins and Bambas exchange cakes on the occasion of certain ceremonies (births, funerals, &c. I think), and that there is no doubt that they are of the same stock. I believe that it certainly is so. It seems to be a common practice in India to give to tribes who have departed from the faith or mixed the blood of their ancestors, names derived from their original tribal names. Thus half-civilised Bheels are called '*Bheelalabs*;' Mahomedan Rajpoots are called "Rangars;" a tribe of bastard Bramins to be afterwards noticed (in Benares and Bahar) 'Bamuns' or 'Babhans.'

The Bramins of the frontier hills are, I think, even handsomer than the Kashmeerees. To my view, the people in general of those hills are the handsomest of the human race.

Descending from the Himalayas, there are some Bramins near the foot of the hills. Except a few priests, I do not think that they are found beyond the Indus, but they are, I understand, pretty numerous in part of the Rawal Pindee district. South of the Salt Range, in the plains, they are well nigh overwhelmed by the strong flow of Rajpoots and Jats (advancing, as I believe, at a later period and from another direction). The Bramins either never occupied the plains of the Punjab to the south-west, or they have been driven from that country. Even nearer the hills they are not exceedingly numerous. But still in that fertile and pleasant strip under the hills we have, among other races, villages of agricultural Bramins in the districts of Sealkot,

Goordaspore &c., in the valleys of the broken country between Hoshearpore and Kangra, and in parts of Umballa district and the adjoining Simla hills; and thus we, as it were, mark the trail of the Bramin race in its progress southwards from the hills of Kashmir to the banks of the sacred Saroostee or Saraswatee and the famous field of the Gulcheter at Tanessur close to the Grand Trunk Road, some thirty miles south of Umballa.

Here also the Bramin population in the country is not specially numerous. Other races have swept over the scene. But lower down the course of the Saraswatee, where it may be traced through the now somewhat desolate countries of Marwar and Jessulmere, the Bramins are still numerous. Where the low and comparatively moist tracts, in which the river once ran, still admit of cultivation, the Saraswatee Bramins are found very industrious and good cultivators, who claim to have occupied the country before Jats and Rajpoots became dominant. *There* is found (at Pokhar) the only temple in India still dedicated to the worship of Brama the Father. The town of 'Palli' seems to be a Bramin centre, and thence come a race of mercantile Bramins called 'Palliwal's.'

Sir John Malcolm also mentions the Marwarree or Saraswatee Bramins as forming a considerable proportion of the most industrious cultivators in Malwa. And following the Saraswatee down to the Indus, we find that (some southern immigrants excepted) they are also the Bramins of Scinde, but said to be much looked down on by more orthodox southerners as eaters of meat and altogether little advanced Bramins.

The settlement on the banks of the Saraswatee is a well-known stage of Hindu history. Here the Bramins came in contact with other races, castes were recognised, and early Hinduism became literary and historical. But the extreme caste and religious system, the full-blown High-Hinduism of the Gangetic Bramins, was not yet. The descendants of those who continued to dwell on the Saraswatee seem to have much kept to the tenets of their forefathers. They are separate from the Kashmeerees and have a place among the recognised divisions of Indian Bramins, but their more advanced brethren give them the lowest place in the orthodox scale, and in their native country they chiefly shine by those simple and agricultural virtues in which their remote ancestors also probably excelled.

It is a curious problem, that lost river, the Saraswatee. The evident river-traces all the way down to the Indus, ancient Hindu history, and the universal traditions of the people of those regions, all go to make it as certain as any historical fact can be, that the Saraswatee was once a fine river, and that the countries through which it flowed (now for the most part desert and barren) were once well-watered and green. No mere diminution in the amount of rainfall, caused by denudations or the like, could have occasioned such a change. The outer range of the Himalaya runs all the way from the Sutlej to the Jumna without a break, and the tributaries of the Saraswatee receive but the outer drainage of the slope a few miles wide. No doubling or trebling of the rainfall could make any of these considerable perennial streams; nothing in fact short of a change of elevation of the ridges to the extent of several thousand feet would render possible any outlet in this quarter of the drainage of the interior of the Himalayas. The Saraswatee itself is now not a stream at all, but an absolutely dry bed, which is only filled by surface flooding in the height of the rains. The high embankments on the present Grand Trunk Road, on the Umballa side of Thanessur or Peeplee, mark the levels, and show the hollow where a great river once flowed. I have long had a theory that, in truth, the stream now called the Jumna once flowed in this channel. The present channel of the Saraswatee points upwards to the point where the Jumna issues from the hills, and ends in a confused drainage within 2 or 3 miles of that almost natural channel in which the Western Jumna Canal (running more like a river than a canal) carries the Jumna water in a course which eventually leads it lower down into the very bed of the Saraswatee. The Jumna at its first issue from the hills runs in a course which points directly towards the Saraswatee and the lower Indus, and the moment you cross, to the west, the high bank (which is accumulated along the course of most rivers), the whole of the drainage of the country is to the Saraswatee and not to the Jumna. In fact the bed of the Jumna is higher than that of the Saraswatee. Sir P. Cautley was anxious, by a change of the Jumna Canal, to carry it directly into the Saraswatee channel, and I believe that to divert the whole river would be a work within easy reach of modern engineering. May it not then be that nature caused a change

the other way, that the stream now called the Jumna then belonged to the Saraswatee, but that those hill torrents from the Sewalik, bringing down masses of sand and earth, raised between them and the main stream a sort of James and Mary which eventually caused the latter to break away to the south-east? If the stream moved, most of the Hindus would probably move forward too and find themselves in the Gangetic valley.

The Saraswatee Bramins are also called (in the south at least) "Kashastalee" a name which seems still to mark the time when they were considered to be of Kashmeeree or Kasha origin. In fact there seem to be several stages in the history of Braminism. The oldest of the race may be the people of the upper hills who date from a time altogether prior to Hinduism. The Kashmeerees were a civilised and literary Braminical people not yet fully Hindu. The Saraswatee Bramins (those Kasha settlers in the plains of India) were the earliest and most simple and pure Hindus of Vedic faith, that faith being now worked out and developed; those of the Ganges and the rest of India are in various phases the types of modern Hinduism.

From the Gulcheter down to Dehli and in the country about Dehli, Bramin villages are scattered about, but the Bramins cannot be said to constitute a very large proportion of the agricultural population. Wherever they are found in this country, they are capital cultivators, quiet, industrious, intelligent; there is no better population, and the women work as well as the men. It was remarked by the fugitives from Dehli at the time of the mutiny, that whenever they came to a Goojar village, they were always plundered; whenever they came to a Bramin village, they were always kindly treated; while at any other village their treatment was uncertain. These Bramins too are, I should think, descendants of the Saraswatee Bramins. Some of the less pure agricultural Bramins of these parts are called 'Tugas' or 'Gour Tugas.' South of Dehli, in the Jyepore country, Bramins seem to be numerous, but I have not been able to ascertain if they are of the same branch. In the Seharunpore district too there are a good many Bramins of secular occupations, besides the priests of Hardwar.

Sir H. Elliott has remarked on the difficulty of accounting for the fact that all the Dehli country is occupied by 'Gour' Bramins. They can hardly, he thinks, have come from Gour in Bengal, from which

they are separated by great tribes of Kanoujeas and others, and their own traditions point to Harriana as their original country. I would suggest the following explanation. The principal tributary of the Saraswatee is the 'Guggur' or 'Ghargar' which now gives its name to the main channel where it passes through the Harriana district. May not the name of 'Gour,' borne by these Bramins of Harriana, be a mere abbreviation of 'Guggur' or Ghargar? May not the Gour Bramins be simply Bramins of the Guggur or Lower Saraswatee?

Generally speaking I think it may be said that in the western parts of the present N. W. Provinces, in the Rohilcund, Meerut and Agra Divisions and in Western Oude, the Bramin population is not specially numerous. They are scattered about everywhere here and there, both as cultivators and in other capacities, but I know no large body of them. I don't know that they follow much any profession involving manual labour, except cultivation and almost any kind of service; unskilled labour as Coolees or spade labourers, they may undertake when pressed, but I do not think that they are artisans. There are a few considerable Bramin bankers in Hindustan, or at least one great house, but that trade is not generally in their hands.

Farther east, in the Lower Doab, Eastern Oude, and the adjoining districts, is the great country of the modern Hindustanee Bramins. Kanouj, the ancient head-quarters of the race, is on the old Ganges 50 or 60 miles above Cawnpore. It is now an insignificant place, and the mass of the Bramin population lies to the east of it. In the districts of Cawnpore and Futtehpore I believe that the Bramin cultivators far exceed in number any other class; in Cawnpore alone there are some 250,000 of them. It is much the same immediately on the other side of the Ganges, in the adjoining parts of Oude. The country of which this is the centre may then more than any other be considered especially that in which the Bramins are now settled as a people. And in the far distant country in which also they are very numerous, the Western Coast of Southern India, the Bramins claim to be colonists from the same region, saying that Paras Ram led them from Calpee (the great Ferry of the Jumna opposite Cawnpore) and causing the sea to recede, settled them under the Western Ghats. The Lower Doab is well-known all over Central and Southern India as the "Unter-bed."

Whether from the example of the Rajpoots, or for other reasons, these Bramins of the Unterbed and Oude have taken largely to the profession of arms, not usually much followed by them in other parts of the country; and beyond their own boundaries in their Military character they are reputed the most overbearing and disagreeable of their race. Yet I fancy that it is rather their profession than their natural character, which has attached to them this bad name. Numerous as they were in the Sepoy Army and foully as that Army behaved, I cannot find that the Bramins were really by any means worse than others; some of the most Bramin Regiments stood the best. And at home they seem to be quiet and peaceable enough. The Bramin district of Cawnpore pays, I think, a higher revenue rate than any other in India, except the peculiar Delta of the Cauvery about Tanjore. Numerous as the Bramins are in this part of the country and apt as soldiers, they have not been the dominant race. I do not know much of the history of the Cawnpore district, but I have never heard of Bramin rule; and certainly over the river, in Oude, the rule is with the Rajpoots, not with the Bramins. All the really old Talookdars are Rajpoots, as are the Rajas of Bundlecund and Baghelcund beyond the Jumna.

I am not sure what is the extent of the Bramin population in Bundlecund. In the Banda District I think that they are common, and certainly in 'Baghelcund,' or Rewah, they are very numerous; but whether the same martial race, I do not know, for there they condescend to very menial services and groom most of the horses on the Jubbulpore road.

In the proper Bramin country, I think that some of them affect the Rajpoot prejudice against actually holding the plough, but even there they perform every other agricultural labour. Agricultural and military as they are, they rejoice in the classic names of Dobeë, Tewaree, and Choubee, that is men of two Veds, of three Veds, of four Veds, and are considered to be very high caste. Between the Ganges and the Gogra, as we recede from the Ganges, the population becomes more Rajpoot than Bramin, but there are many Bramins about 'Ajoodia,' the old 'Oadh.' Beyond the Gogra again is a numerous Bramin population of a different tribe from the martial Bramins of the Ganges, humbler, and not soldiers. Thence to the

north of the Gogra and Ganges all the way into Tirhoot there are, I believe, many Bramins. South of the Gogra and thence across the Ganges, into the Arrah District (Bojpore), runs the Rajpoot dominions. But about Benares, and still more in the greater part of Bahar, the dominion is held by a numerous class of bastard Bramins called 'Bamans' or 'Bhabans,' to which belong both the Raja of Benares and almost all the great landholders of Bahar. There seems to be no doubt that this class is formed by an intermixture of Bramins with some inferior caste. They live in strong and pugnacious brotherhoods, and are in character much more like Rajpoots than Bramins. The main country of the Bramins may then be described to be that part of Hindustan (between the Vyndyas on one side and the Himalayas on the other), from the longitude of Kanouj and Lucknow to near the frontiers of Bengal, with a large segment of more especially Rajpoot country (stretching from Lucknow to Bojpore) cut out of the centre of this tract.

The Hindustanee Bramins are all strict Hindus of the modern type. They are generally good sized and on the whole well-looking men, not I think particularly fair among the higher castes, but seldom so dark as the lower. Their features are good, but by no means generally of the peculiar High-Arian and sub-aquiline type. In fact the breed has here lost some of the purity of its blood, and the features are very much as in Europe. I think I have noticed among many of the Hindustanee Bramins a good deal of the open, blunt, bullet-headed, and as it were anti-aquiline style of countenance; not so handsome as more High-Arian features, but still pleasant enough. I do not think that in appearance they have any decided superiority over the higher castes of Hindustanees in general, though the higher castes have some general advantages over the inferior castes. By far the greater number of them are quite illiterate and have nothing of the clerkly character about them. The priests and Pandits are learned enough in their way, but they have never taken to the use of the Persian character. I doubt whether Hindustanee Bramins are as a body much more clever than several other classes; if they had been, they would have held their own better in spite of Mahomedan rule, as they have done in several other parts of India. As it is, they have scarcely any share of high office and very little literate service.

Besides serving as soldiers, they may be found among the lower hangers-on of courts, jails, &c., as process servers, guards over prisoners, and so on, but little in anything higher. As I have said, they turn their hands to many miscellaneous occupations not peculiar to any one else, and of course occasionally rise.

Sir H. Elliott calls the bastard Bramins of Benares and Bahar 'Bhoonhars' and seems to consider them a branch of the Sarwarea or Transgogra Bramins. Again he speaks of them (quoting from the 'Harivansa') as Military Bramins descendants of *Kasya Princes*, and here he seems to connect the term *Kasya* with *Kashee*, the Hindoo name for Benares. I do not know the derivation of *Kashee*, or whether it is connected with *Kashupya*.

Bramins are numerous in Kumaon and Gurwhal. The great tribe of those Provinces are however "Khassias" who now claim to be Rajpoots, but whose title to that character is more than doubtful. Education is, I think, more general here than in the plains, and the Nagaree or ordinary Sanscrit character is always used. Again the Goorkhas, the dominant tribe in Nepal, are properly called 'Khas,' whence Gor-khas. They are certainly for the most part of Arian and Hindoo origin, and pretend to be Rajpoots; but, according to Mr. Hodgson, they are really bastard Bramins, the offspring of a cross between Bramin immigrants and the people of the hills. Both the Khassias of Kumaon and the Khas of Nepal assert that they are comparatively recent immigrants from the plains, but this is probably in a great degree connected with their claim to the blue blood of the Rajpoots of the plains. The latter by no means acknowledge the connection. The circumstance that a bastard Bramin race is dominant in the plains immediately under the Central parts of Nepal gives much colour to Mr. Hodgson's account of a similar race in the hills. May it not be that the Rajpoots have never got so far east in the hills, and that the hill country was occupied by pre-Rajpoot Bramins? May it be that the names *Kashee*, *Khassia*, and *Khas*, point to a time when the Bramins were known as *Khasas* or *Kashmeerees*, just as English colonists are known as *Anglo-Saxons*?

Mr. B. Colvin, long Deputy Commissioner of Almorah, tells me a curious circumstance, viz. that in Kumaon, although the hill dialect is in the main Hindee, it has some curious grammatical affinities to

the Bengalee, both in some of the popular terminations, in the verb 'to be,' and in other particulars. I had before learned that there was a peculiarity of this kind in the Hindee spoken in the high country immediately south of Bahar, but there I supposed it to be a mere intermixture of the not distant Bengalee. The existence, however, of Bengalee affinities in the patois of Kumaon would seem to suggest the question whether these are not the remains of a form of Arian speech older than the modern Hindee, spoken perhaps before Rajpoots and Jats came on the scene, and then driven forward to Bengal in one direction, into the hills in another. I have not myself any acquaintance with Bengalee, but it would be interesting to enquire if it has any affinities with the older forms of speech in Kashmir and the north-western hills, or again with the Maratta and western dialects.

To get an idea of the Bengalee formation, I asked a friend the other day a single word, the pronoun 'he' and the genitive 'of him,' which he gave me '*Se*' and '*Taha*' or '*Tah.*' At this present writing, by way of experiment, I have just turned up these same words in Mr. Edgeworth's small Kashmir Grammar and find 'he,' '*Su*;' 'of him' '*Teh.*' The '*Se*' is a very old Arian form, found in the Kaffir hills, which disappears in Hindee and reappears in Bengalee; but the genitive '*Teh*' in Cashmiree, '*Tah*' in Bengalee, seems a singular and hardly accidental coincidence.

To return, this brings me to the Bengalee Bramins. They all assert a northern origin as a historical fact, and I believe that there is no doubt of it. Still their nationality is altogether Bengalee, and as the Bengalees differ from all other Indians, these Bramins also differ much in language, dress, habits, and general style from the Hindustanee Bramins.

In appearance they are certainly fairer, larger, and altogether Aryans of a higher type than the mass of the Bengalees. There is much more difference, I think, between Bramins and the mass in Bengal than in Hindustan. Some of them are fine looking men both in size and feature. They regain here too, some (though not all) of the aristocratic and bureaucratic position which they have lost in Hindustan. They have little competition from Rajpoots and rough northern tribes, and might have it pretty much their own way,

were it not that they are hard-pushed by the clerkly caste of Kaits who also are numerous in Bengal. As it is, the Bramins have a large share of the landed property, the public offices, the educated professions, and some mercantile and banking business. They are very numerous. In the entire absence of statistics and detailed information in Bengal, the only source of ethnological information which I can find is in the jail statistics. These show that about 9 per cent. of the total number of Hindu prisoners are Bramins. We may suppose that the Bramins of Bengal proper come to jail less frequently than the inferior classes, and this return certainly seems to prove that the Bramin population must be very large. I do not understand that anywhere in Bengal they form the mass of the population, or that they are often found in the lowest ranks of agriculturists and labourers. They are rather more or less an aristocratic class, and though following a variety of callings and to some extent cultivating the land, will not ordinarily put their hand to the plough, and affect as far as possible the position of superiors. They are altogether unwarlike and somewhat effeminate in their habits.

In Eastern Bengal Mahommedans prevail, and some Bramins are supposed not to like to cross the Berhampooter, hence in that quarter they seem not to be very numerous. In Orissa I believe they are very many, and I see it stated in the Gazetteer of Southern India that in the Oorya portion of the Ganjam District many of the Oorya Bramins both obtain their livelihood as cultivators and traders, and follow the occupations of brickmakers, bricklayers, &c.

The result of education shows the Bramins of Bengal to be most acute and intellectually capable. But they do not appear to have the practical energy of the mercantile and some other classes, nor the political and administrative success of Maratta and Kashmeeree Bramins. In native times I do not remember to have heard of Bengalee Bramins in great places, unless we except Nandcomar who attained so unfortunate an eminence. In these days I believe that intellectual eminence is often combined with much high principle among the educated Bengalees, and I hope that both may bear practical fruit.

Going to the other side of India, in Goozerat the Bramins appear to be numerous, but I have not yet visited that Province, and have not exactly ascertained their position and avocations. Forbes does

not seem to speak of them as forming any large portion of the cultivating classes. They trace their descent from Kashyapa, and are divided into a large number of tribes and sub-divisions. In a secular capacity they seem to have a good share of office (although there also they encounter an energetic writer-caste) and also to trade. The Jains of Western India have Bramins among them, and these would seem to be for the most part Goozerat men.

Next to Goozerat comes the Maratta country, extending from Damaun to the neighbourhood of Goa, and from Bombay to Nagpore and the Wyuganga. The Maratta Bramins are the most famous and successful of their race. That their fortune is due to their talent and energy, is shown by their success beyond their own bounds, in fact throughout Southern and Central India. But in their own country and among their own people, they are also favoured by circumstances. The lower caste men of the pen, who have ousted the Bramins in some countries of the north and more than rivalled them in others, are not found in the Maratta social system (those now found in the Bombay country are Goozerattees, and Bombay itself is in a mercantile sense very much a Goozerattee city). The mass of the Maratta people are of a comparatively humble class, without the pride and jealousy of Bramins shown by Rajpoots and Jats. Hence wherever there is a Maratta people or Maratta rule, Maratta Bramins are the brains and directing power. At first they contented themselves with the highest administrative offices under Maratta rulers, but later, as is well known, the Peshwa and other Bramins usurped the supreme power itself, assumed the command of armies, and openly ruled the confederacy. In truth, so miscellaneous, and so loosely held together by any other tie, were Maratta confederacies and armies, that these Bramins may be considered to be the real source of the power and fame of the Marattas as rulers in India. They were the heads of a body of which others were but the hands guided by them. Even to the present day in many States and places beyond their own limits, they have the chief power.

In fact perhaps no race, certainly no Indian race, has ever shown greater administrative talent and acuteness. The native country of the Maratta Bramins is chiefly to the west, and especially the Concan, south of Bombay, the hilly strip near the Western Coast.

It might be conjectured that centuries of Mahomedan rule might have caused the retreat of the Bramins from the more open plains to these regions; but I do not know that there is historical ground for this supposition, and think it more likely that under any rule they would hold their own and circumvent even foreign rulers. Their personal appearance would lead one rather to suppose that they came from the North-West. Many of them are very fair, and I think that there is among them a much greater tendency to the common occurrence of a somewhat aquiline, or what I call sub-aquiline type of feature than among Hindustanee Bramins. A very marked feature, not uncommonly met with, seems to be a light greyish kind of eye. Altogether, I cannot suppose these Bramins to be a branch of the race which, after occupying Hindustan, extended southwards. I cannot imagine how they could in the south, as it were, in some degree have returned towards an earlier type, instead of step by step becoming darker and more Indian-like. It is undoubtedly the case and is a subject of common remark, that all along the West Coast of India the people are much fairer than in the interior, even though most of the interior country above the Ghats is considerably elevated. Some have accounted for this by saying that colour does not altogether depend on the thermometer, that the inhabitants of the more umbrageous Coast are less exposed to an unclouded sun and dry atmosphere than the people of the bare and treeless plains of the Deccan, and that thus the difference of colour is to be accounted for. I will not say that this cause is wholly without effect, but I think it quite insufficient to account for the whole difference. The Bengalees in a moist atmosphere and amid a luxurious vegetation are generally dark. The blackest of the Aboriginal tribes live in the densest forest country in a moist malarious climate. Even on this very Western Coast I find the Aboriginal Helots of Malabar described as being "of the deepest black." We must look then to some other cause modifying the complexion of many tribes on the West Coast, and that I take to be immigration by sea. That there has been much such immigration, is not only probable, but a historical fact. All along the southern portion of the West Coast, a large part of the population is notoriously to a great degree of foreign blood. The Moplabs are to a great extent Arabs, the 'Teers' or 'Teermen' are also

said to be immigrants (as their very name indicates), and there are many Jews and Christians, though the latter I believe have not much trace of Western blood. All along the Bombay Coast also, from Goa to Kurrachee, are the descendants of Persian, Arab, Portuguese, and other Western immigrants. Hence I did not think it by any means absurd when an educated Bramin of Poonah suggested to me as a theory, that the Bramins owed the light eyes and light complexion noticed among them to an intermixture of Western blood. The Bramins would be less liable, however, to casual and recent intermixture than other races, and I incline rather to the theory that these Bramins of this part of the Coast may have more directly come from the original seats of the race by the route of the Saraswatee and the Indus, and thence perhaps by sea, without passing through Hindustan and Central India and there suffering any infiltration of Aboriginal blood. I have already traced the Bramins down the Saraswatee. Is it not probable enough that in very early days, when they were pressed by Rajpoots and Jats, they may have colonised the Konkan, reduced to subjection the rude Aborigines, and transmitted to descendants features preserved from great deterioration by caste rules, and forms only somewhat deteriorated in size and robustness by a southern climate and the absence of manual labour? If such an immigration took place so early as I suppose, it might well happen that, in long contact with southern elements and southern creeds, the colonists in the Maratta country would separate themselves from the old Saraswatee Bramins and become a separate division.

I have seen some allusions to Konkan Bramins as distinguished from Maratta Bramins, but have not been able to make out the exact distinction. Certainly Maratta Bramins are altogether the dominant race in great part of the Konkan. But it appears that there is a strip to the south, extending beyond the district usually known as the Konkan to some way beyond Goa, in which a mixed language called Konkane is spoken. In this Konkan there are some Bramins still called 'Kashastala or Saraswatee' and from the Konkan some of them have penetrated into the north-western part of the Mysore country, where they are traders and in public employment, and described as very clever but greatly looked down upon by southern Bramins who profess to be much more rigid in their rules. In the

towns of the North Canarese Coast, the Hindu traders are said to be chiefly "Konkanee Bramins who trade and keep shops."

In the Maratta Konkan the Bramins are at the head of the agricultural community. Most of the 'Kotes' or village zemindars who rule over and claim the proprietary right in each village are of this caste. I have not been able to ascertain what proportion of the actual cultivators are of the same class. For the rest, office of every kind, including the village and pergunnah accountantships all over the country, and every service of the head and the pen, seem to be their great resources. They are not military, nor generally in any way men of the sword, though, as I have said, they have in their prosperity taken the command of Maratta Armies. Nor do they seem to have any great commercial proclivities. Among the various races who push to so great a point mercantile enterprise in Bombay I cannot find that the Bramins have any great share. Under our Government they have almost a monopoly of office in Western India.

Adjoining the Maratta country on the east is the Telinga or Telagoo country, very little of which I have visited and of the castes and population of which I have been able to learn less than of any other part of India. This at least, however, I find that here also the Bramins, though not so famous nor, I apprehend, so clever as those of Maharashtra, are numerous and powerful. The Telinga people are described as generally illiterate and as (unlike their Tamil neighbours) leaving literature and science to the Bramins; so that the latter would seem in Telingana, free from the competition of a writer caste, to have in their hands all the secular business of a clerkly character and a good deal more besides. I have not ascertained what proportion of the population they there form, and whether many of them are actual cultivators; but in more than one place I find it stated that many of the Zemindars are Bramins, and in Rajamundry the more respectable inhabitants of the Town are said to be chiefly Bramins.

I can only trust that this meagre account of the Telagoo Bramins will be supplemented by some one better qualified to describe them. Towards Madras I gather that there are some learned Gwallas called Yadavas and Telagoo Chetties (perhaps a merchant class, but I am not sure), who must a good deal interfere with the Bramins. They

do not seem to be very conspicuous in Madras itself, which, though in the Tamil country, is not far from the Telagoo frontier.

In the Canarese country (comprising Canara, Mysore and parts of the Bombay Southern Districts and adjoining Nizam's country) the Bramins are not rivalled by a specific writer class, and have a large share of literate office, very generally (it appears) occupying that of Shanbogue or village accountant, besides many higher offices. But a very large proportion of the Canarese people are of the ultra-Sivite or Lingayet sect, who altogether ignore Bramins in their sacerdotal character; and there are energetic mercantile and other classes. The rule of the Marattas in one quarter, and of the Mahommedans in another was also unfavorable to the power of the Canarese Bramins, and thus they are by no means dominant. Maratta Bramins, Mahommedans, East Indians and others have a large share of the higher offices and occupations.

In the North Western part of the Canarese country, in the district of North Canara, in the high and hilly country above and about the ghats, and the adjoining parts of Mysore, there is a large population of Bramin cultivators who are on all hands represented as exceedingly industrious, thriving, and in every way good. Most of these people are called 'Haiga' Bramins, and they seem to be of pure race and of no bastard or doubtful caste. They especially affect the cultivation of the betel-nut, and both own and cultivate the land over a large extent of country. In the Canara District they constitute one of the most numerous castes, being given by a census taken some years ago as 147,924, to 146,309 Banters (corresponding to Nairs), and 151,491 of the inferior class called Billawars. In the Nagar district of Mysore they are also numerous, and they are there described as "very fair, with large eyes and aquiline noses," a description which would seem to imply for them a derivation from an uncorrupted and little intermixed northern source. They are stated not to be very literary or highly educated, being more devoted to agriculture.

In South Canara and what is called the Talava country, there are again many Bramins who do much cultivation, and on the whole West Coast, down to the extreme South of India, the country is said to have been extensively colonised by the Bramin colony led from Calpee by Parasram, who caused the sea to retire for their convenience.

In the centre of this tract, in Malabar, the Bramins, owing to political circumstances and hostile rule, have been to a great extent driven away, but they are very numerous in Travancore and Cochin; and in the Palghaut valley (a little inland, where the break takes place in the line of the ghats) the Bramins seem to be very numerous as cultivators, and are industrious and good in that capacity. The principal class of Bramins on the South Coast are called Namberees, and they have some very peculiar customs. They affect, however, much of the sacerdotal character, and seem to be very influential in Travancore and Cochin. Throughout the South Western Coast, however, wherever the Nairs and allied tribes are or have been politically dominant or are now numerous, the Bramins have by no means a monopoly of office, even among Hindus; for the Nairs themselves are frequently educated and hold very many public offices.

The Namberee Bramins are described as very like the Nairs and General Hindu population of the South Coast, but as not unfrequently fairer.

It remains to notice the Tamil country. There also the Bramins are numerous, but it appears that throughout the extreme South, they again lose that literary predominance, or almost monopoly, which they enjoy in the Maratta and other countries in the middle zone of India as well as in the extreme North. I have mentioned that the Nairs of the Malayala and Talava country by no means resign the pen to the Bramins; and so also it appears that throughout the Tamil country offshoots of the dominant tribes, under the names of Modellians, Pillays, &c., do much of the clerky work, and the Bramins have not generally the office of village accountant and collector—the possession of which is the greatest test of predominance in that respect. I gather that the Lingamite sect is less numerous in the Tamil than in the Canarese country, and consequently the Bramins are in a sacerdotal point of view more important. They also push their fortunes in many secular ways. They rent much land, but will not hold the plough, and are extensively employed in the public offices as hurkaras (messengers or process servers) and in such like capacities, also as keepers of choultries and in many other occupations. With reference to what I have said of them as renters rather than cultivators, I should add that, though the Palghat country is included

in Malabar, it appears that most of the cultivating Bramins there are of Tamil extraction. Many of them condescend to officiate as astrologers and religious guides to the very lowest and scarcely Hindu castes of Southern India.

Briefly I would thus recapitulate the position of the Bramins in the principal Provinces of India.

In Kashmir, they are altogether dominant by the brain and pen, but are not military.

In the Punjab, Scinde, and countries about the Saraswatee, Bramins are superseded by other races, and are only found here and there in the eastern part of this tract as industrious cultivators claiming to be the ancient occupants of the country.

In Hindustan, Bramins have altogether lost literate predominance (with the exception of some immigrant Cashmeerees), and also political predominance, except something retained by quasi-Bramins of mixed caste in the extreme east of this country. But they constitute a large section of the population of Hindustan, especially of the eastern half, and a large proportion of the cultivators, soldiers, &c.

In Bengal and Orissa, Bramins form a large portion of the Hindu population, occupy to a great extent an aristocratic position, and have a large share in the superior rights in land, in offices, and in the literate professions; but are at the same time quite rivalled by Kaists.

In the Maratta country, Bramins are altogether dominant in literate work, and have the largest share of political power.

In the Telinga country, Bramins are in possession of most of the literate work, and apparently of a good deal of office, land, &c., but my information is very imperfect.

In the South of India, Bramins have but a moderate share of the literate work; but on the West Coast, they have a large share of the land and form a large proportion of the best cultivating population; while in the east of this country they seem to be not dominant and are rivalled by several other tribes, though here also they are numerous and employed in many capacities, secular as well as sacerdotal.

## THE JATS.

On the general scheme of tracing the Arian races from the North-West, I take the Jats before the Rajpoots. These Jats are in fact by far the most perfect specimen of the democratic and more properly Indo-Germanic races, whom I believe to have appeared in India later than the early Braminical Hindus, and who, while Hindu in much of their speech, laws, and manners, have also some peculiarities and institutions, and perhaps some grammatical forms of speech not to be traced in the earlier Braminical writings. These tribes, now constituting over a great part of India an upper and dominant stratum of society, have given to a great degree their own tone and colour to many Provinces. In great part of Jat-land the Jats are not only the upper stratum, but the great body and mass of the free people; and hence we have among them their original institutions in the greatest purity, little modified by modern Braminical Laws, or by those necessities of Military and Feudal organisation which so much alter the institutions of a free people, when they become dominant conquerors over other races greatly superior in number.

There is some variation in the pronunciation of the word 'Jat,' it being sometimes (chiefly in the west country) pronounced so short that it may be written 'Jut;,' sometimes (in much of the Punjab) variably used, and sometimes (chiefly in the east) pronounced very long as 'Jāt' and even occasionally written by early English authors 'Jaut.' And the present religion, dress, &c. of the race also differing in different regions (they are Mussulmans in the west, Sikhs in great part of the Punjab, and in some sense Hindus in the east), some people have supposed Mahommedan Jats of Scinde to be radically different from Hindu Jauts of Bhurtpore, and the wide extent and populousness of this great race is not very generally known. In fact, however, any apparent differences in the extreme of the type disappear, when we trace them as one great continuous population throughout the whole tract, and find that the one extreme gradually and imperceptibly merges into the other.

To prevent future doubts, I will, however, add that there may possibly be small local western tribes of similar name, distinct from the great Jat nation. It seems that on some parts of the frontier Jats are

known as a somewhat pastoral and light-fingered tribe; and Burton in his 'Scinde' speaks of a tribe of Beloochis bearing the name; also says that it is the name of a wandering tribe found about Candahar, Herat, Meshed, &c., and that in all the Western parts of Central Asia, the term is used as synonymous with thief and scoundrel. These gentry may be offshoots of our Jats thrown by circumstances on the resources of their mother-wit, or they may be some other tribe; but at any rate they are in no way a type of the great agricultural nation whose habitat I am about to describe, and about whose oneness and complete ethnological nationality there can be, I think, no doubt whatever.

In all the east of Beloochistan, about the routes by which the most open and constant communications between India and the countries to the west are maintained, in the Provinces marked in the maps as 'Sewestan' and 'Cutch Gandava,' Jats form a large, probably the largest portion of the agricultural population, and claim to be the original owners of the soil. In fact the Beloochis are there but a later wave and upper stratum. The Persian Tajiks are the original agricultural class of all the west of Affghanistan and Beloochistan; then there is a tribe apparently somewhat mixed, called 'Dehwars,' found about Candahar and thereabouts. The Jats are not found in Affghanistan, but in Beloochistan they succeed the Tajiks and Dehwars, as we go east by the Bolan and routes thereabouts. Here then they are not confined to the plains, but occupy the hilly country.

Descending into the plains, we find the Jats spread to the right and left along the Indus and its tributaries, occupying upper Scinde on one side and the Punjab on the other. But it is particularly to be remarked that in the Punjab they are not found in any numbers above the Salt Range, and they are wholly unknown in the Himalaya. In fact, to the north they are altogether excluded from the hilly country, a circumstance which seems to me conclusively to show that they did not enter India by that extreme northern route. The hills to the north seem on the contrary to be a barrier by which the flood of Jats was checked.

In all Upper Scinde the Jats are still the prevailing population, and their language is the language of the country. It is moreover matter of history that they were once the aristocracy of that land, though

latterly other races have dominated and the higher classes among the Jats have lost somewhat of their position. In the south and west of the Punjab too they have long been subject to Mahommedan rulers, but latterly as Sikhs they became rulers of the whole Punjab and of the country beyond as far as the upper Jumna, in all which territories they are still in every way the dominant population. Over great tracts of this country, I should say that three villages out of four are Jat, and that in each Jat village the Jats constitute perhaps two-thirds of the entire population, the remainder being low caste Helots, with a few traders, artisans, &c.

The Juts of the Indus seem on the map to be separated from the Jauts of Bhurtpore and Agra by the whole breadth of Rajpootana, but the fact is that the ordinary geographical nomenclature gives rise to much misconception on the subject. By far the greater part of what we call Rajpootana is, ethnologically speaking, much more a Jat than a Rajpoot country. The great seat of Rajpoot population and ancient power and glory is on the Ganges, and it is said that since the Mahomedans conquered them there, the chief Rajpoot houses have as it were doubled back on the comparatively unfruitful countries which now bear their name, but where, notwithstanding, the most numerous section of the population is Jat. Col. Tod expressly tells us that northern Rajpootana was partitioned into small Jat republics, before the Rajpoots were driven back from Ajoodea and the Ganges. It is clear then that the Jats extend continuously east from the Indus over Rajpootana. They do not seem to have occupied (or at least do not now occupy) lower Scinde, nor are they found in Goozerat, although in the history of the latter country mention is made of incursions of Jat horsemen on the frontier in conjunction with Katties. Their line of settlement lies farther north. They may have arrived on the Saraswatee, before its banks lost their moisture, and if so, their passage to the east would be comparatively easy. Throughout the more open parts of Rajpootana they share the soil with the Aboriginal or semi-Aboriginal Meenas, the remains of the Bramin population, and the dominant Rajpoots; the Jats having, I gather, the largest share of the cultivation. The southern and more hilly parts of Rajpootana (where Mhairs, Meenas, and Bheels so much hold their own,) are not Jat, but in Malwa again they are numerous, and seem to share that Province with Rajpoots and Koonbees.

To the north, in the north-eastern Punjab and Cis-Sutlej districts, as we get near the hills, I think there are evident indications that the Jat population has been advancing on what has once been a proper Rajpoot country, after having perhaps been, before that, a Bramin country. It is not clear whether the Bhattees of Bhatteana were originally Rajpoots or really are Yuti or Jats. But from Bhatteana northwards, Rajpoot villages are scattered about in considerable numbers among the Jats, and there are traces of more extensive Rajpoot possessions. The Rajpoots seem to be here undergoing gradual submersion. But in the extreme north of the Baree and adjoining Doabs of the Punjab (the Baree is that Doab in which Lahore and Umritsir are situated) there is still a strip immediately under the hills, which may be classed with the adjoining hill country as still mainly Rajpoot. To the west, advancing through Rajpootana, we come to the Jats of Bhurtpore and Dholpore, famous in history. Gwalior was a Jat fortress belonging, I think, to the Dholpore Chief. They do not go much further south in this direction. From this point they may be said to occupy the banks of the Jumna all the way north to the hills. The Dehli territory is principally a Jat country, and from Agra upwards the flood of that race has passed the river in considerable numbers, and forms a large part of the population of the Upper Doab in the districts of Allighur, Meerut, and Mozuffernugger. They are just known over the Ganges in the Moradabad district, but they cannot be said to have crossed that river in any numbers.

To define then the Jat country ; take as a basis the country on both sides of the Indus from Lat.  $26^{\circ}$  or  $27^{\circ}$  up to the Salt Range ; from the extremities of this base draw two lines nearly at right angles to the river and inclining south, so as to reach Lat.  $23^{\circ}$  or  $24^{\circ}$  in Malwa, and Lat.  $30^{\circ}$  on the Jumna, thus including Upper Scinde, Marwar, and part of Malwa on one side, and Lahore, Umritsir, and Umballa on the other ; then connect the two eastern points by a line which shall include Dholpore, Agra, Allighur, and Meerut. Within all that ambit the Jat race ethnologically predominates, excepting only the hills of Mewar and the neighbourhood, still held by Aboriginal tribes.

The Jats of Beloochistan are described, from an Affghan or Candahar point of view, as fine athletic men with handsome features, but rather dark.

In Upper Scinde, up the course of the Indus, and in the south-western Punjab, they are now for the most part Mahommedans, and in that character seem to be somewhat inferior to their unconverted and perhaps purer brethren; the more so as they have been long subject to foreign rule. The language spoken along the line of the Indus and throughout Upper Scinde is there known as the "Jatee Gul" or Jat language, but is in fact identical with that which we call Punjabee. The Punjabee may, in fact, properly be called the Jat language; to the Jats the dialect seems especially to belong, and by them chiefly it is spoken. Advancing eastwards into the Punjab and Rajpootana, we find Hindu and Mahommedan Jats much mixed; it often happens that one-half of a village or one branch of a family is Mahommedan, and the other Hindu. Further east, Mahommedan Jats become rarer and rarer, and both about Lahore and all that part of the Punjab and along the line of the Upper Sutlej and Jumna the great mass remain unconverted. In the Punjab they all take the name of 'Sing,' and dress somewhat differently from ordinary Hindu Jats, but for the most part they only become formally Sikhs, when they take service, and that change makes little difference in their laws and social relations. The Jats of Dehli, Bhurtpore, &c. are a very fine race. They still bear the old Hindu names of 'Mull' and such like, and are not all 'Sings.' In Rajpootana the Jats are probably a good deal intermixed by contact with Meenas, &c., and they have now been long subject to an alien rule. One does not there hear much of them otherwise than as quiet and submissive cultivators.

The Jat Sings of the Punjab and the Upper Sutlej may probably be taken as the best representative type of the race. They are a remarkably fine variety of man—tall, large, well-featured, with very plentiful and long beards, fine teeth, and a very pleasant open expression of countenance. I am told that in the Punjab Regiments, which select from several of the finest races in the world, the Sikhs are upon the whole the largest men, although they are not so stout-limbed or in certain respects quite so robust as the Affghan Pathans. Perhaps the larger population to choose from may have something to do with the superior size, but I should say that on an average they are taller than Pathans, with the upper part of the body especially well developed. In pluck and Military qualities they excel the fairer and

in some degree more beautiful non-Pathan races of the northern hills. Altogether then they are not excelled by any race in Asia.

There is among them a large proportion of High-Arian feature, but there is much more variety and not so universal a high-nosed type as among the men of the frontier hills. Compared to northern races they are dark, but in every other respect they are, take them all in all, a very remarkably fine handsome people.

They are as energetic in the arts of peace as in those of war. There are no better cultivators; hard-working and thrifty, they let little land lie waste, and pay their revenue punctually. They have this great advantage too that among them a woman is almost as good as a man, works as well and makes herself as generally useful. They are not literary, they leave that, with proper mercantile business, to the Khatrees (to be afterwards noticed). But many men and some women can read and write in their own rough way, and as waggoners they not unfrequently carry their grain and other goods to distant markets on their own account.

They have an excessive craving after fixed ownership in the soil, and are essentially agriculturists. They seldom undertake a gardening style of cultivation, and prefer broad high lands to more cramped though moister locations. Where the country is more fitted for cattle, they breed them largely, and both ordinary carts and large mercantile waggons are generally plentiful in the Jat countries. Camels too they sometimes breed. But still, in India the Jats have never anything of the pastoral, roving, Gypsy-like character.

I have alluded to the democratic institutions of the Jats, institutions to which we do not find allusions in the books of the Bramins. Yet it is certain that such institutions prevailed in the North of India as early as the time of Alexander the Great. The Greek accounts are distinct on the point. They represent the institutions as in fact extremely democratic, and add that the Indians ascribed their free constitution to Bacchus, by whom they were led into the country. I mentioned Col. Tod's testimony to the former existence of Jat republics in great part of what is now Rajpootana. I know of only one recognised republican State which came down to our day, that of 'Phool' or 'Maraj,' from which sprung the chiefs who founded the States of Pattealah, Nabah, Jheend, &c. The old terri-

tory of the Phoolkeean race was recognised, and treated, among the Protected Sikh States, as a regular republic. But I fear that, with many less creditable institutions, it has now been brought under the general rule of British dominion.

However, States apart, every Jat village is on a small scale a democratic republic. As respects property, there is neither that common tribal right which we find among the wilder Arabs, Turcomans, and New Zealanders, nor that complete joint family which figures so largely in the Hindu Law of the Braminical sages. Every man has his share of the cultivated land, separate and divided. It may be that a father and sons cultivate in common, but entire commensality seldom goes farther. The union in a joint village community is rather the political union of the Commune, so well known in Europe, than a common enjoyment of property. The village site, the waste lands and grazing grounds, and it may be one or two other things belong to the commune, and the members of the commune have in these rights of common. For all the purposes of cultivation, the remainder of the land is in every way separate individual property. And the government of the commune is no patriarched rule, but simply representative government. A Communal Council or Panchayet rules by right of representation. For the rest, the laws of these people are of Arian, Indo-Germanic, and to some extent of the more liberal Hindu type. Marriage is a sacred and irrevocable bond, though remarriage of widows is permitted; and alliances are restricted by the bonds of caste. The hereditary succession and general hereditary character of everything, which usually attends this system of caste and exclusive marriage, prevails among the Jats. Property is equally divided among sons. Daughters get nothing but that which may be given to them at the time of marriage. All the Jats are divided into many Gentes and Tribes, after the universal fashion of the peoples of this stock, and the usual fashion is to marry into another Gens.

In that portion of the Protected Sikh Territories which Sikhs from the Lahore country had occupied as conquerors, there was a perfect feudal system. The chief of a tribe, as General, had a large appanage; smaller chiefs owed him allegiance and service for their smaller domains, and under-holders under them again (all holding on a permanent hereditary tenure), till we come to the tenure of a single

horseman. These latter again have come to be divided under the operation of the rules of inheritance. But this system, it will be observed, is only adopted abroad for purposes of foreign domination.

Beyond the caste system common to them with most Indo-Germans, the Jats have very little of the ceremonial strictness of Hindu caste. In Punjabee Regiments, they mess freely like Europeans, and have their comfortable two or three meals a day.

The Jats sometimes claim to have been originally Rajpoots, and it is so stated in some of the written accounts; but that is only one of the many stories of the kind prompted by a desire to stand high in the Hindu scale, and its futility is illustrated by a counter-story told by some of the Mahomedan Jats, viz. that they are descended from one of the companions of the prophet. That the Jats and Rajpoots and their congeners are branches of one great stock, I have no doubt. It may be possible that the Rajpoots are Jats who have advanced farther into Hindustan, have there more intermingled with Hindu races, have become more high and strict Hindus, and achieved earlier power and glory. But that the Jats are Rajpoots who have receded from a higher Hindu position, is a theory for which there is not the least support, and which is contradicted by every feature in the present position of the now rapidly progressing Jats.

The suggestion that Rajpoots may be Jats more highly developed in a Hindu point of view, would make the latter the earliest and most primitive, though at the same time perhaps the purest of the race; just as I have supposed the Bramins of Cashmere and the Frontier hills to be Hindus of an earlier stage of Braminical development. But I am more inclined to suppose the Jats to be later immigrants from Central or Western Asia. The character of the northern hills is such that immigration from thence could only gradually filtrate into the plains; but by the passes of the Bolan, great immigrations are possible. Looking at the area of Jat occupation, it is just that which we might suppose to be covered by the steady flow of a large flood of population issuing from the Bolan, about Lat.  $28^{\circ}$  or  $30^{\circ}$ , as from a funnel, and thence spreading over the plains and pushing away before it other populations. The Rajpoots, again, when I come to treat of them, will be found to be ranged in a kind of horse shoe form round the outer edge of the Jat area, the mass of them occu-

pying the richer valley of the Ganges. My conjecture is that the Rajpoots are an earlier wave from the same source, and who came in by the same route, who have farther advanced and have been more completely Hinduised, while the Jats have come in behind them.

The Jat or Punjabee language is but a dialect, bearing somewhat the same relation to the Hindee of the Rajpoots and other Hindustanees that Lowland Scotch bears to English. In its main grammatical and essential features it is not widely different. There are certainly in it many words which sound strange to a European only superficially acquainted with the common Hindustanee, and it would be very interesting to examine all these words and ascertain whether any and what foreign elements can be found. But I may state broadly that by far the greater number of these words are really of plain Sanscrit origin, and very many of them are quite familiar to those well acquainted with the purer Hindee dialects. I have been surprised to find how Sanscrit are most of the words which (little linguist that I am) I had supposed to be peculiarly Punjabee. Indeed the Rev. Mr. Trump broadly states the Jat language to be one of the most Pracrit of Indian Vernaculars, and so it clearly is. There remains the old question which concerns it equally with the Hindee, whether the grammar can be derived from the Sanscrit. It seems very improbable that so great a mass of people as the Jats should have lost all traces of a separate language, if they ever had one. If so, it may surely be recognised in some Punjabee words. For the rest, the only doubt seems to be whether the Jats and Rajpoots, speaking an Indo-Germanic tongue allied to the Sanscrit, may have brought with them the grammar which now distinguishes the Punjabee and Hindee; or whether the Bramins, when they spread wide over Hindustan and mixed among a large Aboriginal population, adopted some Aboriginal grammar, and fitted into it their own vocabulary, making a language which Jats and Rajpoots also have received in India; or whether in fact all these tribes have derived a common tongue by direct Pracrit descent from the Sanscrit.

#### THE RAJPOOTS.

I have already made so many allusions to the Rajpoots, that I have half anticipated my description of them. The best proof that they

are not a part of the original Hindu system, but rather something engrafted upon it, is (I think) to be found in the difficulty of defining what is and what is not a Rajpoot. I have already shown, in noticing many tribes, that it is almost impossible to say where the Rajpoots begin and where they end. I shall now, however, confine myself as far as possible to the tribes who are generally acknowledged to be real Rajpoots of blue blood.

They can scarcely be said to have any broad general tribal name like that of the Jats. It is hardly contended that they are really the old Kshatryas of the early Braminical accounts; and though, in a military point of view, they have occupied and more than occupied the place assigned to the Kshatryas, still their numbers, their position and the existence among them of the institutions shared with them by the Jats and unknown to the old Hindoo Shasters (in them we find no trace of democracy) would all go to show that the Rajpoots are another race. In fact the days of the Kshatryas were those of the earliest Hindu annals, many hundred years before Christ, while the Rajpoots may be considered to have been the immediate predecessors of the Mahommedans in the rule of Hindustan. Except then in an affected way and with direct reference to the old Sanscrit Nomenclature, the Rajpoots are not usually called 'Kshatryas,' while the name Rajpoot also is by no means universal among them, and merely means 'Son of a Raja' or 'Royal.' In some parts of the country, they usually call themselves 'Thakoors,' a word which also means Chiefs or Nobles.

They are more frequently known by the names of their tribes as 'Chouhans,' 'Soorujbansees,' 'Bais,' 'Rahtores,' 'Baghels' (or Waghels') or the like, but the practice of marrying into another tribe makes all these high-caste tribes identical for ethnological purposes. I shall continue, then, to call them Rajpoots.

They are chiefly known to Europeans in their military character and as feudal conquerors. But in reality, in their own villages in the plains of the Ganges, they are simple agriculturalists of a constitution very much like that of the Jats, only less pure and complete. The fact is that the Rajpoots have had their day, and are now a down-going race. Partly the furnishing of armies and feudal hosts has exhausted the material and corrupted the simplicity of their ori-

ginal villages ; partly infanticide and other causes tend to diminish their numbers ; the result of all which is, that over great tracts of country we find them rather a minority trying to maintain a failing rule over a scarcely subject majority, than forming full democratic bodies of free Rajpoots. Still, in some parts of the country the agricultural Rajpoot villages are strong and numerous ; the land is divided among them, every Rajpoot is free and equal, and the commune is administered on democratic principles. Wherever this is so, their institutions are like those of the Jats. Although they have never cared much for Bramins, they have, unlike the Jats, the ceremonies and superstitions of Hindu caste. They cook once a day with great fuss and form, almost every man for himself after the most approved Hindustanee fashion, and are very particular about caste-marks, &c. &c. Their widows may not remarry, and it is their excessive point of honour to marry their daughters to none but men of the best tribes (a feeling allied to our chivalry no doubt) that renders the daughters such a burden to them, and makes female infanticide unfortunately so common among them. Their wives again are shut up after the Mahomedan fashion, and are lost for agricultural labour. Altogether Rajpoot females are a very unsatisfactory institution, and this goes far to weigh down and give a comparatively bad name to men who who are often industrious enough.

Like the Jats, the Rajpoots are not found in any numbers to the North of the Salt Range, nor are they in any of the hill country west of the Jhelum.\* If they ever occupied the Western Punjab, they have been driven forward by the Jats, and they are now only found about the Salt Range itself, where a small tribe called *Jhanjhoos*' (now Mahomedans) represents a Rajpoot race that seems to have been once great in those parts. But in the North-Eastern Punjab near the hills, the Rajpoot population is (as I have already noticed) more numerous, and the Himalayas of the Jummoo and Kangra districts are occupied by Hindu Rajpoots who are there altogether the dominant race. I do not know if the highest Rajpoots to the south east

\* It was somewhere suggested that the Gadoons or Jadoons just over the Indus, where that river issues from the Himalayas near Torbela, are Rajpoots, but that seems to be a mere conjecture, founded on a fancied resemblance to the name of a Rajpoot tribe. There is not the least doubt that the Gadoons are pure Pushtoo-speaking Pathans.

would admit the equality, but the Kangra and Jummoo Rajas and their clans affect among themselves to be of very blue blood indeed, and they are certainly very fine handsome men. The Kangra Rajpoots in particular are very fair and handsome and High-Arian looking. I fancy that in all these hills, for a considerable distance to the east, there is a great deal of Kashmeeree or rather old Kasha blood. The women of the hills are in deserved repute and much sought after in the plains. The Kangra Rajas have endless genealogies, but I think that their clansmen are somewhat effeminate looking and not very first rate soldiers. The men of the Jummoo country, the immediate clansmen and subjects of the Maharaja of Cashmere, (and who also occupy the west of the Kangra district), commonly called Dogras, are not spoken of with so much Hindoo respect, and are not so pretty and be-jewelled looking as the Kangra men, but they are much more robust and brave. In the Punjab force, no men are preferred to them as soldiers; they are quiet, staunch, steady and reliable, without the disagreeable Hindustanee airs of the old Sepoy Rajpoots. The Rajpoot population of these hills must be very considerable. East of the Sutlej, in the Simla hills, many of the Rajas and their followers are Rajpoots, but most of the agriculturalists are of another caste called Kanaits.

A large proportion of the Rajpoots scattered about the Eastern Punjab, Cis-Sutlej territory, and Dehli districts are now Mahomme-dans, as are occasional Rajpoot villages all over Hindustan and a good many Rajpoot Rajas, this being no doubt the result of the favour shown to the Rajpoots by the Mogul Emperors; but east of Dehli conversion is quite the exception, by far the greater number are staunch Hindus.

In the Gangetic valley the body of the Rajpoot population may be said to lie next to the Jats to the east, in the middle Doab, Rohilcund, and Oude; and still farther east the country is shared with a Bramin population. Before Rohilcund (given as a jagheer to Rohillas) acquired its present name, it was known as the Rajpoot Province of Katerh, and to the present day in all lower Rohilcund the Rajpoot communities, (they are there called Thakoors) are strong and numerous. They are also numerous in Western Oude, but for what reason I know not, neither the Rohilcund men nor those of

Western Oude entered the Sepoy Army in large numbers. In the Central Doab, in the districts of Mynpooree, Futtehghurh, Etawah, &c. Rajpoots are numerous, and a good many of them served in the army. The Raja of Mynpooree is, I think, one of the highest of the famous Chouhan clan. The lower Doab is, as I have before noticed, more a Bramin country; but Eastern Oude, especially most of the broad tract between the Gogra and the Ganges, is the home of the great Rajpoot population which supplied so large a proportion of the Sepoy Army. At home these Rajpoots are by no means a loose military class, but a purely agricultural population. The prejudice against the particular act of holding the plough which so many of them affect, is reduced to the narrowest possible limits, and many ex-Sepoyes may now be seen grubbing up weeds, raising water by manual labour, and performing all the lowest agricultural functions. Baiswara, the country of the Bais Rajpoots, lying almost parallel to the Bramin country of the lower Doab, is a famous nursery of Sepoyes. In all this part of the country, so far as there still subsist ancient superior rights in the land, they belong to the heads of Rajpoot clans.

Some of the inferior clansmen hold subordinate tenures and village proprietorships, but the great mass of the Rajpoots of Oude are now reduced to the position of mere ryots, in which capacity they are much intermixed with Bramins. Many of the superior rights have passed away to modern men.

Passing to the east of Oude, Rajpoots are pretty numerous in Azimghur and Ghazeepore, but, as I have already mentioned, in the surrounding districts and those farther to east, the chief Rajas and landholders are the bastard Bramins or 'Bhamuns' whose clansmen abound in Behar. In the Arrah district only (in the east) in the small Doab between the Soane and the Ganges, the Rajpoots are strong and numerous. Their leader was the famous rebel landholder, Koer Sing, and they supplied to the Native Army the numerous class known as '*Bhojpoore*' Sepoyes.

This is almost the limit of Rajpoot ethnological occupation to the east, but turning round to the south-west, the Raja of Rewah is chief of the Baghel Rajpoots (whence his country is called Baghelcund), and has no doubt a numerous following of his clansmen, though Aborigines on one side and Bramins on another are also numerous in

his territory. The Boondeelas of Bundelcund are not, I believe, considered to be very pure Rajpoots; they have probably suffered some intermixture, but they are notoriously bold and martial, form a dominant aristocracy, and used to be very troublesome to us. I do not know the proportion of Rajpoot population in Scindia's territories to the west, but believe that it is numerous. In Malwa, Rajpoots of the Rahtore, Chouhan, Sesodya and other clans form a large proportion of the population, and all the surrounding hilly country which is not held by pure Aborigines seems to have been from very old times in the possession of Rajpoot or semi-Rajpoot chiefs. The Mewar or Oodeypore Rajpoots, occupying a strong and elevated country in the west, claim to be the most ancient of the race; and I have seen it stated that some of the western Rajpoots are comparatively fair, with light or grey eyes. If so, that would seem to indicate that they reached their present location by a direct route from the west, and not by doubling back from the Ganges, as is supposed to have been the case in northern Rajpootana.

In the history of Guzerat the Rajpoots are very famous, and many of them seem to have been of the same high-caste tribes whose blood is reputed the best in the east, the Waghels, for instance, being (it appears) the same as the Baghels. They are evidently still numerous, but I have not been able to ascertain what proportion of the population they form, and to what extent they take part in the actual cultivation. Forbes does not speak of them as if they were among the most numerous cultivators.

In Kathywar, Rajpoots seem to be numerous, and from the practice of infanticide we may suppose that they consider themselves high-caste, but I cannot exactly make out whether the Kathis are counted as Rajpoots, or whether the many petty chiefs of Kathywar are principally Kathis or proper Rajpoots. The Kathis seem to have been undoubtedly immigrants from the west and at one time neighbours and allies of Jats.

In Lower Scinde there are undoubted traces of ancient Rajpoot rule, and the Summa Rajpoots ruled more recently under the Mahomedan emperors. Farther west, in Beloochistan, there seem to be traces of Hindu rule of a character more orthodox than that of the Jats, but whether the Rajpoots ever had dominion there, I am unable to say.

Looking back, it will be seen that (as I before said would be the case) I have traced the Rajpoots all round the edge of the more compact mass of the Jat population;—from the Salt Range through the Northern Punjab and adjoining hills to Rohilcund, Oude and the Centre Doab; thence by Bundlecund through Scindia's territory, Malwa, Mewar, Guzerat and Kattywar into Lower Scinde.

There remains in the centre of this circuit the greater part of Rajpootana which I have described as ethnologically more Jat than Rajpoot, though the Rajpoots now rule, after doubling back from the Ganges. They form a numerous and dominant aristocracy, organised on the feudal principles necessary to domination.

Though a full and complete Rajpoot village mainly inhabited by Rajpoots is democratic in its constitution, I have never heard of a Rajpoot Republic on a larger scale; and whether it be from long habits of domination by means of a feudal system, from the imbibing of a Hindu spirit, or from their original genius, they seem to be more than the Jats given to suffer the rule of Rajas and Chiefs. In Rajpootana, however, the chief seems generally to be but a chief, and not a despotic ruler. Numerous fiefs are held by subordinate chiefs, who are again surrounded by Military followers holding many petty jagheers and grants of land on a hereditary service tenure. It may well be supposed that under such circumstances, when the British peace-preserving power is at all relaxed, the authority of the chiefs is very apt to collapse. They never could hold their own against the Marattas. But still, as a quasi-chivalrous aristocracy, with their bards, and genealogies, and military get-up, and contests about the possession of high-caste young ladies, they make a very pretty picture.

The normal Rajpoot, however, to my view is, as I have said, the cultivator of the Gangetic valley, where, at the eastern extremity of the horse-shoe which I have described, they spread out in a broad region into a large population. Physically I do not know any striking features which broadly distinguish the Gangetic Rajpoot from his neighbour the Gangetic Bramin. In a Sepoy Regiment, setting aside caste marks, &c., I doubt whether they could be distinguished. They are both in fact the type of the higher class of the modern Hindustanee population. Both are tall men, though in the native army Commanding Officers went in too much for height, and many

of the unpadded recruits looked at first rather lanky. The modern Rajpoots are quite as Hindu as, and a good deal more prejudiced than, the Bramins. In their own villages they are pleasant good fellows enough, but as Sepoys they were a disagreeable overbearing set, and, so far as I can gather, were upon the whole about the worst class in the mutiny.

As agriculturalists their style of cultivation, &c., is much the same as that of the Jats, although very greatly inferior. They are very fond of land, and do not affect the finer garden cultivation but the broad farming style of agriculture. They also keep cattle when the country is fitted for it, and are very fond of laying their hands on other people's cattle when they have the chance,—a weakness from which the Jats also are not altogether free.

They are as a rule wholly un-literary, and very much confine themselves to the two professions of agriculture and arms.

The Rajpoots everywhere speak dialects of the ordinary Hindee. I am not aware that any traces of any other language have ever been found among them.

#### THE KOONBEES OR KOORMEES.

To the south of the Rajpoots and Jats, the country is mainly occupied by the class above mentioned. In all the central and eastern parts of the N. W. Provinces, or in fact of Hindustan generally, the Koormees are scattered about in considerable numbers as a well-known and very industrious class of quiet cultivators. They own villages of their own, and are also more widely spread in detached families or groups of families. They affect the finer garden style of cultivation much more than Jats and Rajpoots, and like the Jats are assisted by industrious women.

As I shall afterwards notice, the Koonbees seem to be nearly connected with the Mallies, whose name we apply to the whole profession of gardeners.

The name is variously written, Koormee or Coormee, Kunabi, Kunbee or Koonbee, and there is no doubt that the terms are synonymous.

In Hindustan the Koormees do not go much beyond their own agricultural calling, but they are not absolutely unknown as Sepoys,

and they have occasionally, though rarely, risen to higher posts, especially one somewhat notorious family in Oude. In fact, in the Gangetic valley the Koormees, though much appreciated as cultivators, are somewhat looked down upon by the higher castes as mere humble tillers of the soil. If we proceed south from the Lower Doab, towards the Jubbulpore and Saugor territories, Koormees become more numerous, and there are hereabouts a good many 'Lodhas,' a tribe apparently cognate to Koormees, and who are also pretty well known in the North West Provinces. They seem in this part of the Central Provinces to have at one time occupied a very considerable position. Thence westwards, on both sides of the Nerbudda, and still farther west to the north of the Nerbudda in parts of Malwa, that is in fact throughout the southern borders of Hindustan, Hindee-speaking Koormees are very numerous. In most of this country they are the chief cultivating class. In Malwa they meet the Jats and share with them the character of the most respectable and industrious cultivators. In Rajpootana there is a cultivating class called 'Pittuls' who are supposed to be Koormees under another name.

Farther west in Guzerat the Koonbees form the main body of the best cultivating population. They seem to be in the main the owners of the land, and though quiet and unpretending, are said to be still sturdy and independent and altogether a fine agricultural people.

Throughout the whole of the Maratta country, the Koonbees are the main agricultural and landholding tribe. Here also they generally are quiet simple agriculturalists, but the Maratta Koonbees do not seem to be so energetic and good in this way as their northern congeners. They have lived long under much oppression and subject to great disadvantages. In the Nagpore country, Berar and Candeish, however, they are now a sufficiently industrious and easily managed population. To the south, where they meet the Canarese in the Deccan, every one is agreed that the latter are decidedly superior in industry and agricultural energy.

I have seen an allusion to Telinga Koonbees in the north-eastern portion of the Nizam's territory, in the country down the Godavery below the limits of the Maratta tongue, but whether these are really Telingas of this caste, or whether the word is only used to express Telinga cultivators, I am not sure.

In Hindustan the Koormees, as a lower class, are on an average darker and less good looking than Bramins and Rajpoots, but still they are quite Arian in their features, institutions, and manners. So they are in the Maratta country; indeed the Marattas are still known to the people of the south as 'Aryas,' but they have probably towards the south a larger intermixture of Aboriginal blood, and it is notorious that the Marattas are small men compared to the northern tribes.

The constitution of the Koonbees seems to be less democratic than that of Jats and Rajpoots. In the Maratta country (and indeed in the countries to the north of that also) the villages are for the most part ruled by hereditary patels or headmen without much trace of representation, so far as I could learn, and individual property in land has been in many parts subject to many changes and vicissitudes.

Nothing puzzled me more than this, viz. to understand whence came the great Maratta Military element. In the Punjab one can easily understand the sources of Sikh power; every peasant looks fit to be a soldier. But the great mass of the Maratta Koonbees look like nothing of the kind, and are the quietest and most obedient of humble and unwarlike cultivators. On inquiry I gathered that in fact throughout by far the greater part of the Maratta-speaking country, all through Nagpore, Berar, and the Northern Bombay districts, the agricultural Koonbees furnish very few soldiers, nor ever did furnish many. Although the Koonbee element was the foundation of the Maratta power, though Sevajee and some of his chiefs were Koonbees, it appears that these people came almost exclusively from a comparatively small district near Sattara, a hilly region where, as I judge, the Koonbees are very much mixed with numerous aboriginal and semi-aboriginal tribes of Mhars and others, and where, losing with the intermixture many of their agricultural virtues, they acquired more of the qualities of predatory soldiers. It is notorious that Sevajee relied principally on his '*Mawallees*' of the Western Ghats, who were apparently little better than non-descript predatory tribes. In their best days, it does not appear that the Marattas were ever Koonbees to the same extent and in the same sense that the Sikhs were Jats. In fact the Maratta confederacy was more a political than a personal union. Many of the oldest chiefs were not Koonbees. Holkar was of the shepherd, and the Guickwar was of the cow-herd caste. All these

as well as the Koonbees were quite illiterate, and would have done little without the directing power of the Bramins. When they were farther advanced, the Maratta forces seem to have been mere mercenary armies, a congregation of every loose fortune-seeker of every race and class, Mahommedans included, with a nucleus of the population of Sattara and Poonah, from which the proper Maratta chiefs had sprung.

Take them all in all, I think that the Koonbees must be considered one of the most important as well as one of the most useful and most easily governed tribes in India. A great territory is in the main theirs, extending from about 23° or 24° to about 16° Lat., and from the western frontiers of Guzerat to the countries watered by the Wyngunga and the Middle Godavery, and the upper streams of the Nerbudda.

#### OTHER AGRICULTURAL TRIBES.

I have traced the Jats, Rajpoots, and Koonbees as the three chief territorial tribes peculiar to Northern India. I must now go back to notice other landowning tribes intermixed with them.

I shall take first the farming tribes, apt in the use of arms and of a constitution similar to the Jats and Rajpoots; these are principally found in the Punjab. Second, the tribes more or less pastoral in their proclivities, though now almost universally settled in agricultural communities. Third, the fine-farming or gardening tribes.

I have noticed how much the Salt Range seems to be the northern limit of both Jats and Rajpoots. The people north of this range are a great puzzle. They are those who seem to me the finest and handsomest in India, perhaps in the world. They are all now Mahommedans, but are wholly Indian in their language, habits, manners, and constitutions. There can, I think, be no doubt of that; the line between them and their Pathan neighbours is very distinctly drawn, the languages especially being totally different. Knowing the Pathans so well, any relationship with them is never suggested; a Pathan is with them a Pathan, and a man of another tribe is not a Pathan. But they have fanciful Mussulman genealogies, the Dhoonds and Tanaolees from the Caliph Abbas, the Kurrals from Alexander the Great, the Awans from Roostam and the Gukkurs from some other Persian hero.

There are a large number of petty tribes, very like one another, but

known by their own tribal names only; they have no common appellation. On the one hand much in their features, &c. would seem to show that they have kindred with the Kashmeerees or with the pre-Hindu congeners of the earlier Indians found in the hills farther west; on the other hand, their language and character, dress, and the architecture of their houses would indicate that they are nearly allied to the Punjabees. The language is altogether Punjabee. In these respects they wholly differ from Kashmeerees. Jats and Rajpoots are so well known that one would think that if they belonged to those tribes, they would say so. As it is, the only tribe which admits a Hindustanee origin, is that which seems to have the least claim to it, the Dilazaks, the predecessors of the present Pathan tribes in the Peshawar valley, and who seem to have themselves so considerable an infusion of Pathan blood that it has been doubted whether they are not earlier Pathans.

The Swattees too, the people driven out of Swat by the Euzofzyes, though in the main of the blood which supplied the early Indians, must be considered pre-Hindus, and have now a considerable Pathan intermixture.

The Gukkurs were the rulers of the Rawal Pindee district in comparatively modern times. They might possibly be foreign conquerors, but if so, it would seem singular that they should have completely lost their language, and so entirely assimilated to those around them. In appearance I do not think Gukkurs could be distinguished from Awans. Both are very large fine men, but not exceedingly fair, inhabiting as they do a dry, bare, rather low country, hot in summer. The Awans are the most numerous of these frontier tribes, and the best; there is no finer people in India. They are settled in large agricultural communities in the 'Chuch' plain, immediately facing the Peshawur valley on this side the Indus, and are also found in smaller bodies somewhat to the east, in the Jhelum, Guzerat, and Sealkot districts. They are good soldiers as well as good cultivators, and might be taken for the best class of Jats.

The Dhoonds and Tanaolees are to the north in the outer range of the Himalaya and about the Indus near Torbela. I have not been in the Tanaolee country, but the Dhoonds seemed to me to be the handsomest among handsome tribes. It is to be remarked, however, that

in the country far towards the frontier in this direction, the people who are the fairest and handsomest, are not considered the most plucky and trustworthy; the blood of Cashmere and Swat does not seem altogether to tend to these latter qualities. I cannot attempt to trace the minor tribes of Alpials, &c. &c. &c. Both the Awans of the lower lands and the Dhoonds, &c. of the higher lands seem to have democratic village constitutions.

Till we know something of the language of the tribes of the hills west of Cashmere, it would not be safe to speculate on the origin of the people of this corner of India. If the language of the hills is nearly allied to the Hindee and the Punjabee, we may suppose that these are Indianised tribes from the same source. If on the other hand the hill tribes speak a tongue of an earlier Arian form, then we must look to people of the blood of the Jats and Rajpoots for the introduction of the Hindee form of speech both here and in the rest of Hindustan. Looking to the want of any proper tribal name of the Rajpoots, it might be that before they became famous in Hindu story, some of them occupying the Punjab surmounted the Salt Range and mixing with some aboriginal Caucasians, formed the present tribes. Nowhere is there room for more interesting inquiry than in this direction.

Passing farther down in the Punjab I only remember one class of the character that I am now describing, the Doghurs, a Mahommedan tribe found near the Sutlej, fine, good-looking, high-featured men, but not very reliable and rather given to cattle-lifting. I do not know their origin.

Beyond the Sutlej again I have mentioned the Bhattees of Bhatteeana, whose origin is also obscure. But they are certainly one of the very finest and handsomest tribes in India.

In the Simla hills, most of the land is held by a local tribe called Kanaits. They are inferior in position to Rajpoots, more perhaps of the level of Koormees and Lodhas, but they are often educated, and men of this class are generally ministers to the Rajpoot chiefs. In certain places there is a partial and local practice of polyandry among them, but it is not the general custom of the tribe. All those who are not (in the upper hills) in contact with Tartars are quite Arian, though not very large; the women *very* nice-looking.

It will also, I think, be proper to mention the Indian Pathans, before I leave my present class of Fighting-Farmers.

I do not now touch on the proper Pushtoo-speaking Pathans. I do not reckon them as Indian, and all the Pathans beyond the Indus, as well as a few on this side (in the north of the Hazareh District and west of that of Rawal Pindee), are Pushtoo-speakers. The Pathans are the only Central-Asiatic people who have in comparatively modern times colonised to a considerable extent in India. They have never come in large bodies, nor occupied any large tracts at any one spot, but Affghanistan has always been as it were the base of operations of all the successive Mahommedan Empires in India; and from that base Pathans have immigrated in the service or under the protection of Mahommedan rulers, and have settled themselves here and there at many places throughout Northern India and even in some places in Southern India. They are not nearly so much mere Urban fortune-seekers as other Mahommedans, but are generally settled in villages, in many of which they own and cultivate the soil, and in some of which they form large brotherhoods, approaching those of Jats and Rajpoots. Their constitution and modes of government also seem to me to be in these villages very similar. They have been generally a favoured class who have had in places a good deal of jagheer and rent-free land, and still look a good deal to service, but many of them pay their rent or revenue by honest cultivation like any one else. Indian society is a wonderful solvent and absorbent; every one who long lives in it, becomes Indianised; and so all the Pathan colonists, even those whose immigrations are matter of recent history, are essentially Indian, not Affghan. Among Indians, they have very marked characteristics, but their nationality is changed, and the Pathans from the Frontier, who came down in the mutiny times, utterly refused to acknowledge the proudest Indian Pathans as having anything in common with themselves, and chopped off their heads with the utmost non-chalance. In many respects, however, the Indian Pathans are a very great improvement on the wilder Pathans of the Frontier. They are very much more civilised and educated. In India, in fact, the Pathans are quite an aristocratic class. Notwithstanding the wide door to corruption of blood opened by the Mahommedan laws of marriage, they are still a very handsome people;

a large proportion of them are in a respectable well-to-do position, and many of them are very well educated. After all a well-educated Mahommedan has much more in common with us than most Hindus, and comes much nearer our idea of a gentleman. It may be, too, that these Pathans retain some little trace of that non-Indian character which makes us readily become familiar with Affghans. Altogether I have no hesitation in saying that (putting the Punjab apart), among Hindustanees, the Pathans are by far the best class with whom we come in contact. They have always been very numerous in our Irregular Cavalry and also had a large share in our Civil Service. I shall be sorry, if, partly on account of the more insinuating and it may be in some respects sharper character of subservient Hindus, and partly from the difficulty of imposing our education on those who have already an education of their own, these and other Mahommedans are gradually extruded from the public service.

Pathan settlements are dotted here and there about the Punjab, but they are not very numerous. In Hindustan they are more so. They are found about Dehli, and are very numerous in the Upper Doab and Rohilkund, though it must not be supposed that the latter is really a Rohilla country; it is only a Rohilla jagheer, and the Pathans, though positively numerous, are relatively but a small minority of the population. It may be mentioned that the term 'Rohilla' does not signify any particular tribe, but is applied in India to Pathans generally, meaning apparently "mountaineer." The Rohilkund and Dehli Provinces are the chief nurseries of Pathan soldiers, &c., but all over Hindustan, and indeed all over India, Pathan Principalities and Jagheers, Pathan settlements, and Pathan families are found here and there.

It will be well here to dispose of the other Mahommedan settlers, that is, Mahommedans who do not own or cannot be traced to a Hindu origin. With the exception of the Pathans, their origin is, in fact, generally obscure and doubtless very mixed.

The name of Mogul is assumed by but few, and whatever the word may originally have been, it must be understood that it does not now in India in any degree mean 'Mongol.' There is no ethnological trace of Mongol immigration into India. Even the leaders who inherited Mongol claims had, in fact, changed their blood in passing

through Persian and Affghan peoples. And on the Frontier, the term Mogul is now applied to Persian-speakers, as distinguished from Pushtoo-speaking Pathans. Most people will there tell you that 'Mogul' means a Persian, but it is really a somewhat wider designation. In Cabul, the Mahommedan population is simply divided into Pathans and Moguls (or non-Pathans), the latter being chiefly composed of Persian Kazzilbashs and the like. So then in the armies and followings of the Emperors of Dehli, Foreigners were divided into Pathans and Moguls; but while the Pathan settlers are many, the Moguls are, as I have said, very few.

In small Mahommedan countries there are numerous people claiming to be descendants of the prophet after the easy Mahommedan form of descent. Indian Syuds are generally mere loose waifs of low degree among the Urban population; but here and there we have considerable settlements of Syuds holding villages or jagheers, and where these occur, they generally claim and maintain a good deal of dignity and propriety, and are a superior and well educated, if sometimes somewhat bigoted, class.

It is generally said that a 'Sheik' means only a Mahommedan who is neither Pathan, Mogul, nor Syud. There are, however, a good many respectable landholders, and some village communities who bear the name of Sheiks; for instance, the old proprietors of Lucknow, when it was but a village, were Sheiks. It is impossible to trace the origin of these people, much less that of the loose Urban Mahommedan population. But I think it may be said that, generally speaking, the Mahommedans retain among them considerable traces of north-western origin. Dress and manners may have something to do with it, and there are of course many exceptions, but on an average they are fairer and show fewer marks of aboriginal intermixture than the Hindus. High-Arian features are not unfrequently to be seen among them. Even among those who do not directly claim to belong to Pathan and other tribes of the North-West, one often sees handsome faces, features, and beards, such as would make good 'wise men of the east,' or the very best of our oriental imaginings. It is impossible to attribute to these features, in Northern, Central and Eastern India, a Semitic origin (on the South Western borders it is another matter), and I attribute them to the hilly countries of the North-Western Arians.

Of the races which I call in some respect pastoral, I will take first

THE GOOJARS.

They have been long known to us as cultivators of predatory proclivities in the country about Dehli, and after 50 years of enforced peace and quietness, they distinguished themselves by breaking out into wholesale plunder all over that district within a few hours of the out-break of the mutiny, just as if the present generation had been accustomed to it all their lives. However, we must take a wider survey, for the Goojars are a far extending people, numerous in the Punjab and on the Northern Frontier. In fact, they now extend farther to the North-West than any other Indian people. I understand that they are still numerous in Swat and the adjacent hills, and they are said to have been the original inhabitants and owners of part of the Hazareh District, on this side the Indus, before they were in great degree dispossessed by the Swattees, themselves pushed forward by the Affghans. In the hills about Kashmere the Goojars are very numerous; and there more than anywhere else they have an actual pastoral character, being apparently somewhat vagrant in their habits, and at one season receiving the cattle of the Kashmeerees to graze, while at another they bring their own down for sale. Perhaps these are the Goojars who were dispossessed of their homes in Hazareh. It is supposed that in the event of any disturbance in Kashmere, they might visit the valley for other than pastoral purposes.

Descending into the plains of the Punjab, we find the Goojars about Goojerat and the country thereabouts in very much better repute than elsewhere, in fact they are there said to be among the best cultivators. They are very numerous, settled in prosperous communities, and give, it appears, their name to the town and thence to the district of Goojerat. There might be some question whether the word is not the Persian one, '*Goozerat*,' *i. e.* 'Fords' or 'Ferries,' in allusion to the ferries over several rivers thereabouts, but I understand that it is really Goojerat from Goojar. And there are frequent names in the Punjab derived from the same source. In fact, Goojars are very much mixed with Jats in all the northern, if not in all the Jat country, and form a considerable proportion of the population. About Dehli they are, as I have said, very numerous, and they are so in the Meerut and Seharanpore Districts of the Doab. They are numerous

in all Northern Rajpootana, and extend into Malwa and the adjoining parts of Central India.\* They there extend as far east as Bundelcund, where one of the chiefs is a Goojar. But in the other direction they do not approach Goozerat, and, so far as I can learn have never been known there. I believe that the Bombay 'Goozerat' is a name derived from some other source. Its proper form is said to be *Gurjarat*, derived from 'Gurjar' Princes. I do not know the derivation of this last term, but there are *Gurjat* Chiefs in the Cuttack and Southern Nagpore territories, where there are no Goojars. I fancy, however, that I have heard it said (though I cannot now trace the source), that a similarity of names can be traced between places in Goozerat and in the Punjab Goojerat. If that be really so, it would open up an interesting inquiry. To prevent mistake, I should here notice that in the Bombay Presidency the word 'Goozar' is used, not to signify a Goojar in the northern sense, but merely an inhabitant of Goozerat, as thus 'Goozar Bramins,' 'Goozar Banians.'

The Goojars are generally a fair good looking people, especially towards the frontier, and have no aboriginal traces about them. Those located to the east trace their origin from the west. All, I think, to the north of Dehli are now Mahommedans; but those to the east and south of that place are sometimes half-Mahommedans, sometimes a sort of Hindus, though of so lax a character that I believe they are hardly admitted within the pale, and are considered to be in some degree a sect apart. They are sometimes said by the natives to have a language of their own; at least so I was told in the Punjab. It may not improbably be that this is only the patois of one province carried by them into another, but it would be interesting to inquire whether they may possibly have among themselves some sort of Gypsy tongue. Their most proper calling seems to be the keeping of cattle and buffaloes, not sheep; but they do not generally exercise this as a mere caste profession among the general population. They

\* The last Nagpore Prince is stated to have been a *Goojar* adopted into the family, the son of 'Nane Goojar,' but I apprehend that there must be some mistake, as the Nagpore family were, I believe, Maratta Koonbees, of the same race as the Sattara family. Either 'Goojar' must be here a mere name or title of the individual, or the allusion must be to some supposed indiscretion of a lady of the family.

are usually settled in separate villages of their own, and in the absence of pastoral and predatory opportunities are cultivators, like other tribes, though in most places indifferent ones.

I shall here just mention 'Mewattees,' not because I am prepared to class them as 'Pastorals,' but because they are very frequently classed with Goojars, as "Goojars and Mewattees," with reference to their plundering propensities. In fact, although I have always been familiar with Mewattees as a very thieving tribe of cultivators found here and there along the south-western borders of the North West Provinces, I have not been able to make out what they really are. They seem to come from the Central country, from somewhere in Rajpootana or Central India, and their name might seem to indicate a connection with Mewar. I have seen mention of 'Mewassees,' hill chiefs, in those parts, but don't know if they are connected with the Mewattees. In fact, the Alwar country near Dehli seems to have been of late called 'Mewat.' Mewattees are mentioned as common in Malwa in the characters of irregular soldiers and depredators. They extend farther east than the Goojars. I think the villages razed to the ground in the station of Allahabad, for their predatory activity in the mutiny, were those of Mewattees. My impression is that they are mostly Mahommedans and not bad looking, but in truth I know and can find very little about them.

The Goojars are succeeded as cattle-keepers to the east and south by the 'Aheers,' who seem to be the pastoral element of the Rajpoot and Bramin countries, as the Goojars are of the Jat countries. Aheers and Goojars are sometimes spoken of as if connected, but that I believe is an error arising from mere coincidence of profession. Meeting as they do in the country east and south of Dehli, they keep entirely apart (in a social point of view), and are universally recognised as entirely separate and distinct castes, with no connection whatever. The Aheers are not a very strict sect of Hindus in the modern sense, and their widows re-marry, but still they are decided Hindus of the respectable position which their charge of the sacred animal demands. In the strictest days of caste there were a good many Aheers in the Sepoy army. They are good and upper-class-looking Hindustanees. Like the Goojars, they are not a mere cow-keeping caste, but have many independent villages, and in some parts of the

country are in considerable tracts almost the principal landholding class. Under these circumstances they are very fair agriculturalists, only a little given to cattle-lifting, when opportunity offers. Besides the Aheer villages, families of the caste are much spread about the country as cultivators and herdsmen. 'Ghosees' also, common as buffaloe-keepers, are said to be related to the Aheers; they are, I think, Aheers converted to Mahommedanism. Except in the country occupied by Jats and Goojars, Aheers are found all over Hindustan, but do not generally extend east into Bengal. There are many of them just between the proper Jat and the Rajpoot country about the Ganges, to the east of Meerut and Allyghur, and on the other side in part of Rohilcund, and they seem to extend into the south-east of Rajpootana and of the Dehli territory, and are found about the Jumna near Muttra, and in many places farther east. In the Benares and Behar Divisions there are also many of them.

Thence through Central India I am not prepared to say what proportion of the population are Aheers, but they were certainly very famous in old time on the Southern frontiers of Hindustan, in Guzerat, and in the Maratta country. The famous Fort of Asseerghur derives its name from *Asa Aheer*, a noted leader of this tribe, and Aheers are still, I believe, found in those parts. They are said to have been once powerful in Goozerat and to be still numerous in Kattywar. That western country is stated in fact to have been formerly called 'Abhira' or the country of the Aheers. And thence southwards, it seems probable that Aheers were one of the principal Hindu races who along with the Bramins conquered and colonised Southern India. Bramins and Herdsmen are said to have been the first conquerors, and the Aheers may probably be the progenitors of the cowherd castes who are still numerous in the Southern Districts. One can only suppose Goozerat to have been a Goojar country, by assuming Goojars and Aheers to have been originally identical, which at any rate would require that we should go back a very long way. The subject is, however, worthy of inquiry.

Besides the Aheers known in the Maratta Districts, there seems to be in the south of that country and also in the Canarese country a quiet respectable class of cultivators called 'Dhangurs.' The word is translated 'Shepherds,' but I have also seen it stated that the

Dhangurs and Aheers are nearly the same. It would be well to know more on the point.

In Hindustan sheep and goat herds, 'Gaderias,' form a separate and very inferior caste and profession. They have no villages of their own, but tend sheep in the villages in which they reside.

In Bengal Proper and Orissa, the Aheers are succeeded by the Gwallas, whom I have already incidentally noticed as very different in their style, manners and occupations. 'Gwalla' is not a tribal name, but merely means a cowkeeper (from the old Sanscritic word, *go*, a cow), so that the name does not necessarily imply any tribal connection with the Gwallas of the south and elsewhere. The Gwallas (as I have before noticed) are, with their congeners the 'Satgopes,' by far the most numerous Hindu caste in Bengal; and as Bengal is not much of a grazing country, they constitute a large proportion of the cultivators, besides carrying palanquins, acting as domestic servants, and following some other avocations. In the jail returns they are about 13 per cent. of the non-Mahommedans, that is, of Hindus and Aborigines of all sorts taken together; and as Aheers prevail in Behar, it is probable that in Bengal and Orissa the Gwallas amount to fully 20 per cent.

There are no democratic villages in Bengal; indeed village communities in the proper sense, with anything like a municipal constitution of any kind, can hardly be said to exist; the Province is in that respect peculiar. Consequently it is unnecessary to add that the Gwallas are not in regular communities. They are scattered about the country. I believe that they have frequently acquired rights in the land and attained to respectable positions. They seem to be a quiet, decent set of people.

I am not well versed in the manners and customs of the Bengallees, and there seems to be a great want of information on the subject, which I trust may be supplied.

I have before hazarded a conjecture whether the Bengallee Gwallas may not have been formed on the basis of the Aboriginal Bhooyas.

Of the fine cultivators or gardeners, the most important are—

THE MALLIES,

to whom I have alluded as apparently allied to the Koormees, and who are not only the humble gardeners to whom Europeans ordinarily

apply the name (as to a profession), but a considerable and far extended people. On the Frontier, above the Salt Range and extending up into Peshawar, there is a considerable class of 'Mulleals' who are I believe Mallies (though like most of the people of those parts now Mahomedans), and who are very industrious cultivators and gardeners.

Throughout the plains of the Punjab, there is again a very important and numerous class who seem to be allied to the above, called Raees or Raeens. These people have generally villages of their own, or hold divisions of villages on equal terms with Jats and others, and under a similar constitution. They chiefly affect the best lands and finer cultivation, where they pay a high revenue and are much appreciated by native governments; for they are probably, on the whole, the best cultivators in the Province. They are not martial, but are generally (like almost all Punjabee Mahomedans) fair and good-looking men. They are all, so far as I know, Mahomedans, which may account for their bearing a different name from their Hindu congeners, if congeners they be. So far as I am aware, they are not known by this name beyond the Punjab.

A little farther east, long before we come to the Koormees, we meet with Hindu Mallies. I know that between Umballa and Dehli, in the Khytul country (one by nature very little suited for gardening operations), there are a good many Mallie villages. In the North West Provinces I do not think that they are much known as independent landholders, but as gardeners they are scattered about. I find mention made of them as common about Ajmere and on the Southern frontier of Hindustan. Beyond Jubbulpore they are common, mixed with the Koormees. Thence going onwards to the Maratta country, in Nagpore also they share the country with the Koonbees, and are the class next in importance to these latter. In fact, in all this part of Central India, (the southern limits of Hindustan and the Maratta country), Koormees and Mallies seemed to be classed together. The Patels, I learned, were either Koonbees or Mallies, and they often divided the same villages. The two classes (I was told by the Patels of the Nagpore country) will eat together, but do not intermarry. In this latitude both Mallees and Koormees extend far to the east. I find mention of the former in Orissa, and of the latter in Maunbhoom and other districts of Chota-Nagpore.

The Lodhas I have already mentioned as connected with and of the same character as the Koonbees, though they are strictly speaking distinct from them.

The remaining classes of Northern India, whose proper profession is cultivation or gardening, have not generally, to my knowledge, villages of their own. There are, however, scattered through most villages in Hindustan many industrious Kachees and Koerees and Morows (tobacco cultivators) and Kumbohs, and some (though not many) who have no other caste name than that of 'Kisan' or cultivator. The farther we go down in the scale, the greater seems to be the infusion of aboriginal blood, the shorter is the stature, the darker the skin, and the more low-Arian the features; but in none of these decent castes of Hindustan do the features or the complexion and hair assume at all an aboriginal type.

In Bengal the names of castes are different, and *there* very many of the cultivators, the majority I believe in all Eastern Bengal, are Mahommedans, whose original caste and ethnological history I am at present unable to discover. Among Hindus, the most numerous castes after Gwallas, Bramins, and Kaists, are Bagdees (who are I am told of an inferior and aboriginal type), and a decent class of cultivators called Kyburtos. I am as yet altogether puzzled about the ethnology of the mass of Bengal ryots. Most of them, though dark, look Arian, but some are *very* dark, and have a decided tendency to a thickness of lip, and to some features either Aboriginal or Indo-Chinese. I am half inclined to think that there are two types among them. Some of them seem to have a great tendency to curly hair, and to a cast of features which I should be disposed to attribute to the influence of the black woolly-headed Aborigines, who may have stretched across from the Rajmahal to the Garrow hills. Others, especially the Ooryahs, with the Bhooyas of those parts and some of the Bengalees, seem rather to have straight hair with high cheek bones and complexions not very dark, which might suggest an Indo-Chinese element stretching from Burmah across the Soonderbuns. But I have acknowledged that I do not understand Bengal, and I hope that others will throw more light on it.

The inferior Helot classes, who generally, all over Northern India, cultivate to a considerable extent, either on their own account, or as the servants of others, I leave for another division of my subject.

It must, however, be understood that a good deal of cultivation, in most parts of the country, is carried on by miscellaneous cultivators of a great variety of classes, who by caste properly belong to other professions. Cultivation is the one profession which is open to all alike, and is occasionally followed by almost all. In a great part of Hindustan in particular, wherever Rajpoots and Bramins are comparatively few, and Koerees and Kachees are not numerous, there is in the present state of cultivation a large space not occupied by the classes which I have enumerated, and lists of tenant cultivators of these tracts present a very great variety. It is the same in Bengal. The caste of '*Teles*' are supposed to be properly oil-manufacturers, but whether (seeing the large growth of oilseeds) they were also in their origin oil-growers, or whether their multiplication is accidental, they certainly in many parts of the country form an important and respectable section of the agricultural community. Many of them are found both in Hindustan and in the Bombay Presidency, and in Bengal and Orissa they are particularly numerous and well-to-do. In Bengal the Tantees or weavers are also a prosperous class, and own a good deal of land.

The Chumars or leather workers form a large proportion of the population of Hindustan, and are both labourers and cultivators, but they may perhaps better be put among the inferior labouring classes.

For the rest the list of cultivating artisans and others would be endless. They must be classed under their own professions.

#### THE MERCANTILE CLASSES.

First under this head, I will put—

##### THE KHATREES.

Trade is their main occupation, but in fact they have broader and more distinguished functions. Besides monopolising the trade of the Punjab and the greater part of Affghanistan, and doing a good deal beyond those limits, they are in the Punjab the chief civil administrators, and have almost all literate work in their hands. So far as the Sikhs have a priesthood, they are moreover the priests or gooroos of the Sikhs; both Nanuk and Govind were, and the Sodees and Bedees of the present day are, Khatrees. Thus then

they are in fact in the Punjab, so far as a more energetic race will permit them, all that the Maratta Bramins are in the Maratta country, besides engrossing the trade which the Maratta Bramins have not. They are not usually military in their character, but are quite capable of using the sword when necessary. Dewan Sawan Mull, Governor of Mooltan (and his notorious successor Moolraj), and very many of Runjeet Sing's chief functionaries were Khatrees. Even under Mahomedan rulers in the west, they have risen to high administrative posts; there is record of a Khatree Dewan of Badakshan or Koondooz, and I believe of a Khatree Governor of Peshawar under the Affghans. The Emperor Akbar's famous minister, Todar Mull, was a Khatree; and (though I was not before aware of it) a relative of that man of undoubted energy, the great Commissariat Contractor of Agra, Jotee Pershad, lately informed me that he also is a Khatree. Altogether there can be no doubt that these Khatrees are one of the most acute, energetic, and remarkable races in India, though in fact (except locally in the Punjab) they are not much known to Europeans. They are, either on account of their name confounded with Rajpoots (by those who only see the name), or more frequently, on account of their mercantile profession, are confounded with the Buneahs or Banians, with whom socially (as matter of tribe and caste) they have no connection whatever. The Khatrees are staunch Hindus, and it is somewhat singular that, while giving a religion and priests to the Sikhs, they themselves are comparatively seldom Sikhs. And though, judged by a modern Hindu standard, they can hardly penetrate as they do into Central Asia with much regard for caste, they show their staunchness by never succumbing to the Mahomedan faith, where all the Indians around them have done so. I scarcely think that there are such people as Mahomedan Khatrees in latitudes where Jats, Rajpoots, and others are all Mahomedan; and even in Affghanistan they seem to maintain their faith intact. The Khatrees are a very fine, fair, handsome race. And as may be gathered from what I have already said, they are very generally educated. There is a large subordinate class of Khatrees, somewhat lower, but of equal mercantile energy, called Rors or Roras. The proper Khatrees of higher grade will often deny all connection with them, or at least only admit that they have some sort of bastard kindred with Khatrees,

but I think there can be no doubt that they are ethnologically the same, and they are certainly mixed up with Khatrees in their avocations. I shall treat the whole kindred as generically Khatrees. Though the Rors have not usually risen to such high posts, at least one of Runjeet Sing's ministers was of this class.

Speaking of the Khatrees then thus broadly, they have, as I have said, the whole trade of the Punjab and of most of Affghanistan. No village can get on without the Khatree who keeps the accounts, does the banking business, and buys and sells the grain. They seem too to get on with the people better than most traders and usurers of this kind. Of course, like all people so situated, they are often a good deal abused, but in a Punjabee village I think that the Khatree is generally rather a popular character and on friendly terms with his clients; at any rate they appreciate the necessity for him, and are by no means anxious to get rid of him. In Affghanistan, among a rough and alien people, notwithstanding occasional exceptions, the Khatrees are as a rule confined to the position of humble dealers, shop-keepers and money-lenders; but in that capacity the Pathans seem to look on them as a kind of valuable animal, and a Pathan will steal another man's Khatree, not only for the sake of ransom (as is frequently done on the Peshawar and Hazarah frontier), but also as he might steal a milch-cow, or as Jews might, I dare say, be carried off in the middle ages, with a view to render them profitable.

I do not know the exact limits of Khatree occupation to the west, but certainly in all eastern Affghanistan they seem to be just as much a part of the established community as they are in the Punjab. They find their way far into Central Asia, but the farther they get, the more depressed and humiliating is their position. In Turkistan, Vambery speaks of them with great contempt as yellow-faced Hindus of a cowardly and sneaking character. Under Turcoman rule, they could hardly be otherwise. They have even found their way to St. Petersburg and made money there. They are in fact the only Hindus known in Central Asia.

In the Punjab they are so numerous that they cannot all be rich and mercantile, and many of them hold land, cultivate, take service, and follow various avocations. But I do not think that there is in the plains such a thing as a Khatree village or Khatree community,

such as I have described to be the social form of other castes. They are always mixed among other classes.

It is somewhat singular that the Khatrees, so important in Affghanistan, and who also push so far into Central Asia, are altogether excluded from Bramin Kashmere; they are not found there at all. In point of acuteness, I fancy it is an instance of 'two of a trade.' In the hills, however, the 'Kukkas' on the east bank of the Jhelum are said to have been originally Khatrees, (they are a curiously handsome race); and in the interior of the Kangra hills there is an interesting race of fine patriarchal-looking shepherds called 'Gaddees,' most of whom are Khatrees. There are some Bramins among them, and some of low caste, but the great majority are Khatrees, and their story is that they are the remnant of the former rulers of the plains of the Punjab, driven to the hills by conquering invaders. They are a very pleasant, frank, simple people, quite apart from their present neighbours, and a great puzzle. Khatree traders are numerous in Dehli, are found in Agra, Lucknow and Patna, and are well known in the Burra Bazar of Calcutta (though there they are principally connected with Punja b firms). But as soon as they pass east from the limits of the Punjab, they get into the mercantile field of the Bunneeahs, who are quite their equals in mere mercantile ability where little physical courage is required, and in the Bunneeah country the Khatree merchants are mere exceptions in large towns.

In Behar there seems to be a considerable agricultural class called Kshatrees, Chatrees, or Khatrees, who are distinct from and considered to be somewhat lower in rank than Rajpoots. They seem somewhat to affect a Military character, sometimes serve, I believe, as soldiers, and are well known as '*Darwans*' and the like in Calcutta. Buchanan seems to have been inclined to suppose that they are really Khatrees from the west, but I have not yet been able to ascertain whether they are in truth of the same caste as the mercantile Khatrees.

I do not know the exact limits of the Khatrees to the south. I have not visited Mooltan which is a great mercantile centre of the race, and cannot accurately distinguish between Khatree and Bunneeah sects called by their sub-tribal names. The term '*Mooltanees*' seems to be applied to several trading sects in different parts of Central India, &c., some apparently wandering Pathan traders, and some,

I suspect, of some Khatree sect. The Khatrees do not seem as a rule to reach the western Coast; the Guzerat and Cutch traders appear to be Bunneeahs (or Banians) not Khatrees, and in the Bombay market I cannot find that they have any considerable place. In Scinde, however, I find (in Captain Burton's book) an account of a race of "pretended Khsatryas who are really Banians of the Nanuk-Shahi (Sikh) faith," and who trade and have a large share of public offices. These are evidently Khatrees. I had supposed the Lohanee merchants to be Pathans coming under much the same category as the "Povindeahs," but again Captain Burton makes mention of the "Lohanos, a Mooltanee caste of Banians," a robust and good-looking race who trade with Central Asia, and also with the Arabian Coast, who form a very large proportion of the Government servants in Scinde, and who also do some agriculture and labour. I cannot at this moment ascertain whether these Lohanos are really Banians or Khatrees, probably I think the latter. Palgrave again mentions among the Indian traders of the Arabian Coast, as distinguished from Banians, people whom he calls 'Loothians' or Loodianah men. I take it that these must be Khatrees, unless indeed they may possibly be Kashmeree shawl merchants. Loodianah is a large and thriving town of mercantile Khatrees, with a numerous colony of Kashmeree shawl-weavers.

The Khatrees claim to be the descendants of the old Kshatryas, and I am inclined to think that they really have the best claim to that honour. With all their enterprise, it is difficult to imagine them so completely domiciled in Affghanistan, among so alien a people, if they are entirely foreigners in that country. It is well known that the Pathans themselves have advanced into the North Eastern portion of the country which we call Affghanistan, within comparatively recent and historical times; and although the upper valleys of the Indian Caucasus have probably all along been held by pre-Hindu tribes, there seems to be little doubt that the lower valleys of the Cabul country were once Hindu. To this day the peaks of the 'Sufed Koh' between Jalalabad and Cabul bear the palpably Hindu names of "Seeta Ram" and such like.

The old Sanscrit books make the Bramins and Khsatryas to have remotely sprung from a common origin. May it not be that in early

Aryan days the Bramins of Kashmere may first have become literary and civilised, and ruled on the Saraswatee by peaceful arts, after the fashion of the earliest Egyptians before the art of war was invented, (See M. Renan's abstract of recent Egyptian inquiries); and that later a cognate tribe of Khatrees of the Cabul country, rougher and more warlike, may have come down upon them like the Shepherd Kings, and assumed the rule of the Military caste of early Hindu history? That warlike conquerors of one age should become astute money-dealers of another, is but the ordinary course of history—Jews, Greeks, Lombards and others are instances in point, and perhaps when the New Zealanders rule in England, the English may be known as the Khatrees of those parts.

#### THE BUNNEAHS, BANIANs, BANEES, OR WANEES.

No race is more important in India than the Banees. What I have described the Khatrees to be in a mercantile point of view in the Punjab, that the Banees are in the whole of Hindustan and Western India. No village can get on without them. Unlike the Khatrees, they are for the most part confined to their proper mercantile business. A few of them are found in Government offices and such service, more properly the domain of the Kaists, but these are only rare exceptions. They have also under our system acquired by purchase large rights in the land, and take farms of more, but this is in fact with them a mere mercantile operation; they do not cultivate the land, but make the most of the rents payable by the ryots, and the ejected proprietors reproachfully term the British Government "Bunneah ka Raj" or the shopkeepers' rule. Bunneahs may cultivate a few fields, like any one else, or even reduced individuals may earn their livelihood as ryots or labourers, but so far as I know, a proper Bunneah village is nowhere to be found.

There is no doubt that in their own way the Banees are a people of wonderful energy and enterprise, and it is their energy that gives tone and sinew in a commercial, and to a great degree an industrial sense, to the greater part of India. Without the Banees to supply the sinews of war, little would be done. Their function permeates every operation of every village. In all the great cities of Hindustan, they are found in a position commanding much respect as Bankers and

Merchants, and they are also most daring speculators, as is well known in the markets of Bombay and Calcutta. Indeed they often carry the rage for speculation to the point of gambling. In respect of physical courage, however, the case is quite different. Both their habits and their religious ideas make the use of a sword a thing unknown to them, and they have no affectation of personal manliness.

If the Banees are not generally very tall or strong, they are not much the contrary, and they are generally very fair. For this latter feature their indoor avocations may in part account, but that alone is not, I think, sufficient. When one gets peeps of the faces of their women on the occasion of great religious gatherings and the like, they seem to be fair beyond almost any other Hindustanee caste. The men, though flabby and un-muscular looking, are, I think, to an unprejudiced eye often by no means bad looking. They have, however, none of the high-Arian sharpness of feature, but rather a sleek comely pudding-faced kind of countenance, something like those old Egyptian faces which are said to come nearest to the Hindu type. They are, I think, generally reputed more grasping than I have described the Khatrees to be; are more often accused of being hard on those in their power, and exercising a severe tyranny of the purse. But even in their case I believe that this is a good deal exaggerated, and that many of those who abuse them most, can least get on without them. Possessed as they are of so much capital and energy, there can be no doubt that, from an industrial point of view, the acquisition by them, from indolent and unprovident proprietors, of a good deal of the land is beneficial, when it becomes their absolute property. They, almost alone among superior landholders, perform something of the industrial functions of landlords, and they know too well the value of ryots, altogether to expend and sell up those in whom they have a permanent interest. There is to be set, on the other side, the political weakness resulting from the existence of large numbers of strong-armed pre-owners still, as they think, natural proprietors, side by side with new owners who in a difficulty will not fight. Still, if the Bunneahs will not fight, they may perhaps pay others to fight for them. It is only when they are set to 'exploiter' the ryots in a speculative way, as mere temporary lessees and middlemen under the great superior Zemindars, that they are often a great curse,

The great seat of the Bunneahs seems to be in the west, and most of them point to a western origin, or rather, speaking from a Hindustanee point of view, I should say south-western, not to the Punjab, but to Rajpootana and the Bombay country. There are a great many subdivisions among them, and my impression is that the different divisions do not intermarry as do those of Jats and Rajpoots. There may therefore be ethnological distinctions among them, but I do not know that it is so. The most famous of them are the Marwarees; and that is the name of the country, and not of the sect, intimating their habitat in Rajpootana. The red-turbaned gentlemen so conspicuous in the Calcutta Opium marts and Bombay share-markets are generally Marwarees. In Hindustan the highest class of Bunneahs are called 'Aggerwals,' and there are several other sects. The Bunneahs professing the Jain religion are called Srawaks, and under that name they seem to have been famous in very old times, even in parts of Central India which are now comparatively barbarous. In Hindustan, Hindu Boras are a sect of money-lenders and traders and, I imagine, Bunneahs. I believe the name is the same as that of the Mahommedan 'Borahs' of the Bombay side; but the latter, with some peculiar Mahommedan tenets, have probably got some traces of transmarine blood, and I shall reserve them for the category of 'Borderers.' Towards the south of Hindustan I have heard of a sect of inferior Bunneahs called 'Jashwals' who, unlike the race generally, are lax Hindus and even permit their widows to remarry.

So far as I can make out, the proper Banees are not thoroughly and completely domiciled in Bengal proper, and to the want of that element (or of anything equal to it) I attribute the absence of enterprise and practical achievement, which seems to be remarkable among the Bengallee, notwithstanding the great value acquired by the land under the permanent settlement, and the accumulation of wealth during a hundred years of peace. In Calcutta most of the considerable trade and banking business and all the Hindu speculation is done by up-country Marwarees and other Bunneahs, not by Bengallees. In the Bengal districts, though a good many Banees are settled in towns and considerable places, the money-lending and shopkeeping business seems to be in great part in the hands of a variety of other classes. Bramins do, I believe, a good deal of money-lending, and the

goldsmith class are also Bankers in Bengal. Then there is a class of *Sahoos*, whose proper profession is spirit-distilling and vending, but who have a large share of the general trading business. The common 'Modees' or grain-sellers, instead of being almost universally Banees as in Hindustan; are, I understand, of various castes, and there are separate spice-sellers, oil-sellers, &c. If there are not so many enterprising Banees to make the most of the land, there is at any rate this advantage that, I believe, the ryots are now not nearly so much rack-rented in Bengal as they are in Behar and other parts of Hindustan, where the lands of great landholders are almost invariably farmed to speculators.

In Goozerat, Forbes describes the Wanees as very universal and very grasping. But at any rate the traders of the Coast of Goozerat and Cutch are very enterprising. The Banian of those parts is an important institution all over the coasts of Arabia and Africa on the opposite side of the Ocean. And in Bombay, Premchand and other Banees have made their names famous. In the Maratta country, the higher trade and banking seems to be done by Marwarees, the village business by local Wanees. Farther south, in the Canarese country, the classes of trading proclivities called, 'Banijagas' seem to be very numerous, but as the name is derived from the Sanscrit 'Banij' a trader, I cannot be quite sure that the northern and southern traders are related by blood. Inquiry is necessary on this point.

Almost all the Banees are strict Hindus, that is, strict in their own form of the faith; for in some sense Jains and such like may be said not to be proper Hindus. In Hindustan, though there are a good many Jains, the great majority are proper Hindus. They may be considered to be in religion very high Hindus, and carry to a great extreme respect for animal life. This tenet, I think, connects them with the western Jains and others, the foundation of whose faith is really the doctrine of metempsychosis and the transmission of souls from one creature to another. The Banees are, I think, really the most sincerely religious among the Hindus, and much attached to their tenets. Among many other Hindu classes, religion is little better than form. In the west country, Jain tenets very much prevail at the present day among all the Banees classes, and seem to have

had a very ancient hold upon them. In the south, the Banijagas are, it appears, now chiefly Lingamites and, as such, scarcely Braminical Hindus. But at one time the Jain form quite prevailed among them. In fact, in all the west and southwest the Jain religion appears to have been at one time predominant. The Jains seem to assert that the Rajpoots were once of their faith. The Pali language and character would seem especially to belong them.

What then is the origin of the Banees? That is a very puzzling question. I cannot account for them in any historical way, but the speculation which has occurred to my mind is, whether they may not originally have been immigrants by sea from the west who brought with them the Phallus or Lingam, and those ideas of a continually self-reproducing procreative power which took shape in the worship of Siva, and eventually gave birth to Buddhism and to Jainism, and which finally, meeting and amalgamating with the Braminical faith, produced modern Hinduism. If this be so, we might suppose that the Banees had done much to civilise the Central and South of India, before the Bramins got so far. But, as I have said, this is mere speculation; much farther inquiry is necessary.

Among the mercantile classes of the north (as well as of the south) should be classed the well-known Banjaras or wandering grain merchants, men of great energy and usefulness in their day. Though they carry on their trade all over the country, they have in some places fixed homes. On the borders of Rohilcund, towards the Terai, they have in fact considerable settlements, are considerable landed proprietors and altogether important people.

I now come to the Writer classes:—

#### THE KAITIS OR KAYASTS.

Important as this caste now is, I am totally at a loss to imagine how or why it came into existence. In old Hindu times, with a great Bramin class occupying something the position which Bramins now hold among the Marattas (by no means confined to sacerdotal duties, but performing all literate functions), one can see no room for a separate Writer class. If the Rajpoots, coming in as conquerors, wished to put aside the Bramins, they would probably have found Khatrees and Banees ready to assist them. The Mahommedans, we know, had

always among them a large educated class of their own, so much so that in the early days of our rule in Upper India most of our public servants were Mahommedans. Yet somehow there has sprung up this special Writer class, which among Hindus has not only rivalled the Bramins, but in Hindustan may be said to have almost wholly ousted them from secular literate work, and under our Government is rapidly ousting the Mahommedans also.

Very sharp and clever these Kaits certainly are. They are looked on by Hindus as rather a low caste, and their appearance is not aristocratic. Most of them are decidedly dark, generally spare thin men, and, I should say, on the average short, with often sharp weasel-like features, small and quite low-Arian. They are somewhat lax in their ways, given to drink, and on their great annual festival, when they worship the pen, it is rather the correct thing than otherwise to have a good debauch.

They have generally the office of Patwaree, or village accountant; and of high office, having always had a good share, they are getting more and more a monopoly. They are, in fact, first-rate men of business, and without pride ready to adapt themselves to our ways, they have become almost indispensable to us. They have acquired much landed property, some by honest means, some by dishonest means, when very loose practices prevailed in our courts. And of course, with dignity and wealth the respect with which they are regarded from day to day increases. What I have said of loose ways, is only applicable to the lower and more common members of the sect. It is only fair to acknowledge that there are now many high officers and worthy proprietors of this class, whose respectability is great and conduct unimpeachable. I never remember to have heard a conjecture as to the origin of the Kaits. They are never found in separate villages, but are scattered about rather as a separate profession than a separate race. There are a good many illiterate men among them who earn their bread as they best can; but most of them are educated. I should not say that they anywhere in Hindustan form a very large population. One may suppose that when the Bramins got indolent, this class grew up as a sort of low-caste clerks to the Bramins, who ruled by supplanting their masters. But whence did they get their talent? Some of the Aboriginal races seem to have activity and bodily energy, but none of them mental talent.

In Bengal the Kaitis occupy a higher relative position and are very numerous. It is related as a historical fact that they accompanied the Bramins into Bengal from the North-West, and indeed it would seem as if the Hindustanee colonists in Bengal had been almost exclusively Bramins and Kaitis; there are scarcely any other castes of well authenticated Arian descent, while a large proportion of the inhabitants show some aboriginal traces. In Bengal then the Kaitis seem to rank next or nearly next to the Bramins, and form an aristocratic class. According to the Jail Returns, they are 7 per cent. of the Hindus incarcerated in Bengal, Behar and Orissa, and in the general population they are probably in still larger proportion. They have extensive proprietary rights in the land, and also, I believe, cultivate a good deal. Of the ministerial places in the public offices they have the larger share. In the educational institutions and higher professions of Calcutta, they are, I believe, quite equal to the Bramins, all qualities taken together, though some detailed information of the capacities of different classes, as shewn by the educational tests, would be very interesting. Among the native pleaders of the High Court, most of the ablest men are either Bramins or Kaitis; perhaps the ablest of all, at this moment, is a Kait.

Not knowing where else to put them, I shall here mention a caste who are, so far as I know, peculiar to Bengal, the Boidyas or physicians. They are not very numerous, are, I believe, often learned and respectable men, and rank high among Hindus, but in truth I do not know very much about them. It would be interesting to know more.

The Kaitis extend west all through Hindustan, are numerous in Malwa and are found in Goozerat. But in this latter Province we come upon either another caste of the same kind, or a branch of the same bearing a different name, and called—

#### PURBHOOS OR PURVOES

who are very conspicuous in that part of India and in the town of Bombay, where they do most of the work of clerks. I cannot make out whether Kaitis and Purbhoos are in the main the same or different. Of two well informed native gentleman whose opinions have been sent me, one seems to think that they are mere sub-divisions of an original writer class, another, that they are different. Those whom I saw in Bombay seemed to me different in appearance as well as

very different in dress from the Hindustanee Kaitis; they are, I should say, generally fairer and better looking. I should much like to know more about them.

#### THE ARTISANS.

For ethnological purposes it would be useless to go through the long lists of professional castes, as they cannot, so far I know, be distinguished as representing races, but are merely the modern Hindu social division into professions. It will nearly suffice to say that in Northern India almost every possible profession has its separate caste, and that there is no grouping of them together, either into right hand and left hand, or into such groups as the Puchalas of the south. Nothing of the kind is known; Carpenters, Blacksmiths, Goldsmiths, Bricklayers, Potters, Barbers, Confectioners, Washermen, Spirit-sellers, and very many others, have all their own separate castes, and they eat and marry within those castes. Some are more and some less strict Hindus. All are of a low-Arian type, and I am not prepared to suggest any ethnological differences, except that they are better looking in the Punjab, and less so to the east and south. I doubt, whether substantial differences can be found till we get lower, to tribes exhibiting more decided aboriginal traces. Most professions bear different names in Bengal from those in Hindustan. I do not know much of these classes in Goozerat and the Maratta country.

The Hindustanee Kahars or Palkee-bearers are a considerable class, and are strong hard-working men, rather good looking than otherwise. They stand well among Hindus, whose water-carriers they are, and who will therefore generally drink from their hands. They are also fishermen and cultivate a good deal. They have by caste nothing whatever to do with cow-keeping, though they may own cows, like other people. I believe that they are quite distinct both from Bengal Gwallas and from south country Buis or Booes. They are found in parts of the Punjab as well as in all Hindustan, but not in the west of the Punjab.

#### THE INFERIOR AND HELOT CLASSES.

Finally I come to the inferior labouring classes, the Helots and out-castes, among whom, if anywhere, the aboriginal blood should show itself in a marked way.

Castes originating in a difference of races, it may be pretty safely assumed that Helot races represent conquered peoples; but it sometimes happens that the form remains when all substantial difference has disappeared, just as in fossils we have the form although in fact the substance is stone like that which surrounds it. In the hills of the extreme north, where we have the high-Arian race in its purest and most unalloyed state, even the form of a Helot caste is wanting; which is just what we might expect in a country where the Arians themselves are the aborigines. There are no out-caste Pariahs. In Kashmere a tribe called Wattals are said to be low, but they appear to be rather immoral than ethnologically low, a gypsy kind of tribe which supplies dancing girls and prostitutes. The women are notoriously among the handsomest in the valley, so they are not at all Helots such as I mean. In all these hills, the "Chooras" of the plains are altogether wanting.

In the plains of the Punjab there is a thorough Helot tribe. The arrangement of castes is there generally more simple than elsewhere, and a single low caste tribe are both the ordinary labourers who do all the inferior Coolee work, and at the same time the out-caste scavengers of the community. They are in fact all considered to be of the lowest sweeper caste, and are called 'Chooras.' As in most democratic communities there has generally been under the freemen a Helot class (the Helots of Greece, the Slaves of Rome, the Negroes of South and the Irish of North America), so also every Jat village has its Helot quarter, where the low caste people, fewer, but still considerable in number, reside. They sometimes cultivate on their own account, but more generally act as labourers, and do all that is done by the Chamars in Hindustan. When a traveller of rank arrives at a village in Hindustan, the Chamars are called out to carry his baggage; the Chooras in the Punjab.

These Punjabee Helots are in fact fine powerful men and tolerably good looking. They were well-known under native governments as good soldiers, fit to be expended on desperate enterprises. The early Sikh reformers, preaching their doctrines of equality, tried to bring these men within the pale, but with very partial success, though a few were admitted to a respectable position as Sikhs. They were only occasionally used as soldiers by chiefs who were hard-pressed.

It has been reserved for us to enlist them in regular regiments, and to try to raise them to a good position. Like most low-placed men, they look low, when in low case performing low offices; but that they are well grown and powerful, is always clear. I had recently an opportunity of looking at them carefully, in a body drawn up on Regimental Parade, and looked especially with the view of seeing whether I could detect any ethnological peculiarity. I was quite satisfied that nothing of the sort is to be found. There may not be so large a proportion of good looking men as among the higher castes, but as a body they are fine Arians, not very materially inferior to the other people of the country. The only physical peculiarity that I have noticed among people of this class in the Punjab is, that a large proportion of them have only one eye. I apprehend, however, that this is not an ethnological peculiarity, but the result of inferior labour in a dry and dusty country, as may be seen in Egypt.

In Scinde also the low caste people are mentioned as large men of Punjabee origin and speaking the Jatee language. They are there called 'Bale Shahe' or Royal, a term also I believe applied to the sweepers in some other parts of India, and which may seem ironical, but may possibly be founded on some traditions of their former rule.

In the Punjab, in addition to the functions which I have mentioned, the Chooras are generally the village watchmen; and it may be observed that this office is all over India very generally held by the representatives of the oldest races, especially when they possess any fighting capacities. It may be supposed that when conquerors came in, they would find the headmen of the conquered races best acquainted with the localities, and most capable of dealing with those of their brethren who had taken to the jungles. I should always be inclined to look to the watchmen for ancient ethnological traces. The same races who do the watching also often do the thieving, and the Punjab Chooras have done a good deal of theft and robbery and some thuggee. What may be the origin of these Punjabee Helots, I must leave to conjecture. Either they may represent an old aboriginal tribe, whose features have been wholly absorbed by infiltration and intermixture, and who have left no ethnological traces but a dark tinge in the colour of the Punjabees and Affghans of the lower hills, or they may be early Arian inhabitants, conquered and enslaved by subsequent tribes of Bramins, Khatrees, Rajpoots, and Jats.

At any rate it may generally be said, that the whole population of the Punjab, both high and low, is above the average Arian type.

I have before mentioned that the lower class of cultivators and labourers in the Simla hills are called "Kolees." I have not noticed among them any marked aboriginal features.

I have alluded to the Chamars as the labourers of Hindustan, but *there* the functions of the Punjabee Helots are divided; the Chamars are the labourers (besides their own proper profession of curing skins), and the out-caste sweepers are an entirely separate and lower class. I have never quite made out whether the Chamars are considered to be properly Hindus. They are not considered absolutely offensive to the touch like the unclean out-castes, but their name is commonly used to signify a low man, and the greatest insult commonly proposed is to beat a man by the hands of Chamars.

They used to be sworn in a court by a peculiar Gooroo of their own, not by the ordinary name of God; and the sweepers again had a different Gooroo. They really are the modern Sudras of Hindu society, and no Hindustanee village could get on without them. Like others, they do not appear to advantage when engaged in menial offices, but to judge them fairly we should take them clean and decently fed and dressed. Most of our Hindustanee Syces are of this caste, and any one in Northern India may among them satisfy himself of their general style. It seems to me that they are a good specimen of the lower grade of the low-Arian type. An ancient proverb, quoted by Sir H. Elliott, speaks of a black Bramin and a fair Chamar as perversities to be avoided. In these days I think many Bramins may be found darker than many Chamars; but as a rule and on an average the Chamars are very decidedly dark, also rather small, though active and well knit. In features they are as it were quite the opposite of the high-Arian; there is a want of prominence, a simplicity as it were of feature; but still they do not I think show anything whatever that can really be called aboriginal. Judged by a European standard, and colour and size apart, I think that their features are quite as good as the average of Europeans of inferior degree.

The Chamars have never been soldiers, though I believe that we have enlisted some of them since the mutiny; nor have they generally

held the office of watchman ; that is more frequently held by the unclean out-castes. In their own trade as leatherworkers and shoemakers, they are clever intelligent men, and they are the same as Syces and sometimes Coachmen, and as Coolees and hired labourers. In some parts of the country, a good deal of the cultivation is in their hands ; but I have not heard of their acquiring considerable landed rights or rising high in the world, except in Chateesgurh in the Central Provinces, where I understand that a colony of Chamars of a reformed faith have come to occupy quite an aristocratic position.

The Chamars generally are apt to be somewhat foul feeders ; the lower people of the race habitually eat the dead cattle which they skin. They are also a good deal given to drink, when they can afford it.

The unclean outcastes are generally by no means numerous in Hindustan, and are for the most part confined to their own proper functions. There are various sub-divisions of them, and they are somewhat indiscriminately known by various names, Bhangees, Meh-ters, &c. General Briggs, in an ingenious paper, tracing the names of provinces to aboriginal tribes, makes the Bhangees the Aborigines of Bengal, but the term is a Hindustanee one, not Bengalee. The term 'Dome' is somewhat generally applied to these people, or if specially, I should say that their particular function is more particularly connected with dead dogs. It would appear, however, that in the north of Hindustan under the Himalayas, the Domes were once a considerable tribe, and in the Kumaon hills, they are still a numerous Helot section of the population, being in fact the only inferior class, and assuming the functions of artizans as well as those of ordinary labourers.

They are there described as very black, with curly hair, and altogether very aboriginal in appearance. I had not myself noticed this, but when I knew Kumaon I had not much taken up ethnology. In the plains where races have been longer and more mixed, and where, as I have said, the lowest caste are few in numbers, they do not, I think, exhibit aboriginal features. The fact is that so small a class has been recruited by people turned out of other classes, to a degree which has quite obliterated their original type. There are now many decidedly good-looking people among them, and their women often take up with men of other caste. On the average, I should say, that they are now decidedly better looking than the quiet decent Chamars.

The result is that, in my view, in Hindustan, after 3,000 or longer years of juxta-position, the Arian element has quite prevailed in feature over the aboriginal type, and the population, take them all in all, are in this particular about as Arian as Europeans, but dark in skin and usually smaller.

It is on the authority of one of the most learned native members of the society that I have alluded to the *Bagdees*, one of the most numerous non-Mussulman castes of Bengal, as aboriginal, but I have no particular description of them; and though I have observed the much greater frequency of aboriginal feature in Bengal, I am not sufficiently acquainted with the people to distinguish the special personal characteristics of the different inferior classes. The *Bagdees* seem to be cultivators, fishermen, watchmen, and dacoits. On the borders of Bengal and Behar, the work of labourers is done by *Rajwars*, *Bhooyas* and other aboriginal tribes whom I have noticed. The unclean tribes seems to be very various, and to have among them a system of castes more particular than that of many *Bramins*. I was lately obliged to dismiss the lowest servant in my establishment, an excellent man, because he respectfully but firmly declined to wash the cat, as impossible under the rules of his caste.

In the Prison Returns there is a large entry under the head of 'Chandals,' the orthodox low caste name, and others appear under the titles of 'Dosads,' 'Harees,' 'Bhoomallees,' &c. Altogether they must be numerous in Bengal. There is in the list a considerable caste of 'Mooshers,' but I cannot find what they are.

I consider that in Bengal there is still a very great field for ethnological exploration.

In the plains of Goozerat, the *Kolees* seem to fill the place of the inferior grade in the social scale, as labourers and lower cultivators, being there rather members of the ordinary community than a separate aboriginal tribe. The unclean outcastes are there called *Dhers* and *Olganas*.

In the Maratta country, the '*Mhars*' seem to perform the functions of '*Begars*' (forced bearers of burdens), watchmen, and *Helots* generally, much as the Punjab *Helots* do among the *Jats*. There is also a low caste of *Mbangs*. The lowest unclean caste are called '*Dhers*' there too, but I have also seen it asserted that the '*Mhars*' are really the

same as the "Dhers." There is a low caste called "Parwarees" in the country below the Ghats. They are found in the Bombay army. They, also, seem to be much the same as Mhars. Everything seems to point to the reasonable expectation, that if we could but trace the matter back far enough, the Goozerattee language would be found to be the tongue of the Rajpoots and Koormees with an infusion derived from the Koolees, and the Maratta that of the Koormees and Mallies with a considerable infusion derived from the aboriginal Mhars. I have not any good description of the personal appearance of the modern Mhars. The Ramooses of the south of the Bombay country, seem to have been a bold robber caste, now settled down to cultivation. They came apparently from the Telagoo country and are not aboriginal to the Maratta districts.

Besides the settled lower classes, there are also in the north some tribes of a character which is apparently more common in the south; people who are a kind of half-tamed huntsmen, watchmen, and thieves, doing little regular labour. In all Oude and in some of the neighbouring districts to the east, there prevails a very peculiar tribe called "Pasees" who almost monopolise the office of village watchmen and who are in their way extremely good active men. They are also huntsmen and thieve extensively, also to some degree cultivate and labour. On the whole they are superior to most of these tribes.

Then there are several wandering tribes of Bhoureahs, Sansees, Harnees, Koonjars, Dhanuks, and others who go about on pretext of trapping vermin and the like, and are great robbers. There are also everywhere the gypsy 'Nuts' or 'Sirkie-bashes' (dwellers under reed-mats), but Gypsies are too well-known all over the world to need farther specification here.

#### THE TRIBES OF THE SOUTH.

I have already avowed my ignorance of the Telinga country, and without a good knowledge of the races there existing, it would be impossible to trace the Aryan tribes in their progress from North to South—for I find that a very large proportion of the tribes farther South refer to Andria, the Telinga country, as a former stage in their southward progress. That country seems in fact to have been a great nursery of the southern tribes. Whether "Andria" is another form of

“Ariana” I am unable to say. The change, on the southern frontier of the Maratta country, to a Canarese population seems to be abrupt, and there are few traces of progress of the tribes southwards at that point. I am inclined to think that the aborigines held out in the hilly country about Sattara and Poonah till a more recent date, and that the Arian immigration into the south principally occurred by a route farther to the east through the Telinga country, which may possibly have been then more extensive than it now is. In this I put aside the question of maritime immigration from the west.

The Telinga country seems, from some source, to have been civilised at a very early date, and there appears to be reason to believe that a good deal of the country about Warangal and thence eastwards towards the sea, was in a better state than that into which it has since fallen. Much of the ancient Telinga country is said to have been taken from the Koles who (in the sense in which I have used the word) are not now adjacent—the Gonds intervening—and the country was it seems anciently called “Kalinga” which may be another form of Coolie-land. The old Telingas seem to have been a maritime people, and it was probably they who carried Hindu ideas and perhaps some Hindu blood into the Eastern Isles. To this day the Hindus of the Eastern Coast are called “Klings” on the opposite side of the Bay and in the Islands, a name evidently derived from Kalinga or Kalinga. It is then much to be hoped that we may obtain some better knowledge of the Telinga country.

The Bainjagas, who are very important in the Canarese country, are stated to be comparatively humble in the Telinga country and reduced to the condition of cultivators and labourers, while the mercantile business is in the hands of Comtees or Comatiyas, claiming to be a race of pure Arian Vaisyas. The dominant classes are others of Arian character, whom I shall presently mention so far as I know them. All this would seem to indicate that if the Banees, being according to my speculation western immigrants, ever reached the Telinga country as Srawaks or Lingamites, or with some earliest forms of that type of faith, they have since been reduced and humbled by Northern Arians.

The principal people of whom I find mention in the Telinga country are Aylmas or Velmas, said to be “the Rajpoots of the

South," and apparently somewhat like them in character, a dominant agricultural tribe of military proclivities. But of the nature of their settlements I have no information. Another similar tribe are mentioned as "Ratsawars."

Another fine tribe called Reddies and found in the Northern Canarese country, are also stated to be a Telinga tribe, but of their location in the latter country I have no particulars.

The original Telinga "Andras" seem to have come from the North West by the valleys of the Godavery and Wyngunga. The better classes of them would seem to be taller, fairer, and better looking than most of the southerners. The "common Telinga peasantry" are described as people of spare form and dark complexion, with little spirit or enterprise, but it is added that they do well in the Madras Army. I cannot make out what are the common castes of these people:

'Naik,' a word known in the native army and elsewhere, is in some sense a Telinga, but more properly I believe an aboriginal word. There are I think some people called Naiks towards the Eastern Ghats, but in most places 'Naik' is the title of a headman. The Telinga villages, I find it stated, are not compact and fort-looking like those of Northern India and the Maratta country, but loose and detached, which would seem to be rather an approach to the very loose Bengal form. There are a good many Gonds in the North East, but the common low tribes are 'Dhers' and 'Beders' who have their Helots' quarter in each village.

The Telinga palanquin-bearers are widely spread over the south and are, I imagine, the Buis of whom I have before made mention. The bearers who ply at Madras itself and on the East Coast seem to come from Ganjam and the Northern Circars, which also furnish many of the so-called "Coolee" emigrants to the Mauritius.

The Canarese country is a remarkable instance of the way in which names are transposed in India. The Canarese name is given to everything that is not Canarese, and to nothing that is. What is called in Bombay the "Southern Maratta country," because the Marattas conquered it (the districts of Dharwar and Belgaum and the country about Beejapore) is for the most part ethnologically Canarese, while the Canara districts on the West Coast (though there is some Canarese intermixture and they were once ruled by a Canarese

dynasty) are principally inhabited by races alien to the Canarese, more akin to the Marattas in the extreme north, and akin to the Malayala people in the south. About and under the Ghats, the Marattas and Northern Bramins run farther south than they do on the plains of the Deccan.

On the other side of the Peninsula, the Carnatic, wholly Non-Canarese, will always be called the Carnatic, because a dynasty seated in the Canarese country once had authority there.

The real Canarese country is, the southern part of the Bombay Presidency, part of the adjoining Nizam's territory, part of Bellary, and nearly the whole of Mysore. The Canarese can scarcely be said to be Hindus, the Lingamite sect so much prevails, and those Lingamites so entirely ignore Bramins, and so completely make their Lingam worship a separate faith. Most of the people are called 'Lingamites' or 'Sibahtagars,' a name which conceals various castes and races; for it is only a religious designation, and Lingamites are of many castes. So far as I can gather, the chief people of the Canarese country are the Baniagas who both trade and hold land, and are very numerous.

In the north of this country the Reddies, whom I have already mentioned, are described as a fine handsome powerful race, capital cultivators, living together in large villages, and raising much cotton, which with other produce they often export as well as grow. They pay their revenue well, but are jealous of interference in their village concerns, and somewhat litigious. This is an old account, and it seems very like what might be said of Jats. I do not know what is the present condition of these communities. The widows of the Reddies remarry. They are much superior to their southern Maratta neighbours in an industrial and personal point of view.

Farther south the chief castes of Hindu cultivators are 'Wokuls' or 'Ooculagas,' said to be called by the Mahommedans 'Koonbees,' and whom the Abbe Dubois considers to be in essentials the same as or similar to the Tanul Vellallers, though they will not eat or marry together. Whatever they may originally have been, they are evidently now a different caste from both Koonbees and Vellallers. I have few particulars regarding their character, but they seem to be on the whole good cultivators. The headmen of Canarese villages are called

'Gaudas,' and under native governments not unfrequently farmed the rents. There also seems to have been the village communal system in some degree, but in most places not democratic. The Wokuls are indifferent soldiers, but serve as Militia. They eat flesh freely and are not a strict class. There are, it seems, a number of sub-divisions among them. One of the chief are called Gungacara, but whether that indicates a northern origin, I can't say. In truth Wokul seems to be a very wide word. A considerable proportion of the cultivators, in several parts of this country, seem to be settled and reclaimed aborigines, sturdy "Beders" and "Malawa" or "hillmen," and there are a class allied to the Billiaru and Teermen of the Western Coast.

The low Helot outcastes are numerous and called "*Hollayers.*" Some of this caste seem to be still aboriginal in the Western Ghats, they are mentioned as coming down to the Coast nearly or quite naked; but most of them are agricultural labourers and serfs. They are said to correspond to the "Dhers" to the north and to the Palli or Pallers to the south. "Halaya" means ancient, and the word Hollayer perhaps only means "the ancient race." The Gollars, Golavadu or Gwallas seem to be few, but the "Dhangars," mentioned as connected with Aheers, extend a good way south, and there is a large class of the aboriginal shepherds the "Carambers." There are Banjaras called also "Lambadi," and I believe also "Warali" or "Katode Warali," but I am not sure whether these last are not a kind of Gypsies found also in the Bombay country.

The Buis and Bustars are palanquin-bearers, fishermen, ferrymen and distillers.

The old Canarese dynasties and most of the people were at one time Jain, but those of that faith are now few, they have returned to the worship of Siva and the Lingam, which seems to be their ancient faith. This former Jain profession seems to be, however, a link of connection with the Banees farther North.

My impression, in passing through the country, has been that the Canarese as a body are fairer and better looking than most of their southern neighbours; and as the tribes of a northern character seem to prevail among them less than in the Tamil and Telagoo country, it may be a question whether their features are influenced by an infusion from the west. It seems that the ancient name of the Canarese

people and language is "Arabee," but I have been unable to trace the origin or derivation of that name. There are some vague traditions of former Arab conquest in those parts, but I have not been able to connect them with the Canarese name. The language is certainly, like the other languages of the South of India, Dravidian with Sanscrit super-imposed, but it is an undoubted fact (as we shall see when we come to the Western Coast) that a succession of immigrations has occurred there, and one of them seems to a considerable extent to have flowed over into the Canarese country. Perhaps still more ancient immigrations may have flowed farther, and it might be well worth while minutely to inquire whether any Himyaritic or Egyptian importations can be traced in the Canarese tongue.

In the Tamul country there is little suspicion of Western blood. The dominant tribe is of a very decided Northern character, while the mass of the lower classes is probably more aboriginal than in any other part of India. Consequently most of the Tamul people are small and black, and there seem to be among them frequent traces of aboriginal features.

The superior agricultural class, owning and cultivating most of the land and in possession of many chiefships, &c. are the "Vellallers," a people of whom their own traditions of immigration from the North, coupled with their laws and institutions, leave in my mind no doubt that they belong to the class of later democratic tribes. Much has been done to dissolve the old communal system, but the early descriptions of Vellaller villages, their apportionment of the lands and mode of self-government are exactly such as would describe a Jat village of the present day.

The term Vellaller, like the Canarese Wokul, seems to be used to express a cultivator of the soil, in fact may be translated zemindar or cultivator, just as "Jat" is synonymous with zemindar in the Punjab. Whether the Vellallers are directly connected with the Velmas of the Telagoo country or with the Bellalla Rajas (who, ruling in the Canarese country, carried their arms into the south), I am unable to say. They appear to burn their dead, but are Hindus of the looser sort in their religious observances, and in their rules respecting marriage, &c. Like most of these tribes, they do not ordinarily marry more than one wife, unless the first fails to bring

children. They have apparently some Poojarees of their own caste, but also to some degree accept Bramins as priests. Some of them are educated, or at least some sections of them are quite literate.

Of this sort I have mentioned the Modelliars, who are distinctly stated to be a branch of them, but I am not quite sure whether it actually is so as regards the Pillays. The Vellallers are the principal tribe among the Tamul population in the north of Ceylon. The whole race seems to be an industrious good people.

The cowherds in the Tamul country are it appears called "Idayan," and I have alluded to the learned branch of the cowherd race called Yadavas. I have not been able to ascertain who are the merchant class among the Tamul people, whether Modelliars, Pillays, &c. or whether there are any Banijagas.

The artisans in the south generally seem to be classed in groups, one caste comprising several different handicrafts, the principal of which is that of the Panchalas or Pancham-Bandams, comprising carpenters, blacksmiths, coppersmiths, masons and another which has escaped me.

The principal low caste tribes are the Palli or Pallers, and the Pariahs, who, though somewhat similar in name, are quite distinct and in fact seem to be a good deal opposed to one another one (the Pallers;) forming the lowest grade of what are called the right hand castes, the other (the Pariahs) holding the same place among the left hand castes. Then there are the robber castes, Kallars and Marawars. I have been unable to make out accurately whether these are the same or different, whether Marawar is the name of the tribe and Kallar only means robber, or whether there are two tribes. However predatory their disposition, they are not all now robbers, but seem to form a considerable portion of the settled inhabitants of the extreme south of the Peninsula. In one place I find the Marawars described as very aboriginal in feature, and in that respect giving much ground for the belief that they are descended from the monkeys who assisted in the conquest of Ceylon, while in another place they are said to be well made and featured and of a martial disposition. Probably they vary very much, accordingly as they are more or less crossed with Arians. The Tondimans people are, it appears, mostly Kallars. There seems to be a great resemblance between the position of the

Ramooses of the southern parts of the Bombay territory, the better Beders of the centre of the Peninsula, and the Kallars and Marawars of the south. All are of a sturdy, semi-military, predatory character. They have generally, in times of trouble, acquired considerable position, and their chiefs have risen to be Polygars. Evidently they are superior to the simpler aborigines. The Ramooses are described as ill-favoured, but not altogether different in appearance from the ordinary population. They have many customs which seem to indicate some connection with the northern democratic tribes (see full particulars in the Madras Literary Journal), and have the Rajpoot-like traditions of the Sacred Horse, &c. It is in such tribes that I think an infusion of Yavana blood may well be suspected.

The Pallers are probably related to the Puliars of the Pulney hills, but as settled inhabitants they seem to be decent cultivators of low degree. They are very numerous, and seem chiefly to cultivate kitchen gardens and small farms. They bury their dead, and have Poojarees of their own caste, eat animal food when they can get it, and drink freely. Like most non-Arian tribes, they appear to practice polygamy when they can afford it.

The Pariahs are well known, their name having become proverbial. *They* also seem to be numerous, and somewhat lower in degree than the Pallers, being under native rule a sort of serfs, and living in serf quarters attached to the Vellaller villages. I think that traces of the thick lip and something of the prognathous jaws of their ancestors may sometimes be traced in those whom we see in service. Yet they are certainly very intelligent good servants. It appears that they are sometimes educated, and that there have even been Pariah authors. Perhaps their masters sometimes found them intelligent, and had them educated.

A strong mark that even yet Hindu ideas and manners have not fully taken hold of the extreme south, is this that *there*, as it appears, even some pretty decent and respectable castes bury, instead of burning their dead.

The division into right hand and left hand castes, which prevails all over Southern India is very extraordinary and unexplained. They are sometimes violent factions, and yet, for anything that we are told, there is as little occasion for the feeling as for the feud between the

three-year-olds and four-year-olds in Ireland. The Canarese Bani-jagas seem to be the chief of the right hand castes, with the lower cultivating classes of Hollayers and Kallars under them—while the better classes connected with the land appear to be the left hand, with the Pariah serfs under them. The Abbé Dubois seems rather to reverse this arrangement as respects right and left, but the more recent statements are probably the better. The artisans seem to be divided. I think that the subject deserves farther inquiry. Possibly these factions may represent two different streams of civilisation and domination meeting in the south.

The old dominant tribe of the South Western Coast are the Nairs, who seem long to have dominated that country from the Western Ghats. These Nairs are the chief people of Malabar and Travancore, and the Bunts, who occupy a similar position in Canara, are cognate to them, as are the Coorgs above them. They are chiefly notorious for the singular custom of polyandry, and the consequent order of succession through females. Polyandry is not now universally practised (though not uncommon), but the rule of succession through females is at this day the actual unvarying law of this people. They are a good-sized well-featured race, but rather dark, especially compared to the other inhabitants of this Coast. They are not only soldiers and landholders, but are also often educated, and are then considered to be remarkably good accountants. I have mentioned the prevalence of Bramins in this part of India. They seem to get on very well with the Nairs, and share the land with them. Indeed, it is said, that the Nair women are not always satisfied with their own polyandrical arrangements, and that a good deal of Bramin blood has been infused into the Nair aristocracy by the channel of female descent.

There seem to be a considerable number of the Agrestic slaves of Malabar, the black aboriginal Chermars, to whom, as well as to the Nagadies (if possible still lower), I have already alluded. The remaining important sections of the population of this part of India I shall soon come to, but with regard to the effect of immigration upon them, I shall class them under the head of Borderers.

The system of village communities does not prevail on this Western Coast. The land is there considered to be the private property, in full right, of private landholders who hold separately, more after a modern

European fashion. It is also a general observation that in all hilly and broken countries (such as are the Western Ghats and their spurs on either side) village communities are neither required, nor can be easily formed. In the midst of great plain countries, the cultivation of a community is concentrated within fixed and not distant limits, and concentration of habitation is required for defence. In hilly countries, the occasional spaces fit for cultivation are occupied by petty scattered hamlets and individual habitations.

I have never heard any attempt to account for the singular polyandry of the Nairs. My impression, however, is that polyandry is only a step in advance of the custom which is well-known as existing both among the old Jews and among almost all those modern Hindu tribes which permit remarriage, as well as among some other races, viz., that the wife of one brother passes on his decease to the next brother. Among the Jats, the men strenuously assert this right, and the women generally as strenuously deny it; but as we do not enforce it, it has never been decided which is in the right. At any rate it is always asserted. Now when the woman is recognised to be family property, and when moreover the Hindu and older than Hindu doctrine of joint family property is brought to bear on the matter, it seems to require but a little pressure and a little philosophy to convert a successive holding into a joint contemporaneous holding; especially when childless elder brothers are getting old, and younger brothers are rising up who may supply the want. In an early state of society, we know that in war the women are always carried off as the prize of the victors; consequently, as the fortune of war varies, tribes must often be left with a deficiency of women to an inconvenient degree, which the polyandrical arrangement among brothers (already possessed of contingent remainders in the same woman) obviates. This result seems to have followed among some of the Scythian tribes, and there is a tendency to the same thing among some of the Arian tribes of the Himalayas. In this last case, the cause assigned often is, that the women being good-looking and much prized in the plains, fathers have great temptations to make advantageous matches for their daughters (to sell them, rude people say), and women become scarce in the hills.

We may suppose that the Nairs were perhaps a tribe who had

pushed far ahead of their base of operations, possibly their baggage and most of their women had been cut off, and being left with a scant supply of wives in their new settlements, they may have adopted the present arrangement. Yet it seems one which has little to recommend it to permanence. The extraordinary thing then is, that it appears that in some parts of the Malabar Coast, parts of other tribes have actually to some degree borrowed the practice from the Nairs: There can be nothing about the country unfavourable to the propagation of women: Any cause tending to female infanticide would also tend to polyandry, but this has not been assigned as the reason in Malabar.

In the Canara districts, the Jains are still numerous, many of the Bants, &c. being of this sect, and it appears that this country (known also as the Tulu or Tulava country) was formerly a great stronghold of the Jains and ruled by Jain Rajas.

### THE BORDERERS.

#### THE TEERMEN OR ISLANDERS OF THE SOUTH WEST COAST.

On the Malabar Coast there is a numerous class called Teers or Teermen. They are generally a fair good-looking race, but considered to be of very low caste. Caste ideas are there carried to an extreme unknown in Hindustan, where, with the exception of the unclean scavenger caste, mere contiguity and general intercourse is not supposed to affect caste, and all classes mix freely together. In Malabar and Travancore, the Nairs do not pretend to be more than Soodras, but they make out the Teers and Shanars (who are much the same) to be so infinitely below them, that they must get out of the way when a Nair calls out to announce his approach in the public road. And yet the Teers are by no means a low and degraded caste; on the contrary they are, as I said, a good-looking, and they are also a thriving prosperous people, who are largely educated in the Government schools, obtain much public and private service, are acquiring land, and are in every way well-to-do.

They have (it seemed to me in Malabar) not the least aboriginal trace, but are fairer and in appearance more refined looking than the Nairs. The Shanar women of this class are those about whose liberty to cover themselves a disturbance was made in the Travancore

country by the classes who considered them too low for this decent practice. All the Teer and Shanar people are said to be by caste or profession palm-growers or toddy-drawers, in allusion to the principal product of their native regions. 'Teer' it seems means 'Island' and the Teermen are generally understood to be Islanders or immigrants by sea. Their relationship to the Maldivians is spoken of, but that is a petty group, and the only people to whom it is clear that they are related are the Singhalese. I am not acquainted with Singhalese ethnology, but the Singhalese whom I have seen seemed, I think, to be a fine-featured straight-haired people with no dash of the Indian Aborigines and like the Teers, only somewhat darker and somewhat different in dress, &c. Caldwell speaks of the Teers as being a reflex of the previous Hindoo emigration to Ceylon. Yet if all the accounts be correct, it is difficult to suppose all the congeners of the Teers to have come from Ceylon. Not only are the Teers very numerous in Malabar, where they form a great proportion of the population, but all the Shanars farther south are stated to be of the same race, as are the Billiaru (said to mean 'Bow men'), the lower race in Canara, and a considerable number of people related to the latter who are found in Mysore, and there called Halaya Paika or old Paiks. Some of these people are, however, I believe much darker and less good looking than the proper Teers. The latter are also said to have contributed to form the Moplals. If so large a population has immigrated, it must have been a long time ago. I said I think that there can be little doubt of their relationship to the Singhalese. It would seem from the published accounts, that the Singhalese are not Dravidian in language and manners, but derive the main portions of their language and religion, and perhaps of their civilisation, from Bengal and Magadha. That they received their present Buddhism from Magadha, and much of their language from a Sanscritic source, there can, I believe, be no doubt. But here also Western elements may be mixed with the other, and very careful inquiry is necessary.

It would be curious if it proved that, as it were in the three extremities of India, in Cashmere in the north protected by mountains, Bengal in the east protected by the marshes of the Ganges and Berhampootra, and parts of Ceylon and Malabar on the south protected by distance and water, there remain three remnants of the

older and softer Indian civilisation, not swept over by the democratic tribes of the north-west, and still retaining considerable points of resemblance among themselves.

#### THE SOUTHERN CHRISTIANS.

I have not been able to find any precise ethnological description of the Christians of the Southern Coast, but so far as I can learn, they are principally Shanars.

#### THE MOPLAHS.

I believe that the notoriety of certain events has led most people at a distance to suppose the Moplahs to be a small sect of religious fanatics on the West Coast. Nothing can be a greater mistake. They are a large, most energetic, and most prosperous people; in some industrial respects perhaps the best population to be found anywhere in India. In point of numbers alone they are very considerable. In a large portion of the Malabar country, they form full half the population, and in the Malabar district their total number by census is not far short of half a million. They are also numerous in Canara and very numerous in Travancore. The Lubbays of the Tinnevelly Coasts seem to be as nearly as possible the same race. It is evident then that they are numerous enough to form a small kingdom, and in point of wealth and individual comfort and prosperity they certainly exceed any similar number of any other race in India. I confidently assert that no one can see the comfortable, neat, superior two-storied houses and homesteads of the Moplahs of the West Coast, without feeling that he has come upon a people non-Indian in their vigour, progressiveness, and whole style. One hardly feels oneself in India. There is no doubt that the Moplahs have a very large share of Arab blood. I have not been able to ascertain particulars of the date of their immigration, nor of the parts of Arabia from which, and the tribes from among whom they come, which latter points would be important now that Mr. Palgrave has led us to distinguish among Arab and quasi-Arabs; but the general native belief, which is probably correct, is that the Moplahs are a cross between Arabs and Teermen. The result is a fine, stout, manly, good-looking race. Their religion and much of their energy and manners

are Arab, but at all events they are Arabs of an industrious money-getting stamp. They have most of the trade of the Coast in their hands, and they are rapidly acquiring a larger and larger share in the land, not only inferior rights by settlement and lease, but also superior rights by purchase and mortgage. As respects their religious fanaticism, I believe it will generally be found that fanaticism is most frequently used as an instrument of political warfare, and that in the most sincere it is but a symptom of political discontent. In spite of Mr. Palgrave, I think that when Arabs beyond their own country are Mahommedans, they are pretty zealous, especially when they find themselves confronted with unbelievers. Probably the Moplahs are as good Mahommedans as are usually found, and in time of political discontent there is no lack of religious leaders from Arabia; but in fact I understand that it is perfectly clear to those acquainted with the matter that the Moplah outrages of which we have heard so much, are really political, or perhaps I should rather say social, outbursts of a few individuals among an energetic people, directed not against the British Government or Christian rule, but against Hindu landlords. The land question is at the bottom of it all. It is the old story of an inferior race with the law in their favour, and a more energetic race who wish to progress somewhat more rapidly than a conservative law allows. The more serious attacks on European officers have been made on them, not because they are Christians, but because they have not taken a view sufficiently favourable to the Moplahs in questions between them and the Hindu landlords.

They are a sturdy and independent as well as an intelligent and educated race, and though they make, I believe, capital public servants when they enter our service, they do not much seek it, and circumstances seem to have rendered them somewhat apart and over-independent. There is perhaps less intercourse and friendly feeling than is desirable between the governors and the governed. Still the Moplahs are an ethnological fact, and a strong and rapidly progressing fact; we can't get rid of them, and we must try to guide their energy in the right direction. After all, their outbreaks have been those of a very few individuals, and have only been serious on account of their extreme pluck and energy, with which only European soldiers can cope.

## MIXED AND IMMIGRANT RACES ON THE BOMBAY COAST.

The Mahommedan Borahs, with equal mercantile energy, are a pleasant contrast to the Moplahs in their quiet demeanour and ready acceptance of British rule. They seem to be of the sect of Ismaleahs or Assassins, who are supposed to hold murder among their tenets; but the Borahs are very mild, peaceable, shop-keeping assassins indeed. I believe that the name is that of the Hindu mercantile Borahs, but there is an evident infusion of immigrant blood, which probably came in together with their religion. It is probable that they are a cross between immigrants from the Persian Gulf and Hindu Borahs. Whether called Gulf-Arabs or Persians, the population of the countries at the Northern end of the Gulf is evidently more Persian than Arab, and *there* also seems to be a chief seat of the Ismaleah sect. The Borahs seem to some extent to cultivate and hold land, but their proper avocation is trade; and a most useful and prosperous race they are. They are very numerous in Bombay, and thence west and north-west; they have a large proportion of the trade of Western India, and form an important class in all the large towns up to about the centre of India. Boorhanpore is, I believe, the "city of the Borahs" to which they attach peculiar importance, and where they desire to lay their bones; and they are found in Ellichpore, Nagpore, Indore, Nusseerabad, and many other places in those directions. They are generally a fair good looking people, and deal largely in all sorts of Europe and foreign goods.

The Parsees are so well-known that I need say little of them. They must form altogether a considerable population in the west of India, comprising many humble members in service, &c. as well as merchants. They are, I think, in feature, in the main, of a high-Arian type, somewhat intermixed perhaps after a very long residence in India, and somewhat blunted and thickened as compared to the sharper and more chiselled northern faces; but still there is generally the prominence of feature which we might expect from an extraction originally Persian.

I believe that there are some black Jews on the Western Coast, but the comparatively recent Jew settlers somewhat numerous about Bombay, and who form a considerable community in Calcutta, are one

of the most striking and, I think I may say, handsome of all races. A remarkably showy oriental dress, setting off a complexion almost European, no doubt goes for something ; but still the people themselves are very remarkable. Far from the dingy old-clo' looking complexion which we are apt to associate with European Jews, their complexion is the most bright and transparent looking to be seen anywhere, and the blood seems quite to over-master the faint tinge of olive in their skins. The features are large and prominent, almost to excess, and their forms tall and goodly. I believe that these people are all connected with the Persian Gulf, and that they derive their blood from thence. After Mr. Palgrave's description of the true Arab physique, one may well believe that their traits are really rather Persian than Semitic.

#### THE SCINDEES.

I have already noticed the people of Upper Scinde. The people and language properly called 'Scindee' are almost confined to the lower part of the Province, and I have reserved them to be classed among the Borderers, because they are not altogether an extension of any of the Indian Arians of whom I have treated, but a composite race largely influenced by other elements. The Arabs seem to have conquered Scinde some centuries before India at large was overrun by Mahomedans of other races; and at this day there is both much Arabic in the Scindee language, and probably a good deal of Arab blood in the Scindee people. There is also probably some Persian, some Hindu, and perhaps some aboriginal Koolee blood. In short both the people and the language are altogether composite. The amalgamation does not seem to have had the good industrial result shown in the Moplahs and Borahs. The Scindees are described as well grown and rolust, but dark in skin, debased in morals, and idle. The Delta and the country of the Lower Indus seem to be very ill and insufficiently cultivated; and the people are given to hunting, fishing, and pastoral pursuits quite as much as to cultivation.

#### THE BELOCHEES.

I have not alluded to the Beloches as an element in making up the Scindees, because it would seem as if the Beloches themselves were a

composite people, made up of the blood of Persians and Arabs, and I don't know what besides. However, if that is so, it is not now a mere mixture, but a chemical union of the elements thrown together, and the Belochees, if their language is composite, are still now a people of distinct traits and nationality. They acquired, as is well-known, at a comparatively recent time the dominion of Scinde, and they are pretty well-known as settlers in the North-West of India, say to about as far as Dehli; but they have there none of the dignity and station of the Pathan settlers. I dare say there are decent cultivators among them; but they are more often camel-drivers and such like, and they have not a good name, being generally supposed to have considerable robber and cut-throat proclivities. I don't think they have any villages of their own; they are generally only scattered about in the capacities which I have mentioned. They are fine powerful men, but rather dark. Those whom I have seen of the families of the Ameers of Scinde are fair and good looking, but even in Belochistan I believe it may be said of the Belochees generally, that they are a good deal darker than the Pathans. They are similarly arranged in tribes, and are similarly predatory upon the border; but I understand that they are a good deal less democratic in their constitution, and more amenable to the authority of their chiefs than the Pathans. This too may make them preferable as mercenary soldiers. It is somewhat curious that, while in the west of India Arabs are entertained in that capacity, on the Coasts of Arabia itself and of Africa, Belochees are the people so employed by the chiefs. They are in fact the Swiss of those parts.

I have alluded before to the Brahooes, and as I believe that they are not known as residents within Indian limits, I need not recur to them.

#### THE AFGHANS OR PATHANS.

I have included the Indian Pathans among modern Indian tribes, and have sometimes called the Pathans proper "Afghans," to distinguish them, and in deference to English habit. But among the people themselves, the name Afghan is hardly known.

Physically these people are among the very finest on the earth. And they have a pleasant, frank, simple, unaffected way, that makes

a man at once feel, when he gets among them, that he is out of India. A European will really more amalgamate with a Pathan in a week than with a thorough Indian in seven years.

The Pathans are decidedly high-Arian in feature; and if their features are less universally very high and chiselled than those seen in the northern hills, they have on the other hand more of a broad, robust, ruddy, manly look, and the people are in fact a hardier and bolder people. About Cabul they are fair, but some of the tribes in the lower and hotter hills and valleys adjoining India have somewhat dark skins. Rough, simple, and frank as these people generally look, they are in fact by no means simple. I believe that some of the more isolated tribes, Wazerees, &c., have more simple virtue, but the great majority of the Afghans, partly probably by nature and more in consequence of long dealing with many nations (holding as they do the portals of India), have the reputation of being a very astute, intriguing, ambitious, avaricious, and crafty people. Great allowance must, however, be made for their situation and temptations. One cannot but feel that so energetic and fine a race, living in a country so poor, but the highway of so many nations, must of necessity learn to live a good deal on their neighbours. I am told by officers on the frontier, that in point of bold unblushing lying, a Hindu is a mere child to a Pathan. I suppose this habit comes from long living by their wits. The character of faithfulness, however, is in the main injurious to the Pathans. They are distrusted as mercenaries. It is felt that if they are always ready to do any work when it is made worth their while, they are also people of a calculating disposition, who are very likely to turn, when the advantages preponderate in favour of another policy; as the Persians found to their cost in the last century, when they too much availed themselves of the services of the Afghans. At present they are very popular in our native army, and certainly make capital soldiers. But they are fickle and uncertain, and seldom serve long without a break. A man gets a message to say that it is absolutely necessary that he should come home and murder his uncle, and off he goes with or without leave. They come back, however. It is a thing to be understood that the Ameer of Cabul pretends to no authority whatever over the Eastern Afghan tribes. They are avowedly politically quite independent,

while in one sense, without our attempting to interfere in their internal affairs (that they will not permit for an instant), they are becoming more and more our military retainers. A very large number of them pass through our service, and a steady income is derived from it.

The Pathans south and south-west of Peshawar are pure and rough, but the Eusofzies and tribes to the north seem to differ considerably in character. In fact, as I have before mentioned, the Pathans are comparatively recent conquerors and colonists of the northern hills and valleys. They have there mixed much with people of an Indian type, pre-Hindu it may be, but probably the ancestors of Hindus. These people have not the Hindu caste which, for the most part, prevents amalgamation on the part of the Khatrees, and I think there can be little doubt that their blood has much influenced the character of the Eusofzye clans. The purer Afghans are extremely illiterate, and the very opposite of bigots in matters of religion. The Eusofzies are perhaps all the fairer and handsomer for the intermixture of blood; they are also more civilised in their manners and much more literary. And they have imbibed very much of that veneration, that religious capacity, which distinguishes the oldest Indian branch of Arians. Mahomedans as they are, they really seem to have some religious zeal, and they are very much priest-ridden. In fact the Akhoond of Swat and other priests have, to some extent, induced the tribes to submit to a certain and partial religious government, if it can be called by that name. The priests seem to have considerable grants of land, and at any rate succeed in levying a regular tithe from the landholders and cultivators, whose differences they settle as far as they can. It is among these people that discontented Mahomedan immigrants from Hindustan have found some sort of shelter. It should be understood that intermixture has not destroyed the military qualities of the Eusofzies themselves. With an inferior population at home to cultivate their fields, they are amongst the most notable Pathan soldiers who have pushed their fortunes in India.

The proper Afghan constitution is democratic in the extreme, so much so that any sort of government on a large scale is almost impossible, and the Ameer's authority is confined to a few open valleys (for the most part cultivated by inferior races) and to a very uncertain

feudal chiefship over the western clans. They have their regular system of democratic representation and self-government by the assemblies of Jeergahs and Oolooses; but like most rude people so situated, no man's nationality goes beyond his own clan (just as in civilised Greece, it did not go beyond his own city), and within the clan order is very insufficiently maintained. Afghan individuality in very irrepressible.

A considerable population of proper Pathans are now our subjects in the districts of Peshawar and Kohat, and it would be very interesting to examine critically, how far their constitution is really different from that of the Jats and other democratic Indian tribes. It is generally said that as a people they are very different, and non-Indians must be very different from Indians. The language too shows that, Arian though they be, the Pathans are a branch separated by a wide interval. But still I have not been able to discover by cursory inquiry that their constitution is other than that of the more democratic Indo-Germans. I rather incline to think that they are probably of the same stock as the Jats and other tribes, but of a common ancestry, long anterior to the entrance of the latter into India. It may be that while some tribes poured into India, others have been gradually working their way though the hills, dispossessing the Khatrees and Khasas and more aboriginal Caucasians who held what is now modern Afghanistan.

#### THE ABORIGINAL ARIANS OF THE INDIAN CAUCASUS.

I have lately called attention to our ignorance of these most interesting people, probably the remains of the pre-Hindu ancestors of the earliest Hindus. Of the Kaffirs of the most inaccessible portions of the range, between the Kashgar river and Bameean, we have heard a great deal, but learned almost nothing. They are thought to be related to Europeans, because they sit on chairs and drink wine copiously. They must be a sturdy race, to have maintained their independence so long. All the other tribes seem to be more or less Mahomedans. There are the "Neemchahs" or half breeds on the southern slope of the Caucasus, between the Afghans and the higher peaks, speaking a language with a strong affinity to the Indian tongues, and which also seems to present some curious affinities to

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the Latin. In the lower country near the debouchure of the Kashgar river, the people speak a mixed language called "Laghmanee." In the upper valley of that river, the name Kashgar seems to mark the trace of early Khasas.

The ancient language of Swat seems to have disappeared, and the country is now Pathan, with a subject race of aboriginal blood, that is pure Arian aborigines. But farther north, in the valleys of the Ghilghit river, running into the Indus from the West, we have an Arian people speaking a language of their own, which is cognate to the tongue of the tribes east of the Indus in and about the country called "Chilas." Some of these latter are independent and scarcely known, but most of this country, and also Ghilgit, is now subject to the Maharajah of Cashmere. The "Dards" seem to be among these tribes.

It may be asserted of all these Caucasian tribes (excepting the Kaffirs of whom we know so little) that, while they are physically as handsome and fine as possible, they are not so democratic and sturdy in independence as the Afghans. We know very well what an undertaking it is to subdue, still more to rule, an Afghan tribe in their own country. But the Afghans have certainly subdued many of these Caucasians. The Maharajah of Cashmere has conquered and governs many more. Those in contact with our own frontier are quiet and not troublesome. And in Kashgar it is understood that the people submit to their rulers, in a way which Afghans will never suffer. Altogether it may be assumed that this race is less independent (though it may be more intellectual) than the democratic races; more amenable to Rajas and Priests, and altogether just such a people as we might expect to give birth to Khasas and early Braminical Hindus. Living in countries most favourable to the Vine they seem to be generally given to the use of wine. Whether the use of chairs extends beyond Kaffiristan I cannot say. We have in fact everything to learn about these people and their languages.

#### THE NORTHERN BORDERERS OF MIXED TARTAR OR THIBETAN BLOOD.

The Mongolians and Arians seem to cross well. Most of the tribes falling under this heading are physically vigorous and industriously energetic.

I have before alluded to the Hazarahs beyond Cabul and Ghuznee, who come down to Peshawar and the Punjab for labour. This name "Hazarah" has no connection with that of the Cis-Indus district so called from a town of that name. These Hazarahs are Persian in speech, Sheeah in religion, and decidedly Mongol in feature, characteristics, which would seem to tally with the story of their having been a body of slaves in the train of some Mahomedan conqueror; but whether this is really historical, I cannot say. They are very independent and industrious, decidedly a good race.

The people of Ghilgit are the farthest Arians of the country whence the Indus flows. To the north the people are of Turkish race, and in the valley of the Indus above the junction with the Ghilgit river are the Bultees of Iskardo, &c. The language of the Bultees is decidedly Thibetan, and their features show a large proportion of the blood of that race. Some of it may be, as they say, that of Alexander, for anything I know to the contrary; but we should hardly have heard of it, if they had not been Mahomedans. They are Sheeahs, as are several tribes in those higher countries, a circumstance which has not been explained. They seem to be a good, stout, quiet race. The Maharajah of Cashmere (who rules the country) has enlisted many of them into his service, apparently with advantage.

In the upper valleys of the Sutlej, in Spiti, Kanawer, &c. there are mixed races exhibiting much Thibetan blood, and apparently more Buddhist than Hindu in religion. A very Thibetan-looking colony used to be settled at Mahasoo just beyond Simla, and people of that race did much of the heavier work, carrying wood on their backs. They are powerful, ruddy-looking people, and as entirely unlike Indians as anything one can imagine. The women especially are remarkably fine females in an industrial sense; but in other respects, whatever they may be from a Turanian point of view, they are not likely to be dangerous to the Arian visitors to the sanatorium.

From this point for many hundred miles to the east, all the passes, the very crests and centres of the passes through the snowy range, are occupied by a peculiar tribe who almost monopolise the trade across, principally carried on upon the backs of sheep. They also cultivate some land. They are known as the "Bhooteas," but that is so wide a word (in fact identical with Thibetan) that it is little guide to us.

I believe that there are some very curious tribes in valleys near and immediately beyond the snows, but I have not the means of specifying them.

As respects the Himalayas generally, the following may, I think, be said. From Cashmere eastwards, all the easily accessible portions of the Himalayas are occupied by perfectly Arian Hindus, as far as the eastern border of Kumaon and the Kalee river, separating that Province from the Nepal dominions; the Thibetans being here confined to the valleys about and beyond the snow. Throughout the whole length of Nepal again people of Thibetan blood have partially flooded over into the Nepal country, have there met and intermixed with other races, and have formed mixed tribes who appear to be generally (the proper Goorkhas perhaps excepted) more Thibetan than Indian in physiognomy and speech, but are or affect to be more Indian than Thibetan in religion and manners, doubtless under the influence of the dominant "Khas." East of Nepal, in Sikkim and Bhootan, Thibetans are altogether dominant, and the Hindu element almost disappears. The soldiers whom we erroneously call 'real Goorkhas' are mostly of the Gurang and Magar tribes of western Nepal. Their features are ultra-Mongolian, but they are small, whereas the Thibetans are generally large. Of their pluck and energy there can be no doubt. At the Simla Government School, the children from a Goorkha Regiment were found at least to equal, in fact rather to beat the Hindus. They themselves affect to be Hindus, and stoutly deny being Buddhists, though they are free from most disagreeable Hindu prejudices. The Newars, the cultivating peasantry of the valley of Nepal, are stated to have Thibetan looking features, with a fair and ruddy complexion. Both their language and that of the Gurangs and Magars seem to be in the main Thibetan, at least in the fundamental numerals, pronouns, &c. Still more is it so as regards the languages of the tribes farther east, Kerantis, Murmis, and others, of whom I know little.

The Lepchas of Sikkim and Lopas of Bhootan are unmitigated Buddhist Thibetans. There seem to be several tribes of "Rong," "Khampas" or Kambas, and Limboos, who come from different parts of Thibet, and there are some differences of language. The Lepcha tribes are described as a dirty, good-natured people, in character said

to be something like the Mongols from beyond the Chinese wall, as described in recent accounts. The Lopas, &c. of Bhootan seem to be more difficult to deal with. Farther east are, I believe, still wilder Thibetan tribes. All these people are idle, but very powerful; and when they do work, they carry enormous loads, both men and women. They are said to carry up to Darjeeling as much as 250 lbs. in a single load. And at some of the Hill Stations on the Eastern Frontiers of Bengal, I understand it is the fashion that a European visitor is carried up the hill in a basket on the back of an old woman.

#### THE PEOPLE OF THE EASTERN FRONTIER.

The people of the very lowest hills of Bhootan and of all the low country at their foot are of another race, the Meches or Mechis (before alluded to in marking the boundaries of the Indian Aborigines), who are apparently the same as Hodgson's "Bodo." They are, it appears, now quite ascertained by their language to be Indo-Chinese of the Lohitic or Burmese branch of the Turanian family, a connexion which their physiognomy confirms. They seem to be a good-sized, fair, but rather yellow-looking people. They are described as rude in their agriculture (using the hoe, not the plough), and erratic in their habits, but good-natured and tolerably industrious. They profess a kind of debased Hinduism, but are very omnivorous in their habits. The Dimals are a smaller but somewhat similar tribe, speaking a language which in some degree differs.

Passing over the Garrow and Cossya Hills to Cachar, the Cachar people again are of the same race as the Mechis. So, it would appear (so far as I can gather), are the Nagas, Abors, and some other tribes in the hills bordering on Assam. There are aboriginal tribes of Tipperah and Munneepore, but of their ethnology I am not informed. In the Cossya hills are an isolated body of people of the Taic or Siamese race. Of this race were the Ahoms who once ruled Assam, as are, it appears, the Khamtis and some other tribes of the more distant hills of that Province; also the Shan tribes of the Burmese interior. The Karens are, I rather think, Lohitic. It is evident, however, that on this Eastern Frontier I have got into a vast ethnological region, with which I have no personal acquaintance, and with which I cannot deal farther than to point out the vast field for

inquiry, and to suggest how great a service any one would render, who would briefly classify and describe these tribes. There are endless distinct tribes, even the names of which I do not attempt to give.

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POSTSCRIPT.

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When this paper had nearly passed through the Press, Colonel Dalton's paper on the Kols (to the want of which I have alluded) was received in the office of the Society, and it will be printed along with this. I have only had an opportunity of hastily glancing at it, but have seen enough to be sure that it will admirably fill up just what was wanting in regard to our knowledge of the aboriginal tribes, and will be read with extreme interest. The two papers, thus published together, having been written without concert, may be found to express or assume different opinions on some points; but I hope that the general result of Colonel Dalton's paper will tend rather to confirm than to contradict most of that which I have written. In regard to the general Negrito character of the Dravidian tribes he fully bears me out. At the same time he seems to point to a considerable difference in the type of the Moondahs, Hos, Sontals, and others speaking the language which I have called Kolarian. He seems in some degree to support Major Tickell's account of the superior physical qualities of the Hos, but he also tells us that other tribes of this race are much more degraded and less good looking. In fact, the principal tribes of the race, the Moondahs and Sontals, are now extremely well known, and it is patent to all that they are among the ugliest of mankind. The Sontals are a proverb for a combination of simple good nature and ugliness. Still, I quite admit that most of these people are less black and Negrito-looking than the Savage Dravidian tribes. I think I have already suggested, and I am inclined to repeat, that they look in some respects more like Hottentots than Negroes. It is very much to be desired that a more complete study of their language should in some degree break through the complete isolation which has been hitherto attributed to it. It seems to have no affinity to the more Eastern tongues so far as has yet been discovered.

I have been struck by those parts of Colonel Dalton's description, which would seem to show, among the more civilised of these tribes, some institutions akin to those of the modern Hindoos. Not only does it appear that the Kolarian tribes burn their dead, but also I notice that the systematic division of their tribes is very similar to that which I have described among the Hindoos, and especially that they have the peculiar rule which forbids intermarriage among people of the same tribe, and imposes on every man the necessity of taking his wife from another tribe. The question will be, whether the practices common to Kolarians and Hindoos are borrowed by Kolarians from Hindoos, or by Hindoos from Kolarians. Many interesting subjects of inquiry may be opened out.

Colonel Dalton's account of the tenacity with which some of the tribes cling to their ancient rights in the soil, seems somewhat at variance with the information which I had noted respecting their ready emigration. That many of them do emigrate, is certain; but perhaps my information has reference to the Dravidians and less settled tribes,

Colonel Dalton in one place speaks of the Kolarian Hos as more dignified and more like North American Indians, and the Dravidian Oraons as more like light-hearted Negroes; but in other places he seems rather to confirm my suggestion that the Kolarian Sontals and Moondahs are an especially light-hearted race, and the Dravidians less so; the Dravidian Oraons having, he says, learned their songs and dances from the Moondahs and other Kolarians among whom they have settled. Certainly the flat and broad-faced Sontals and Moondahs seem to bear no resemblance to the North American style of feature.

Colonel Dalton more than confirms what I have said in regard to the increase of numbers of the Kolarian tribes of the Chota-Nagpore division. He tells us that, notwithstanding their tendency to drink, they increase rapidly. He evidently takes a most favourable view of them, and I think it impossible to doubt that we have in these tribes, in a healthy and accessible country in the immediate vicinity of the Capital of India, a people whom it behoves us to cherish and utilise—a people comparatively free from the peculiar vices of the modern Indians, simple, truthful and ready to receive our religion and the

impress of our manners—possessed moreover of much industrial energy, laboriousness, and ductibility. To make such a people thoroughly our own—to render the central and healthy plateau occupied by them a completely Christian and Anglicised country, would be (higher considerations apart) a very great source of strength and comfort to the English in India. I think that every effort should be made in this direction.

Colonel Dalton has sent with his paper a grammar of the Oraon language by the Rev. Mr. Batsch. This is a Dravidian tongue. The Rev. Mr. Phillips has published a grammar and introduction to the Sontal language, but he has put it in the Bengallee character, somewhat unfortunately, as I think—for although I have not advocated the Romanising of the written vernacular languages, I should prefer to give to the Kolarian tribes, hitherto entirely without a written character, our own Roman letters, rather than those of the foreign and hated Bengallee. Since then Mr. Phillips's work is not available for my present purpose, I propose to re-publish, for comparison with Mr. Batsch's Oraon grammar, the brief grammar of the Kolarian "Ho" language, published by Major. Tickell in an old number of the Society's Journal. I hope then, by placing, as appendices to the present publication, vocabularies of test words both Arian and Aboriginal (including in the latter both Dravidian, Kolarian and Indo-Chinese dialects), and the sketches of Dravidian and Kolarian grammar, to supply the rough elements for a comparison of all the dialects of India. And I trust that if a beginning is thus made, we may hereafter obtain much information, more full, ample, and complete.



*The "Kols" of Chota-Nagpore.—By Lt.-Col. E. T. DALTON, Commissioner of Chota-Nagpore.*

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The country called Chota (or properly Chuttia) Nagpore is the eastern portion of the extensive plateau of Central India on which are the sources of the Koel, the Soobunreka, the Damoodah and other less known Indian rivers. It extends into Sirgoojah and forms what is called the Oopur Ghat or highland of Juspore, and it is connected by a continuous chain of hills with the Vindhyan and Kymore ranges, from which flow affluents of the Ganges, and with the highlands of Omerkuntuck on which are the sources of the Nurbudda. That the population of this watershed is found to be, for the most part, a heterogeneous collection of non-Arian tribes, is in itself a fair proof that these tribes were at one time the inhabitants of the plains who, driven from their original sites at different periods by Braminical invaders, gradually fell back, following converging lines of rivers in their retreat, till from different directions, nations, some bearing marks of common origin though separated for ages, others bearing no trace of such affinity, met at the sources of the streams, and formed new nationalities in the secure asylum they found there.

The plateau averages more than 2,000 feet above the sea level; it is on all sides somewhat difficult of access, and it is owing to the security thus given, that the primitive tribes, still found on it, retained for ages so much of their independence and idiosyncrasy. After overcoming the difficulties of the approach, these first settlers must have rejoiced at finding they had not merely reached the summit of a range of hills, but had ascended to a new country, well suited to their wants and out of reach of their enemies; and here they made their final stand.

They found a genial climate at this elevation and a well-wooded undulating country, divided and diversified by interior ranges of hills uplifting the fertilizing streams, or breaking out in rocky excrescences, sometimes in vast semi-globular masses of granite, like sunken domes of gigantic temples, sometimes in huge fragments piled in most fan-

tastic forms, viewed with awe by the new settlers as the dwelling places of the local gods.

The total area of the plateau thus occupied is about 7,000 square miles, and the present population may be estimated at a million; more than half of whom are of the race best known to us by the name of "Kol."

This word is one of the epithets of abuse applied by the Braminical races to the aborigines of the country who opposed their early settlement, and it has adhered to the primitive inhabitants of Chota Nagpore for ages. It includes many tribes; the people of this province to whom it is generally applied, are either Moondah or Oraon; and though these races are now found in many parts of the country occupying the same villages, cultivating the same fields, celebrating together the same festivals, and enjoying the same amusements, they are of totally distinct origin and cannot intermarry without loss of caste.

The received tradition is, that the Moondahs first occupied the country, and had been long settled there, when the Oraons made their appearance. The Moondahs believe themselves to be autochthonous, or at all events declare that they are all descended from one man and woman, who were produced or established themselves, at a place called Satyomba, which is revered by the whole tribe as the cradle of the race.

Satyomba is the name of a pergunnah on the edge of the plateau overlooking the valley of the Damoodah. It is not improbable that the Moondah race had previously occupied a position on that river, and that, in departing from it, the division took place which separated them from their brethren the Sonthals. The Sonthals, unquestionably a branch of the same people, have to this day a veneration for the Damoodah, and call it their *sea*; and the ashes of their dead are always preserved till they have the opportunity of disposing of them by throwing them into that stream or burying them near its banks. The Sonthals, remaining in the plains, had easy access to the river and retained their veneration for it. The Moondahs, settling on the highlands, were less faithful to it, but from its name they might claim it as their own; for, though Damoodur has been adopted as one of the sacred names of "Krishno," does not Dah-Moondah in their own language mean "the water of the Moondah?"

We find the Moondah settlements chiefly in the eastern and southern parts of Chota-Nagpore, the Oraons predominating in the western; and this strengthens the hypothesis that the Moondahs ascended from the eastern side of the plateau.

The intimate connection between the Sonthals, the Bhoonij and the Chota-Nagpore Moondah tribes has long been known. I have pointed out their affinity with the Korewahs of Sirgoojah and Juspoor, and have given some account of that wild clan.\* I have now to add to the list the "*Kheriahs*," another aboriginal tribe settled on the plateau of Chota-Nagpore, and the "*Juangas*" of the Cuttack tributary mehals, whose women are so conservative in their notions, that they still adhere to the fashion in dress first introduced by mother Eve and wear nothing but leaves. I had often met with individuals and families of the Kheriah tribe, living in mixed communities, but from contact with other races they had lost much of their individuality, and I found it difficult to place them.

This year, I happened to come upon some of their principal settlements in pergunnah Bussiah, on the southern borders of the portion of the plateau occupied by the Moondahs, and collected round me the elders of the tribe. These settlements all lie near the Koel, one of the streams from the watershed of Chota-Nagpore, which, after its union with the Sunkh in Gangpore, becomes the Bramni and terminates its career at Point Palmyras.

The Kheriahs venerate the Koel as the Sonthals the Damoodah. They were in all probability once settled on its banks in the lowlands, and clinging to it in their retreat and adopting the place of refuge that it led to, regard it still as communicating with their fatherland, and with this idea the urns containing the ashes of their dead are dashed into a rock-broken rapid of the river, so that their contents may be rapidly borne away by the current to mingle with the ashes of their forefathers.

They say their first settlement was Pora, a village on the Koel, and that there were no Moondahs in the country, at least in that part of it, when their ancestors first came there. There is sufficient resemblance between the Kheriahs and Moondahs in language and customs

\* As. Soc. Journal, Vol. XXXIV. p. 1.

and appearance, to make us certain of their consanguinity, and at the same time sufficient divergence to lead to the inference that the relationship is a remote one, and that the two branches of the family had been long separated when they met again on the banks of the Koel. These points of resemblance and divergence I will describe, when treating of the manners and customs of the race generally.

The Juangas or Puttoons (leaf-clad) are noticed in a paper by Mr. E. A. Samuells.\* They are found in the Cuttack tributary mehals of Keonjur, Pal Lehra, Dhekenal and Hindole. They are thus isolated from all other branches of the Moondah family, and have not themselves the least notion of their connection with them; but their language, a specimen of which is given in the table appended, shews they are of the same race, and that their nearest kinsmen are the Kheriahs, a fragment of the tribe left behind when the remainder ascended the valley of the Koel. The Hos of Singbhoom have a tradition that they once wore leaves only, and not long ago threatened to revert to them, unless cloth-sellers lowered their prices!

The Bhoomij form the majority of the population in all the estates of the Manbhoom district to the south of the Kassae river. As they approach the confines of Chota-Nagpore, they appear to be called indiscriminately Moondahs or Bhoomij, and they intermarry. More to the east the Bhoomij have become Hindooized, or rather Bengaleeized, to a great extent, and many of them have acquired considerable estates, like the Mankees of Chota-Nagpore, and positions of influence as "Sirdar Ghatwalls," the hereditary custodians of the passes.

The characteristics of the tribe that they most tenaciously cling to, are the national dances and songs. The Bhoomij appear to have been the first to colonise the large pergunnah called Dhulbhoom or Ghatsillah, attached to the Singbhoom district. The Rajah or Zemindar is, in all probability, himself a Bhoomij by race, though (without thereby improving his pedigree, so far as I can see) he endeavours to conceal his extraction under one of those hazy traditions that Bramins always have ready for families in want of them. His ancestor, according to their version, was a washerman, a Dhoby who

\* As. Soc. Journal, Vol. XXV. p. 295, 1856.

saved the goddess Kali when, as Runkini, she ran away from Pochete. Discredit has attached to the Bhoomij and Sonthal in consequence of the human sacrifices offered at this shrine of Runkini, but the whole establishment and ritual are essentially Braminical. The Bhoomij and Sonthal races personally do not much care for the blood-thirsty goddess. The Bhoomij is the branch of the Moondah race that has spread farthest in an eastern direction. Bhoomij are to be found in Mohurbhunj and Keonjur, though perhaps not so much at home there as in Dhulbhoom.

The Sonthals are now chiefly massed in the Sonthal Pergunnahs, but they muster strong in Mohurbhunj, and there are several colonies of them in the Singbhoom district. They are an erratic race, and their ancient traditions are lost in the history of their modern migrations; but my idea is that their chief settlements in Bengal were once on the Damoodah river, and that they gave way to the Koormees, an industrious Hindoo race, who now form the bulk of the population in that part of Manbhoom.

In a southerly direction the next tribe of "Dasyus" that we come across are the Khunds, but I am unable to trace any point of resemblance between them and the Moondah, either in their religion with its morbid superstitions and horrible human sacrifices, or in their language.

To trace the further ramifications of the Moondahs we must proceed west, not south, and take up the link in the hills and highest tablelands of Sirgoojah and Juspore, where we find the wildest of the race in the Korewahs. I have given a brief note on them in the paper above quoted, and have only to add that the Korewahs are quite unaware of the connectionship between themselves and the Kols. They do not acknowledge, and do not see, that the languages are almost identical. This would not, I conceive, have been the case if the Korewahs had broken off from their Satyomba kinsfolk.

The Korewahs are another branch of the family, and the history of their migrations is no doubt an independent one. It is probable that they were forced back into the hills they now occupy by the Gooands, as a Hindooized clan of that people became the dominant race in the plains of Sirgoojah. Moreover, as pointed out by Mr. G. Campbell, at a late meeting of the Society, we have in

this Journal\* a brief notice of a tribe called "Coour Gooand," and a vocabulary which proves them to be not Gooand at all, but another branch of the great family we are describing, occupying the Gavilghur range of hills near Ellichpore. Dr. Latham mentions in connection with them another tribe which he calls Chunah, but I have no further information about them. If the investigation is carried out, we shall, no doubt, find connecting links in the intervening ranges of hills.

Thus we have in the Coours of Ellichpore, the Korewahs of Sirgoolah and Juspore, the Moondahs and the Kheriahs of Chota-Nagpore, the Hos of Singbhoom, the Bhoomij of Manbhoom and Dhulbhoom, and the Sonthals of Manbhoom, Singbhoom, Cuttack, tributary mehals, Hazareebagh and the Sonthal Pergunnahs (the author of the introduction to the Sonthal language, the Rev. J. Phillips, adds "Nákâles and Kodas," I do not know where they are to be found,) a kindred people sufficiently numerous, if united, to form a nation of several millions of souls. They were, in all probability, one of the tribes that were most persistent in their hostility to the Arian invaders, and thus earned for themselves the epithets of "worshippers of *mad* gods," "haters of Bramins," "ferocious lookers," "inhuman," "flesh-eaters," "devourers of life," "possessed of magical powers," "changing their shape at will."† To this day, the Arians settled in Chota-Nagpore and Singbhoom firmly believe that the Moondahs have powers as wizards and witches, and can transform themselves into tigers and other beasts of prey, with the view of devouring their enemies, and that they can witch away the lives of man and beast. It is to the wildest and most savage of the tribe that such powers are generally ascribed; and amongst the Kols themselves the belief in the magic powers of their brethren is so strong, that I have heard converts to Christianity assert they were first induced to turn to our religion, because sorcery had apparently no power over those who were baptized! The upper classes of the Moondahs, those who aspire to be Zemindars, have assumed the "*poita*" and taken to Bramins and Kali, but the mass of the people adore their "mad gods" still, after their own primitive fashion. The great propitiatory sacrifices to the local deities or devils are carousals

\* As. Soc. Journal, Vol. XIII, p. 19.

† See Muir's Sanscrit texts.

at which they eat, drink, sing, dance and make love, but though the austere "munis" of old must have stood aghast at such wild ebullitions of devotion, it is a fact that whilst the mass of the Kols have not taken to the worship of any Hindoo idols, the Hindoos settled in the province think it expedient to propitiate the gods of the Kols. It is gratifying that the darkness in which this primitive and interesting people have so long dwelt, is now being dispelled by a brighter light: that their paganism is at length yielding to the gentle influence of Christian teaching; that there is abroad amongst them a widespread feeling that a change is necessary, a change more perfect than can be typified by the adoption of a "*poita*."

As the Moondahs first settled at Satyomba spread over the country, they formed themselves into communities called Purhas, or the country was divided into Purhas, each consisting of twelve or more villages under a chief. They do not appear in their earlier days to have acknowledged any chief, superior to the head of the Purha; the ordinary business of the community was conducted by him, and on extraordinary occasions, the Purha chiefs met and took counsel together.

Vestiges of this ancient system are still met with in many parts of the country. Though ignored as geographical or fiscal or territorial divisions, the Purhas still exist in the eyes of the people, and they still have chiefs whom they call Rajahs, men of influence and weight, who preside when a meeting is called to adjudicate regarding breaches of social observances, and who take the lead on the great hunting expeditions and national festivals.

It is said that the Moondahs were in a very wild state, occupying but a small portion of the plateau, when the Oraons, driven from the Rhotas hills, swarmed into the country, and sought and obtained permission to occupy it jointly with the Moondahs. Both Moondahs and Oraons declare there was on this occasion no fighting. The former were glad to obtain assistance in reclaiming the country they had adopted, and the Oraons are said to have come with large herds of cattle and implements of husbandry previously unknown to the Moondahs.

It is probable that the Moondahs of those days were not more advanced than are to this day their brethren, the hill Korewahs of Sirgoojah, a tribe that know not the use of the plough: but they

were great hunters, and could sing and dance and make merry. The Oraon youth and maidens speedily acquired the songs and the steps, and this I doubt not aided greatly the harmonious blending of the two peoples.

There are no ancient temples or other antiquities on the plateau of Chota-Nagpore to indicate that the early Braminical races or Buddhists ever obtained a footing there; there is no tradition even of the "Munis" having sought retreats amongst its rocks or by its waterfalls for their devotional exercises. We find such monuments in Sirgoojah to the very foot of the western face of the plateau; and, as I have recently described in a paper devoted to the antiquities of Manbhoom, we find numerous remains of Arian colonization close to its southern and eastern approaches, but none on the plateau itself. Left to themselves, the Kols increased and multiplied, and lived a happy arcadian sort of life under their republican form of government for many centuries; but it is said that a wily Bramin at last obtained a footing amongst them, and an important change in the form of government was the result.

The Rajah of the Purha of which Satyomba was the head quarters, was a Moondah named Madura. His occupation of the supposed cradle of the race gave him precedence in the confederate councils; and a child of his house, reared in it if not born there, was, through his influence and by the advice of a Bramin he had taken into his service, elected supreme chief over the whole confederacy; but as it would not suit the noble family, his descendants, to have it supposed that their ancestor was one of the despised race called Kol, they have adopted the following legend as their origin:—

"When Jonmajoya, Rajah of Hustinapoor, attempted the destruction of the Nags or Serpent race, one of them, Poondorik, assumed the form of a Brahmin and went to the house of a Bramin at Benares to study the 'shasters.' The Benares Bramin, pleased with the intelligence and grace of his pupil, gave him his only daughter 'Parbutee' to be his wife. Poondorik and his wife, Parbutee, together visited Juggernath, and on their return, passing through this country, then called 'Jharkhund,' the forest land, she was seized with the pains of labour near Satyomba, and gave birth to a child and died.

"Madura's Bramin happening to pass, bearing an image of the sun worshipped by the Moondahs, saw the child sleeping and protected by a snake with expanded hood. This snake was Poondorik, relapsed into his original form. He addressed the Bramin, told his own story and the story of the child's birth, declared that the babe was destined to be a great Rajah, and that his name was to be Funimatuk Roy, 'the snake hood crowned,' a worshipper of the sun, whose image the Bramin bore, and the Bramin was to be the family priest. The snake then vanished. The child was taken to Madura's house and adopted and brought up with his own son, a boy of much the same age. When Funimatuk Roy was twelve years of age, Madura convened the Purha chiefs, and it is said the neighbouring Rajahs, including the Rajah of Sirgoojah and the Dytya Rajah, and suggested that one of the two lads should be selected as the Rajah of Nagpore. The lads were subjected to an examination, when it was found that the snake boy had already acquired all the accomplishments necessary for his destined position, whilst the other was a mere rustic. It was then (according to the annals of the Nagbunsee family) ruled, that Funimatuk Roy and his heirs for ever should be the Rajahs, and that the Moondah's child and his descendants should bear burdens, and thus all who claim to hold lands as descendants of the Moondahs and Oroans that first cleared them, are bound, when called on, to bear the burdens imposed on them by the Rajah and his assigns!"

It is frankly admitted in the annals I quote from, that a difficulty arose regarding Funimatuk's birth, when he sought in marriage the daughter of the Sikurbhoom (or Pochete) Rajah. The Sikurbhoom family priest was sent to examine the certificates of birth and found none: but Rajah Matuck Roy prayed for the intercession of his *ophidian* parent; he had calmly contemplated his position and put it to his father, that if the Sikurbhoom priest was not satisfied, a Moondah or an Oroan girl should become Queen of Nagpore. This was not to be thought of. So the Nag once more entered an appearance, satisfied the Bramin by a relation of wonders, and since then the Nagbunsis have always intermarried with the best Rajpoot families. It is particularly noted that at Funimatuk Roy's wedding-feast the Oroans and Moondahs all got drunk and began to fight, and the Rajah of Nagpore and Madura had to obtain the assistance of his guests, the

Rajah of Sirgoojah and the Dytya Rajah, to separate them. The Dytya Rajah was, I presume, the Rajah of Patkoom, as that family bear the surname of Adytya to this day.

The marriage was celebrated at Satyomba, and there the first Rajah resided in a mud fort. The fourth in descent from Funimatuk moved his court to Chuttia, where we have the remains of a fort with masonry walls and some stone temples ascribed to him. Subsequently Doisa was chosen as the seat of Government, and here are some fine buildings, shewing that the family were improving in art and in civilization, when they moved there. This site also has been abandoned, and the present Rajah lives in a very mean house at Palkote.

The sway of the Rajah of Chota-Nagpore does not, in early times, appear to have extended beyond the plateau or fringe of hills which divide it from the plains, but the Moondahs overran those limits and formed colonies in what are now called the five pergunnahs—Silli, Tamar, Barundah, Rabey and Boondoo—which did not acknowledge the Rajah-elect of Satyomba. In time, each of these pergunnahs elected a Rajah of its own, who (their descendants declare) were each of a divine or miraculous birth, like Funimatuk Roy; and on the strength of it they all call themselves Chuttrees and wear the cord. They intermarry amongst themselves or with the petty Rajahs of Manbhoom who are of similar origin; so their claim to be Chuttrees, or at all events Hindoos of respectable caste, is not disputed. According to their own tradition, the Rajahs of the five pergunnahs first forfeited their independence by submitting to pay tribute to the Rajah of Cuttack. Eventually, however, they were subjugated by the Maharajah of Chota-Nagpore, and submitted to pay tribute to and accept the "Tilluck" or symbol of investiture from him. The Moondahs comprise about two-thirds of the population of the five pergunnahs, and all who are not Moondahs are settlers of no very ancient date.

In the northern and western parts of Chota-Nagpore, the authority of the old Moondah or Oraon chiefs has been almost effaced by the middlemen who have been introduced by the Zemindars as more profitable farmers, or by the Bramins, Rajpoots and others to whom, for religious or secular services, grants have been made by the Maharajah and members of his family holding under him. In many instances, the Kols have been entirely dispossessed of the lands their

ancestors brought under cultivation, and ryots from other parts of India, more subservient to the wishes of the farmers, have been introduced. In some villages the peasant proprietary right of the aborigines has been entirely extinguished, and the few of that class that remain are found in the position of farm labourers.

In the southern parts of Chota-Nagpore the Moondah chiefs, there as in Singbhoom called Mankees, have managed to retain their position, first, by resisting in open arms all attempts to encroach upon it, and lastly, by a settlement suggested and brought about by the officers of the British Government and concluded with the Maharajah shortly after the Kol disturbances in A. D. 1833.

These Mankees have each under them about as many villages as formerly were included in a "Purha," and they pay a quit rent to the Maharajah as a commutation of the service and tribute in kind formerly paid to him as Lord Paramount, and they collect this and a little more as the contribution for their own support from the heads of villages, who again collect according to ancient custom at fixed rates from the villagers. There is fixity of tenure throughout, from the Maharajah to the cultivator, notwithstanding the intervention of the Mankee, the village Moondah, or Mohto. This is no doubt a living exemplification of the relation that, in older times, subsisted between the cultivator of the soil and his chief in most parts of India.

In the Hoor Lurka Kols of Singbhoom we have a people who, till recently, had no notion of what it was to pay rent to any one, or even to give pecuniary support to their chiefs. They had their Mankees and Moondahs, but no one exercised any right arising from a title in the land except the cultivators. We have a very interesting description of the Hos, their country and their languages, by Colonel Tickell,\* and to this, before proceeding further with my memoir, I will add a brief sketch of their history.

The Singbhoom district is of a singular interest to the ethnologist. That portion of it called the Colehan, the Ho-desum or country proper of the Hos, is a series of fair and fertile plains, broken, divided and surrounded by hills; about 60 miles in length from north to south, and from 35 to 60 in breadth from east to west. It has to the south and south east the tributary estates, Mohurbhun. Keonjur, Bonai

\* As. Soc. Journal, Vol. IX. pp. 783, 997, 1063.

and Gangpore, inhabited by Ooriah-speaking Hindoos, to the east and north the Bengalee pergunnah of Dhulbhoom and district of Manbhoom, and north and north-east the Hindee district of Lohardaggah, and it is occupied by a race totally distinct by descent, custom, religion and language from any of the three. A people on whose smiling country covetous eyes have often been directed, but into which no one ever attempted with impunity to intrude.

It is impossible to say when the Hos first entered Singbhoom; but as we find that the Chota-Nagpore Moondahs more and more assimilate to the Hos, as we approach Singbhoom from Chota-Nagpore, we may safely infer that the Hos came originally from that country; and this is their own tradition. They appear to have brought with them and retained their system of confederate government by Purhas, but in Singbhoom the word now used to express it, is Pirhi or Peer. Thus the Colehan is divided into Pirhis, each under a Mankee as chief of the Pirhi, and each village having its Moondah as headman.

According to their own tradition, the Hos displaced a nation of Jains settled in the eastern parts of Singbhoom, some remains of whom are still extant, and a nation of Bhuyahs from the western and southern parts, driving them out of, and appropriating to their own exclusive use, the richest part of the country. From these early times, probably more than 2,000 years ago, they have proudly held the country they acquired; and, in my humble opinion, they have the right to say they never submitted to rulers of an alien race, till they were forced to do so by the power of the British Empire.

At the commencement of the present century, Singbhoom was only known to the British Government as a country under the rule of certain Rajpoot chiefs, all of one family, whose independence, when we first occupied the Orissa Provinces, Lord Wellesley promised to respect. After the final cession of all the surrounding districts in 1819 these chiefs, occupying a territory that embraces the Colehan, voluntarily submitted to the British Government, and immediately sought the assistance of that Government in reducing the "Hos" to submission, asserting that the Hos were their subjects then in rebellion; but they admitted that for fifty years they had exercised no authority over them, and I find no proof that the Hos had at any former period ever submitted to them. It is not pretended that they were conquered,

but supremacy was claimed by the Rajpoot Rajahs over the Ho tribes next to them, thus dividing the country and the people amongst four Rajpoot chiefs, the Rajahs of Mohurbhunj and Porahat, Koer of Seraikilla, and Thakoor of Khursowan.

It is true that the chiefs of Singbhoom, ancestors of the Rajahs of Porahat, Seraikilla and Thakoor of Khursowan, obtained great influence over their wild neighbours. They were gradually induced to believe tales which gave to the founder of this family a miraculous birth in their country, and they accorded to him divine honors, whilst they repudiated the idea of his being their temporal chief. The oldest surviving member of the Porahat family tells me that no regular tribute was ever received from the Colehan, but they were treated and employed rather as friendly allies than as subjects, and at certain seasons presents of trifling value were received from them and presents given in return.

When a division of the estate of the Singhoom chief occurred, the brothers each took, with the share assigned to him, a share in the goodwill of the Hos. Thus the Seraikilla and Khursowan families claimed the allegiance of the tribes nearest to them. The claim of the Mohurbhunj Rajah sprang up as the Kols extended their cultivation, till it touched or ran over his boundary. But it is admitted that all recorded attempts of the Rajpoot chiefs to subdue them had been signally defeated.

On the last occasion, the great grandfather of the present Maharajah of Chota-Nagpore, at the head of 20,000 of his own men co-operating with the forces of the Singbhoom Rajpoot chiefs, entered the Colehan. The Hos allowed him to do this; they then fell on his army in masses, and, routing it with immense slaughter, ignominiously expelled him, pursuing him into his own territory, and severely retaliating on the border villages of the Maharajah and his allies.

It was no doubt in retaliation for these attacks on their independence that the Hos now became, as they were found to be when first brought to our notice (in 1819-20), the scourge of the inhabitants of the more civilized parts of Singbhoom and of all the surrounding districts. They shewed no mercy to the Braminical inhabitants of the villages they attacked and pillaged. A long line of Bramin villages on the Bramin river in Gangpoor was laid waste by them and has remained

depopulated ever since. No traveller ever ventured to pass through their country. No Bramin, Rajpoot or other Hindoo caste, or Mussalman was suffered to reside in it.

In 1820, the Agent Governor-General, Major Roughsedge, entered the Colehan at the head of a force consisting of a battalion of infantry, with cavalry and artillery. He was surprised to find the wild race, of whom he had heard such disparaging accounts, in possession of an open undulating and richly cultivated country, studded with villages in groves of magnificent tamarind and mango trees, abounding in unusual indications of rural wealth. He was allowed to enter on this scene unmolested, but the slaughter of some of his camp-followers, who had incautiously strayed into one of the villages, demonstrated the hostility of the people, and an attempt to capture the murderers brought about the first collision between the Hos and our troops. A party of cavalry, sent to the offending village, was met in the open field by 300 warriors, who undauntedly advanced to meet the charge, rushed between the ranks of the horsemen, hacking especially at the horses with their formidable battle-axes, and shewing no disposition to yield or to turn, till half their number had been sabred or shot. In the village where the murder was committed, was found a reserve of 60 men who fought desperately and were all killed! The same evening another body of Lurkaks\* attacked the rear of the column and cut off a convoy of supplies. It became necessary to act with vigour, and the old Hos of the present day describe the retaliation that now fell upon them as dreadfully severe. Eventually some intercepted mails were restored uninjured, as a token of submission, and the Lurka chiefs in the vicinity entered into engagements to acknowledge and pay tribute to the Rajah of Singbhoom.†

Major Roughsedge met with further opposition in his progress towards Sumbulpoor through the Southern Peers: he had in fact to fight his way out of the country; and on his leaving it a war broke out between the Kols who had submitted, and those who had not. One hundred Hindustanee burkundazes under a Soobadar were sent by the Agent to the support of the Rajah and his Lurka allies, and this for a time gave them the advantage; but the Soobadar having

\* "Laraka," the fighters, a common name for the Hos.

† Major Roughsedge's dispatches.

been induced to enter the Colehan to assist in levying a contribution, was attacked, and he and the *whole of the party cut up!*

In 1821 a large force was employed to reduce the Lurkas to submission, and after a month's hostilities, the leaders, encouraged by a proclamation surrendered and entered into engagement, binding themselves to subjection to the British Government, and agreeing to pay to the chiefs at the rate of 8 annas for each plough. It was now noticed that the Lurkas evinced a perfect willingness to be guided and ruled by British officers, and the utmost repugnance to the authority arrogated over them by the Singbhoom chiefs; and it would have saved much blood, expense and trouble, if this feeling had at the time been taken advantage of. Made over to the chiefs, they soon again became restive and reverted to their old practices of resistance and pillage. The circle of depredations gradually increased, till it had included Dhulbhoom, devastated Bamunghatee, and extended to some parts of Chota-Nagpore. The chiefs under whom the Lurkas had been placed could not control them, and for some five years, from 1830 to 1836 the Hos, maintained this hostile attitude.

In consequence of this unsatisfactory state of affairs, a proposal made by Captain Wilkinson in August 1836, to employ a force and thoroughly subdue the Lurkas, and then to take the whole tribe under the direct management of British officers, was favourably received by Government and promptly acted on. Two Regiments of Infantry and two Brigades of guns entered Singbhoom in November 1836, and operations were immediately commenced against the refractory Peers; and by February following all the Mankees and Moondahs had submitted and bound themselves by fresh engagements to obey and pay revenue to the British Government, and no longer to follow the orders of the chiefs to whom they had previously been required to submit. Six hundred and twenty-two villages, with a population estimated at 90,000 souls, of whom more than three-fourths are Hos, were thus brought and have since remained under the immediate control of the British Government. Since then, the population and spread of cultivation have immensely increased, and the people are now peaceful, prosperous and happy. From the region round about the station, Chybassah, 170 miles due west from Calcutta, the waste lands have entirely disappeared. Colonies of Hindus may now be

found settled in the heart of the Colehan, occupying villages apart from the Hos, but without demur placing themselves under the Ho Mankees of Peers. For their own system of government is, as far as possible, preserved, and the Mankees are officers of police as well as the tuhsildars or rent-collectors of their circles. One great change is now being peaceably introduced, the old system of assessment on ploughs is under process of commutation to a light assessment on the land.

This is undoubtedly the nucleus of the Moondah nation, the most compact, the purest, most powerful and most interesting division of the whole race, and in appearance decidedly the best looking. In their erect carriage and fine manly bearing, the Hos look like a people that have maintained and are proud of their independence. Many have features of sufficiently good cast to entitle them to rank as Arians; high noses, large but well formed mouths, beautiful teeth, and the facial angle as good as in the Hindu races. The figures both of male and female freely displayed by the extreme scantiness of the national costume are often models of beauty; but this description applies only to the people of the highly cultivated part of the country who have seldom been subjected to severe privation and who generally fare right well. The inhabitants of the imperfectly reclaimed hill forests are more savage-looking, but they seldom deteriorate to the almost simian physiognomy that the Oraons are found with under similar circumstances. When the face of the Moondah varies from the Arian or Caucasian type, it appears to me rather to merge into the Mongolian than the Negro. High cheek bones, small openings for the eyes, having in some rare instances a tendency to the peculiar oblique set of the Mongolian, and flattish faces without much beard or whisker. They are of average stature, and in colour vary from brown to tawny yellow.

## II.—THE ORAONS.

The Oraons have a tradition that they were once settled in Guzerat. They were expelled from that part of India, and, retreating east, made a stand at fort Kalinjur where they fought the "Loorik Sowrik" of "Pali-pipri," were defeated, and, retreating still east, settled on the Rhotas hills. Here they say, they remained unmolested till attacked and

driven from the hills by the Mahomedans in the reign of the emperor Akbar, but as they aver this occurred fifty-two generations ago, there is an anachronism somewhere. I think they were settled in Chota Nagpore centuries before the days of Akbar, but it is probable that some of the clan remained in the Rhotas hills until the Mahomedans constructed their fortress there.

The accounts of ancient Guzerat faintly confirm the Oraon tradition. I find from Thornton's Gazetteer that there is a race settled there from remote antiquity who are called Coolies; but there is nothing in the name, which, as I observed before, appears to have been applied very generally to the aborigines by the Arians, and the account given of the Coolies does not lead me to suppose they are of the Oraon family. There is, however, a short description of what appears to be a remnant of a tribe, which would answer perfectly for the Oraons,—“A small, active, well built race, engaged to some extent in cultivation, but by choice deriving their subsistence, as far as possible, from the chase, fishing, or the collecting of wild fruits and the marketable produce of the jungles for sale. Their peculiar pursuits, little relished or shared in by the rest of the community, caused them to be viewed with dislike and dread, and the reputation of possessing great powers in sorcery subjects them to much cruel treatment.”

Every word of the above description applies to the Oraon tribe, and the name given to this remnant of a people viz. “Dunjas,” is an Oraon word not unlike the term Dhangurh, so commonly applied to the Oraons in the countries to which they emigrate for work.

The names traditionally handed down amongst the Oraons, as Loorik Sowrik, allude probably to some tribe of Sravacks or Sowoks or Jains, and the Palipipri might refer to the Palithana mountains, the Jain temples on which are amongst the most interesting architectural works in India. The etymology of the word Oraon, I have not been able to trace satisfactorily, but it may have been applied to the tribe in consequence of their migratory habits. They call themselves “Khoonkir.”

Between the language of the Oraons and the language of the Moondahs and their cognates, I can trace no similarity either in pronunciation, formation, construction or general character. With pretty copious vocabularies before me, I can find no analogues, and

whilst the language of the Moondahs is soft and sonorous, that of the Oraons is guttural and harsh. Doctor Latham, in his descriptive ethnology, has noticed the near connection of the Oraon, Rájmahal hill and Tamul languages, and especially observes on the similarity of the personal pronouns.

| <i>English.</i> | <i>Rajmahal.</i> | <i>Oraon.</i> | <i>Tamul, &amp;c</i> |
|-----------------|------------------|---------------|----------------------|
| I               | En               | En            | nam, En.             |
| Thou            | Nin              | Nin           | Nin                  |
| He, she, it     | Ath              | As            | Ata                  |
| We              | Nim              | Em            | Nam                  |
| Ye              | Nina             | Nim           | Nim                  |
| They            | Awar             | Ar            | Awar                 |

Out of a vocabulary of about 24 Oraon and Tamul words, I find the following analogues.

| <i>English.</i> | <i>Tamul.</i> | <i>Tuda.</i> | <i>Oraon.</i> |
|-----------------|---------------|--------------|---------------|
| Man             | Al            | Al           | Al            |
| Eye             | Kam           | Kan          | Khan          |
| Tooth           | Pal           | Paroh        | Pulla         |

But I find in the language now spoken by the Oraons, words of Sanscrit origin not in common use, as "*puph*," flower, "*amb*," water, "*kesh*," hair, indicative of their having occupied some country in common with people speaking a Sanscrit or Prakrit dialect.

The annexed notes on the language with which I have been favoured by the Rev. Frederic Batsch, senior Missionary at Ranchee, will, I hope, throw some light on the subject. The resemblance between the Oraon and Tamul language does not invalidate their own migratory traditions, for it is not more marked than the relation between the Tamul and the language of the Gonds and others.

Their physical peculiarities are as different from those of the Moondah as are their linguistic characteristics. The Oroans must be regarded as a very small race, not short and squat like some of the Indo-Chinese stock, but a well proportioned small race. The young men and women have light graceful figures and are as active as monkeys. Their complexions are, as a rule, of the darkest; but if we take as our type those who dwell in mixed communities, we find great variety in feature and colour. If we take those who, living in isolated positions, may be supposed to offer us the purest blood, we find them

generally dark and ill-favoured. They have wide mouths, thick lips and projecting maxillary processes, nostrils wide apart, and no elevation of nose to speak of, and low though not in general very receding foreheads. I have seen amongst them heads that in the woolly crispness of the hair completed the similitude of the Oraons to the Negro. It may be said that the class I am describing have degenerated in feature from living a wilder and more savage life than others of their clan; but I do not find this degeneracy of feature amongst the Jushpore Korewahs, who are to the Moondahs of Chota-Nagpore what the Jushpore Oraons are to the Oraons of the same district.\* I found the Korewahs mostly short of stature, but with well knit muscular frames, complexion brown not black, sharp bright deep set eyes, noses not deficient in prominency, somewhat high cheek bones, but without notable maxillary protuberances. In the more civilized parts of the province, both Oraons and Moondahs improve in appearance. The former indeed still retain their somewhat diminutive appearance, but in complexion they are fairer, in features softer, some even good looking, and the youthful amongst them all pleasing from their usual happy contented expression and imperturbable good humour.

Driven from the Rhotas hills, the Oraons, according to their own tradition, separated into two great divisions. One of these, moving east, found a final resting-place in the Rájmahal hills; the other, going south, sought refuge in the Palamow hills, and wandered from valley to valley in those ranges, till they found themselves in Burway, a hill-locked estate in Chota-Nagpore proper. From thence they occupied the highlands of Jushpore and formed the settlements in the vicinity of Lohardugga, on the Chota-Nagpore plateáu, where they still constitute the bulk of the population. The Satyomba Moondahs had not effected settlements so far to the west.

The identity of the language spoken by the Rájmahal hill people (not the Sonthals) and that of the Oraons is full and sufficient confirmation of the tradition of their common origin, and of the division of the tribe spoken of above; but a comparison of the customs of the Rájmahal hill people, who being isolated must have retained those they brought with them to the hills, with the customs of the Oraons, demonstrates that the latter are derived from the Moondahs.

\* Asiatic Society's Journal, Vol. XXXIV. p. 15.

Referring to Col. Walter Sherwill's account of the Rájmahal hill people,\* I find, in regard to marriage, that it is customary for the young couple to sleep together on the same bed before marriage. The Oraons would consider this a very indecorous proceeding, though a public recognition that the young couple have slept together after the marriage is with the Oraons an important sequel to the ceremony. In the Rájmahal hills, says Col. Sherwill, the dead are buried. The Rig Veda and Ramayun tell us that this was the custom of the Dusyas, but the Moondahs and their cognates all burn their dead, and the Oraons follow their example.

The Rájmahal hill men swear on salt, the Oraons have a veneration for salt, but swear on *dub* grass, † *huldee* and rice.

The Oraons know nothing of Bedo Gosain, the invisible spirit adored by the Rájmahalies. Their supreme deity is the sun under the title of Dhurmo, but as that and the Rájmahalee term are both of Sanscrit origin, it evinces that neither race have in their own language any word for the Deity.

Lastly, the hill man is described as less cheerful than the Sonthal, less industrious, and as not joining in the dances that the people of the Moondah stock are so-devoted to. In Chota-Nagpore the Oraons are more lively than the Moondahs, quite as industrious, and the most enthusiastic and nimble-footed of the dancers.

The two races, Moondah and Oraon, must have been for ages the only colonists of the plateau; it is singular that they have no tradition of any disquite having arisen between them. Affecting jealousy to guard against admixture of the races by sexual intercourse, they in other respects lived as one people, the Oraon conforming more to the customs of the Moondah than the Moondahs to the Oraon, and in many instances adopting the Moondah language and losing their own.

In villages east of Ranchee, though inhabited wholly by Oraons, the Moondah, not Oraon, is the language spoken; but the Moondah language is not much known in the vicinity of Lohardaggah or in Jushpore.

The village systems of the two people became almost identical in form. The village priest, called the Pahan, is probably an Oraon institution, as, I think, amongst the Moondahs the principle is that the head of the family is priest; but the Moondahs of Chota-Nagpore

\* Asiatic Society's Journal, Vol. XX. p. 544.

† *Agrostis linearis*.

adopted it, and in their villages, as well as in those of the Oraons, there is always a Pahan. The village system now existing is such as it became after many encroachments by the Rajah and the middlemen introduced by him. Still as bearing the impress of a very primitive form of government, it is worth describing, and in doing so, I will make use of a very elaborate report on the subject written by Doctor Davidson in 1839.

The actual descendants of the men who formed the villages are called Bhuinhurs. They are a privileged class, who hold their lands at low fixed rates or rent-free, but they are bound to do service to the chief or his representative. The head of the Bhuinhurs is called the Moondah, and is generally the representative of the old Moondah chief of the village. He presides when meetings are held to settle disputes about social customs; and all demands for service on the Bhuinhurs by the proprietor or farmer are made through him. He holds his lands as Bhuinhurree, and has no other emolument.

The Mahto, though second in point of rank, is the most important functionary in the village. He has the assessment and settlement of all lands not held by the hereditary cultivators; collects all dues and rents, and is responsible for them to the farmer or proprietor. He holds for his services one *powa* of land rent-free, and in some villages gets a fee of one or two pice annually from each ryot. The office is not hereditary.

The Pahan is the village priest. He is a Moondah or Oraon by caste, but all observances for propitiating the village gods or devils are performed by him. No Bramins are permitted to interfere. The office of Pahan is generally hereditary, but is not necessarily so. He has under his charge the land called "Dalikhatari," and from the proceeds of this land, he has to support himself and to provide the rice and rice-beer required for the great festivals.

The Bhandari assists in the collection of rents, summoning ryots who have to do work or whose attendance is required by the Zemin-dar or farmer, and in looking after the collections made in kind. He has an allowance of one *powa* of land, and gets from each ryot one *kerai* or bundle of each crop as it is cut.

There is a Gorait for each village, and a Kotewar for one or more villages. The former is the messenger of the Zemindar or his representative, the latter is the Police officer.

The villagers maintain a blacksmith and a Gowala or herd; the latter takes care of all the village cattle, and is supposed to be responsible if any are stolen. They each get a maund of dhan for every plough and three *kerais*, bundles, of other crops.

According to the tradition of the Kols, the Rajah is entitled to the rent of only half of the land in each village. The remainder is Bhuinhurree, or rent-free under some other denomination, but in most villages rent is now taken on from two-thirds to three-fourths of the land. The land is thus divided:—

I. Rughus—the land that pays rent to the owner or his representative.

II. Bhetketta, a certain portion of the Rughus which each ryot, not a Bhuinhur, is allowed to cultivate free of rent, but for which he has to perform various services to the landlord or farmer.

III. The land allotted to the Mahto, the Pahan and the Bhundari.

IV. Munghus—the land at the disposal of the landlord or his agent or the farmer of the village. For the cultivation of this land, the holder of the village can make any arrangement that he pleases.

V. Bhuinhurree is the land held rent free by the descendants of the founder of the village, who are, however, bound to render certain services to the Rajah or his representative.

VI. Bhootketta—the land, the produce of which is appropriated to the expense of the great village poojas and festivals; a portion of this called "Dalikhatari" is assigned to the Pahan for the ordinary annual poojas, and the proceeds of the remainder are reserved for the triennial sacrifices and extraordinary occasions.

The rent is assessed on the wet land only. The cultivator is entitled to upland in proportion to the wet land for which he pays. If he cultivates more, the custom is for a payment in kind called Muswur, to be made when the crop is harvested.

The Bhuinhurs cling most tenaciously to their Bhuinhurree lands. Insurrections have followed attempts to disturb these tenures, and even now such attempts are sure to lead to serious affrays. The Kol insurrection of 1833 was, without doubt, mainly caused by the encroachments of alien farmers and sub-proprietors on the rights of the descendants of the old settlers. The first burst of the outbreak was a pretty broad hint, a general conflagration of the houses of alien farmers

and sub-proprietors, and the massacre of all that the incensed Kols could find.

The Kols of Chota-Nagpore, generally a good-tempered, mild, inoffensive race, become wild with excitement on this question, and nothing can reconcile them to a decree or order which in any way infringes on what they consider their proprietary right. According to their theory, dispossession for generations can no more annul their right in the land than it can extinguish the ties of blood. The courts will not always accept this doctrine, and the Kols cannot regard as equitable any decision that excludes it.

An Oraon family lives very promiscuously in a small, indifferently constructed and untidy looking hut, and their village often consists of a street or court of such huts. In all that relates to their inner domestic life, they are less susceptible of improvement than the other tribes. They have no gardens or orchards attached to individual houses, but the groves of fruit-trees that they plant outside the village form a beautiful feature in the scenery of Chota-Nagpore, and they have generally, in and about the village, some fine trees which are common property. In every Oraon village of old standing there is a house called the "Doomcooreea" (Bachelor's Hall), in which all unmarried men and boys of the tribe are obliged to sleep. Any one absenting himself and spending the night elsewhere in the village is fined. In this building the flags, musical instruments, yaks' tails, dancing equipments and other property used at the festivals are kept. They have a regular system of fagging in the Doomcooreea. The small boys have to shampoo the limbs of their luxurious masters, and obey all orders of the elders, who also systematically bully them to make them, it is alleged, hardy. In some villages the unmarried girls have a house to themselves, an old woman being appointed as Duenna to look after them. She is always armed with a stick to keep the boys off. A circular space, in front of the Doomcooreea, is kept clear as the village dancing ground. It is generally sheltered by fine old trees, and seats are placed all round for spectators or tired dancers.

The Doomcooreea is never used by boys of the Moondah tribe. It is an institution quite unknown to the Hos, but the Moondahs and Hos build themselves houses in which all the family can be decently accommo-

dated. Their houses are more isolated, occupy much more space and are in appearance much more civilized than those of the Oraons, with verandahs, well raised plinths and separate apartments for the married and single members of the family. Every Moondah village has its dancing place, though it has no Doomcooreea. The best Korewah villages consist of about forty houses built round a large square, in the centre of which is the dancing arena; but as the Korewahs are nomads, changing their abodes every second or third year, their villages may be regarded as mere standing camps. The Kheriahs build substantial comfortable houses like the Hos. It is curious they have the same word "O" for a house and the sky. The Moondah word "Ora" is, like the Turkoman "Ova," a house or tent. The flags kept in the Oraon Doomcooreea appear to be an Oraon institution. Every village or group of villages, probably the head quarters of each "Parha," has its peculiar flag, and we have actually had cases in courts praying for injunction against villages charged with having assumed flags that did not belong to them!

I will now proceed to review the customs of the Moondahs and Oraons together, taking care to note all points of divergence that are known to me.

After the birth of a child, the mother has to undergo purification, and on the same day that this ceremony takes place, which is simply a process of ablution, the child is named. Elderly females or matrons, friends and relations assemble for this purpose, and a vessel containing water is placed in the midst, and as the name first selected is pronounced, one of the women drops a grain of rice into the water. If the grain of rice sinks, that name is discarded, and the experiment is repeated with the second name on the list, and so on till, as the name is pronounced, the grain floats. (The Garrows of the eastern frontier have a similar method for divining the name of the spirit they ought to invoke on particular occasions.) If the name of some friend is chosen, it is considered as establishing a tie between the child and his namesake, resembling that which subsists between a Christian child and his godfather. The person whose name is selected is always called Saki or Sakhi, a word of Sanscrit origin meaning friend, so that in "nam Saki" we have in meaning and sound our word namesake. The following are some names of girls, Jambi, Jima, Jingi, Turki,

Sulgi,\* Pongla, Madhi, Makoo, Roomeca Saggi, Dinli, Natri, Akli, Bangi, Julli, and the Hindoo names of the days of the week are very commonly given. The following are the names of boys—Rumsi, Birsa, Somra, Daharoo, Singra, Satri, Dubroo, Doolkoo, Didoo, Runka, Biggoo. But they have adopted many foreign names, and the names of British officers they have known and esteemed, are thus preserved amongst the Hos of Singbhoom, and may be handed down from generation to generation. Thus "Major" and "Captain" have become common names in the Colehan, originally taken from Major Roughsedge, the first British officer they ever saw, and Captain Wilkinson (now Col. Wilkinson) whom they regard as their greatest benefactor. Doctor, Tickell, &c. are also common. Girls, when three or four years of age, receive their mark of caste. Three lines tattooed on the forehead and two on each temple, four dots on the chin and one on the nose. It does not appear to be connected with any religious custom, nor is it applied with any ceremony, and as neither the Moondahs nor the Oraons have any particular term for it in their own language, it is probable that they adopted it from the Sudhs or Hindoos. Some Moondah girls of Chota-Nagpore have different marks. Those of Singbhoom have adopted the arrow, appropriately enough, as the national weapon of their lords and masters.

The Kheriahs and Juangas, though isolated from the Moondahs and Oraons, have the same triple and double marks on the forehead and temples. The Oraon boys are marked, when children, on the arms by rather a severe process of puncturation, which they consider it manly to endure. The only reason I have heard assigned for this custom is, that through it even the naked dead may have a distinguishing mark.

When a girl approaches maturity, it is incumbent on her to bind up her hair, and from that period of her life she is restricted to food prepared by her own people. As a child with her hair loose, she is permitted to partake of whatever is edible, no matter by whom prepared. Young men enjoy this liberty of appetite till they marry. They then, to use their own expression, put salt in their flesh, and must not partake of food prepared by aliens. The Oraons have a veneration for salt, and they are not absolutely prohibited from partaking of

\* A common name and also the name of a goddess, and the name, I see, of one of the young ladies from the Andaman Islands.

plain rice cooked by others, provided they are left to salt it themselves. The salt, it would appear, thus applied, removes the "Taboo," and makes *fas* what is otherwise *nefas*.

As a rule, marriages are not contracted till both the bride and bridegroom are of mature age. It is sometimes left to the parents to select wives for their sons, but the young people have ample opportunities for studying each others characters, love-making and following the bent of their own inclinations; and it very often happens, that plans concocted by the parents are frustrated by the children.

In Chota-Nagpore, amongst the agricultural classes, and in Singbhoom amongst all classes of Kols, the girls have all a price fixed upon them, and this the lover or his friends must arrange to pay, before the parents of the bride will give their consent. In Singbhoom, the price is so high, especially for young ladies of good family, that marriage is frequently put off till late in life; and girls valued not so much for their charms and accomplishments as for their pedigree, often grow grey as maidens in the house of their fathers. Singbhoom is perhaps the only place in India in which old maids are found; they have plenty of them there. But though urged to change this practice by all who take an interest in them, the old Mankees of Singbhoom are inflexible, not only in demanding a high price for their girls, but in insisting that it shall be paid, according to ancient custom, chiefly in cattle. A Mankee of the old school will not take less than forty head of cattle for his daughter; but the eyes of the rising generation are opened to the absurdity of the practice, and some of us may live to see it changed.

In consequence of this custom, the grown up boys and girls are quite a separate institution in every Kol village; there is very little restraint on their intercourse, they form a very pleasant society of their own, from which the old people sensibly keep aloof. If a flirtation is known to have gone too far, the matter is generally settled by the young man being made to pay the price for the girl and marry her.

In Chota-Nagpore the daughter of a Mankee was, some years ago, valued at about 36 Rs, but they are gradually adopting the custom of the Hindoos in regard to their marriages, and giving up the objectionable practice of putting a price on them. The price paid by

the common people ranges from 10 to 12 rupees. These disagreeable preliminaries having been arranged, the bridegroom and a large party of his friends of both sexes enter with much singing and dancing and sham fighting the village of the bride, where they meet the bride's party and are hospitably entertained.

The bride and bridegroom are now well anointed with turmeric, and bathed, and then taken and wedded, not to each other, but to two trees! The bride to a Mowa tree, the bridegroom to a Mango. They are made to touch the tree with "*seendoor*," (red lead), and then to clasp it in their arms. On returning, they are placed standing face to face, the girl on a curry stone over a ploughshare supported on sheaves of corn or grass. The bridegroom stands ungallantly treading on his bride's toes, and in this position touches her forehead with the red lead; she touches his forehead in the same manner. The bride's maids then, after some preliminary splashing and sprinkling, pour a jar of water over the head of each: this necessitates a change of raiment, and apparently concludes the ceremony, as the young couple going inside to change, do not appear again till the cock-crowing announces the dawn or its approach. At the first crow the bride's maids, who with the young men have been merrily keeping it up all night with the song and dance, burst into the nuptial chamber and bring forth the blushing bride and her bashful lord; and then they all go down to the river or to a tank to bathe, and parties of boys and girls form sides under the leadership of the bride and bridegroom, and pelt each other with clods of earth. The bridegroom next takes a water vessel and conceals it in the stream or water for the bride to find. She then conceals it from him, and when he has found it, she takes it up filled with water and places it on her head. She lifts her arm to support the pitcher, and the bridegroom, standing behind her with his bow strung, and the hand that grasps it lightly resting on her shoulder, discharges an arrow from the pretty loophole thus formed into the path before her. The girl walks on to where the arrow falls, and with head erect and still bearing the pitcher of water, she picks it up with her foot, takes it into her hand, and restores it to her husband with a graceful obeisance. She thus shews that she can adroitly perform her domestic duties and knows her duty to her lord and master, whilst he, on his part, in discharging an arrow to clear

her path of an imaginary foe, indicates that he is prepared to perform his duty as her guide and protector through life.

In the Oraon marriages, many of these symbolical ceremonies are omitted, and the important one of exchanging the "*sindoor*" is differently performed. The bridegroom stands behind his bride with his toes on her heels, and stretches over her head to touch her forehead with the powder. She touches his forehead by reaching back over his shoulder. The cold bath completes the ceremony, they go to their own apartment to change their clothes, and do not emerge till morning.

The price paid for a girl in cows is called "*Sukmur*" by the Kheriah tribe. They have no word for marriage in their own language, and the only ceremony used appears to be little more than a sort of public recognition of the cohabitation. They have learned to call this "*biha*," but they admitted to me that this public recognition was often dispensed with.

It takes place in this wise. After the settlement of the usual preliminaries, the bride is brought to the village of her intended bridegroom by her own people and their friends, and they halt and bivouac in the village grove. The bridegroom and his friends join them in the grove where they all regale themselves and dance, and during these nuptial dances the bride and bridegroom are each borne on the hips of one of their dancing friends; they are not allowed to put their feet to the ground. Thus wildly dancing, they proceed into the village, and the bride and bridegroom are taken to the latter's house and anointed with oil; they are then brought outside, and the ceremony of touching each other's forehead with the "*sindoor*" is performed, followed by the splashing and sousing which becomes a general romp. Then the young couple are left to themselves till morning. The bride's maids arouse them as the cock crows, and after the public ablution of garments and their wearers the party breaks up.

The gestures of the dancers on these occasions, and the songs, all bear more directly than delicately on what is evidently considered as the main object of the festivities.

In Singbhoom, marriages, notwithstanding the lateness at which they take place are generally arranged by the parents, but their wishes are not unfrequently anticipated by love matches. In the various journeyings to and fro that are found necessary when a match

is being arranged, omens are carefully observed, and the match is broken off, if they are unfavourable. At the actual marriage there is much feasting and dancing, but little ceremony. The turning point of the affair is, when the bride and bridegroom mix and drink off some of the beer they have each been helped to ; the boy pours some of the beer given to him into the girl's cup, she pours from her cup into the boy's cup, and they drink and thus become of the same "*keeli*" or clan, for the Hos, Moondahs and Oraons are all divided into families under this name, and may not take to wife a girl of their own *keeli*.

This division of the primitive races into something having a semblance to caste, will be found in the North Eastern Frontier as well as in this province. The Garrows, for instance, are divided into what are called "maharis," and a man may not marry a girl of his own mahari.

It is obvious that the custom does not spring from any such notion of caste as are found amongst the Hindoos, and that it is not one which these races have adopted from the Hindoos, because with a Hindoo, caste is destroyed by a marriage *out* of it. It is equally opposed to the custom of the Jews, whose daughters (at least if heiresses) were obliged to take husbands of their own tribe.\*

In Singbhoom the bride and bridegroom do not touch each other with "*sindoor*", as is the custom in Chota-Nagpore. The Oraons and Moondahs may have adopted the custom from the Hindoos, and the primitive practice of the race is probably as it is found amongst the more isolated Hos.

A very singular scene may sometimes be noticed in the markets of Singbhoom. A young man suddenly makes a pounce on a girl and carries her off bodily, his friends covering the retreat (like a group from the picture of the rape of the Sabines). This is generally a summary method of surmounting the obstacles that cruel parents may have placed in the lovers' path ; but though it is sometimes done in anticipation of the favourable inclination of the girl herself, and in spite of her struggles and tears, no disinterested person interferes, and the girls, late companions of the abducted maiden, often applaud the exploit.

The Ho husband has to pay a high price for his wife, and it is

\* Numbers xxxvi. 6.

certain that he highly appreciates her. Although he is not known to have for her any more endearing epithet than "my old woman," yet by no civilized race are wives treated with more consideration than by the untutored Ho. The whole of the domestic arrangements are under her exclusive management. She is consulted on all occasions, and I know one or two husbands whom I am almost inclined to regard as henpecked. The Kols seldom take a second wife during the lifetime of the first, but I know instances of their having done so. The wife always cooks for her husband, and when the dinner is ready, they sit down and eat it together like Christians; but the Oraons have followed the Hindoo custom of making the woman eat the leavings of her lord.

It is customary with all these tribes to pay particular attention to omens, when any of them set out to arrange the preliminaries of a marriage. The Hos who are more under the influence of this superstition than their cognates or than the Oraons, have a long list of deterrent signs, which have been described by Tickell in his paper above quoted. I subjoin the most noticeable of those that are observed by the Oraons.

1. On leaving the house "to win a bride", they look out for omens. If a cow calls and the calf responds, it is good. If there is no response, the wooing is postponed or abandoned.

2. If they find a dead mouse on the road, they must stop and make a diagnosis. If ants and flies have possessed themselves of the carcass, it is good, they go on. If the insects appear to have shunned it (which is not very likely to happen), they go back.

3. It is not good to meet oxen or buffaloes with their horns crossed, or to see a hawk strike a bird, or to come upon women washing clothes. It is good to see people burying a dead body, and to find on their road a cow giving milk to her calf.

4. If they see a man cutting a tree, and the tree falls before they can get past it, it is very bad. If they pass before it falls, it is all right. A certain bird heard on the left gives a note of joy; if heard on the right, he is a harbinger of woe.

5. If, on approaching the village of the girl, they come on women with water-pots full, it is a happy omen. If they meet a party with empty water-pots, it is a bad one.

The Nagpore Kols, whether of the Moondah or Oraon tribe, and all the cognates of the Moondahs that I know of, are passionately fond of dancing, and with them dancing is as much an accomplishment as it is with the civilized nations of Europe. They have a great variety of dances, and in each different steps and figures are used, of great intricacy, but they are performed with a neatness and precision that can only be acquired by great practice. Little children are hardly on their legs, before they begin to learn their dancing steps; and the result of this early training is that, however difficult the step, the limbs of the performers move as if they belonged to one body. They have musical voices and a great variety of simple melodies. It is a fact that, when we raised a corps of Kols, their early practice in keeping step and time greatly facilitated the operations of drill; and the Missionaries have availed themselves of the musical talents and taste of the Kol converts to produce congregational singing that would be a credit to an English country church.

The dances are seen to the greatest advantage at the great periodical festivals called "Jatras." They are at appointed places and seasons, and when the day comes, all take a holiday and proceed to the spot in their best array. The girls, on these occasions, put on their best dress, generally a white "saree" with a broad red border. They tastefully arrange flowers in their hair and plumes of the long breast feathers of the paddy-bird. The young men wear Turkey red turbans, and add a snow white cloth to their usually scanty garb, and also adorn themselves with flowers and peacock's feathers. As parties from the different villages come near the trysting place, they may be observed finishing their toilettes in the open fields; when all is ready, the groups form, and their approach from different sides, with their banners and yak's tails waving, horns and symbols sounding, marshalled into alternate ranks of lads and lasses all keeping perfect step and dress, with the gay head-dresses of the girls and the numerous brass ornaments of the boys glittering in the sun, forms a very lively and pleasing picture. They enter the grove where the meeting is held in jaunty dashing style, wheeling and countermarching and forming lines, circles and columns with grace and precision. The dance with these movements is called "khurriah," and they are held in all months of the year, a series of them following each other at

short intervals at different places all over the country, and the attendance, at some that I have seen, could not be under 5,000 people, all enjoying themselves.

When they enter the grove, the different groups join and dance the *khurriah* together, forming one vast dancing procession. Then each takes its own place and plants its flag and dances round it till near sunset, when all go dancing home. This is followed by a carouse in the village, after which the dance is often continued at the "*akrah*" all night.

At each of these "Jatras," a kind of fair is held, and fairings and refreshments are to be had in abundance. The young men can treat their partners with sweetmeats and do so. As already observed, there is a place in every village called "*akrah*" set apart for dancing and ceremonies. This is a circular arena with a post in the centre, and around it are benches for the spectators or for the dancers when wearied, the whole being generally shaded by fine old tamarind, the most beautiful of village trees.

The season dances in the village open with the *kurrum* in July, at the commencement of the planting season. There is a movement in this dance called "*hojar*" when the girls suddenly kneel and pat the ground in time to the music, as if caressing and coaxing it to be productive. On the day appointed for the ceremony, the boys and girls go in procession to the *kurrum* tree, cut and bring back to the village some branches, which are planted in the *akrah*. An old man with a liberal allowance of beer is placed to watch these, whilst the young people refresh themselves. They all, old and young, then assemble in the *akrah*, and one of the elders harangues them, and after giving them much good advice, concludes by directing them to commence the dance. The songs sung on this occasion are in Hindee, and contain allusions to the flooded state of the rivers and fields. They also sing an ode to the Satyomba Rajah. The *kurrum* is kept by the Soodh or Hindoo population as well as by the Kols.

After harvest of the earlier crop of the planted rice, in November, the "*matha*" is danced by the boys and girls in the village. The girls, moving in a semicircle and clasping each others hands, dance with a very lively step and bowing motion of the body to the men who sing and play to them. The girls have another dance at this

season called "*angua*," because it is danced in front of the house instead of the *akrah* ; to this and to a feast held on the occasion the young men are not invited.

The "Jadoor" dances commence on the completion of the great harvest of the rice crop, and continue till the commencement of the hot season. This is one of the most characteristic dances, from the peculiar way in which the arms are interwoven and clasped behind the back of the performers.

Then comes the "Sarhool," at the close of the month of Phalgun or early in March. The Sarhool is the flower of the Saul tree which now blossoms. The boys and girls make garlands of these flowers, weave them in their hair and decorate their houses with them. The dance on this occasion, called the "Baihini," is a very frisky one. The boys and girls dance to each other, clasping hands and pirouetting, so as to cause "*dos-à-dos*" concussions which appear to constitute the best part of the fun. Yet the subject of the song sung at the Sarhool feast is a sad one. A girl who had married out of the village is supposed to return to it in affliction, and to sit weeping at one side of the house, whilst her former associates are revelling at the other. The songs are in the Moondah language.

They have besides different dances for weddings, and a dance called "Jumhir" which is suited to any occasion. The dances above briefly noticed are all more or less connected with some religious ceremony, but this is left to the elders. The young people seem to me to take little interest in that part of the festival, which is, in proportion to the dancing, in importance like the bread to Falstaff's sack. They are always ready for a dance, and night after night in some villages the *akrah* drums collect the youths and maidens after the evening meal, and if you go quietly to the scene, as I have done, you may find that, whilst some are dancing, others are flirting in the most demonstrative manner, seated in detached couples on the benches or on the roots of the great trees, with arms round each others' waists, looking lovingly into each others' faces.

Next to dancing, that which most engrosses the mind of the Kol is the belief in and fear of witchcraft. All disease in men and in cattle is attributed to one of two causes, the wrath of some evil spirit who has to be appeased, or the spell of some witch or sorcerer

who should be destroyed. The fear of punishment and, I may add for some of them, the respect they bear to the orders of their rulers, restrain their hands, and witch murders are now very rare, but a village is soon made too hot to hold one who is supposed to be a witch.

When a belief is entertained that sickness in a family, or mortality amongst cattle, or other misfortune has been brought about by sorcery, a Sokha or witch-finder is employed to find out who has cast the spell. By the Sokhas various methods of divination are employed. One of the most common is the test by the stone and "*poila*." The latter is a large wooden cup shaped like a half cocoanut, used as a measure for grain. It is placed under a flat stone, and becomes a pivot for the stone to turn on. A boy is then placed in a sitting position on the stone, supporting himself by his hands, and the names of all the people in the neighbourhood are slowly pronounced, and as each name is uttered, a few grains of rice are thrown at the boy; when they come to the name of the witch or wizard, the stone turns and the boy rolls off!

There is no necessary collusion between the Sokha and the boy; the motion of the hand throwing the rice produces *coma*, and the Sokha is, I suppose, sufficiently a mesmerist to bring about the required result when he pleases.

The Singbhoom Kols or Hos, left to themselves, not only considered it necessary to put to death a witch thus denounced, but if she had children or other blood relations, they must all perish, as all of the same blood were supposed to be tainted.

In 1857, when, in consequence of the mutinies, Singbhoom was temporarily without officers, the Ho tribes of the southern parts of the district, always the most turbulent, released from a restraint they had never been very patient under, set to work to search out the witches and sorcerers who, it was supposed, from the long spell of protection they had enjoyed, had increased and multiplied to a dangerous extent. In a report on this subject from the district officer, in 1860, it is stated that "the destruction of human life that ensued is too terrible to contemplate; whole families were put an end to. In some instances the destroyers, issuing forth in the dusk and commencing with the denounced wizard and his household, went from house

to house, until before the morning dawn they had succeeded in extinguishing, as they supposed, the whole race." On the suppression of the disturbances, the return of the refractory Hos to order was as sudden and decisive as had been their relapse into barbarism. The survivors of the families who had suffered at once emerged with confidence from their hiding-places, and of the cases of witchcraft-murder, thus or otherwise brought to notice, the perpetrators were in almost every instance prosecuted to conviction.

It was melancholy to have to condemn men who themselves artlessly detailed every incident of the crime with which they were charged. The work of retribution was a sad task, but it was rigorously carried out, and we have not since then had a single case of witchcraft murder in the Colehan. That the belief in the existence of witches and sorcerers is consequently extirpated, cannot be hoped. Nothing but their conversion from paganism could effect this. I am convinced that in most instances the prisoners, who in their examinations detailed the most marvellous effects of imputed sorcery, were sincere believers in all that they narrated.

One of them, named Mora, saw his wife killed by a tiger, which he followed till it led him to the house of a man named Poosa whom he knew. He told Poosa's relations what had occurred, declaring to them that Poosa had, in the form of a tiger, killed and eaten his wife. The relatives appealed to, did not for a moment discredit the charge. They said they were aware that Poosa did possess the imputed power of metamorphosis. They brought him out and, delivering him bound to his accuser, stood by whilst Mora deliberately put him to death.

In explanation of their having so acted, they deposed that Poosa had one night devoured an entire goat and roared like a tiger, whilst he was eating it; and on another occasion he informed his friends he had a longing to eat a particular bullock, and that very night that very bullock was killed and devoured by a tiger!

From their having lived so long together, it is not surprising that we should find the religious ceremonies of the Oraon and Moondah almost identical. The Oraons have adopted the religion of the Moondah, but they retain some features of their original faith which indicate that it was in many essential points different from that to which they have conformed.

I have already observed that the Pahan or village priest is in all probability an Oraon institution. The Rajmahali have a similar functionary called 'Demam,' who foretells events, offers sacrifices, regulates feasts and exorcises devils. In the Ho and Moondah villages, all priestly functions may be performed by the head of the family, or, if the occasion be one in which the village generally is concerned, by any elder of the requisite knowledge and experience. They worship the sun, "Singbonga," as the supreme being, the creator, the preserver; and a number of secondary gods, all invisible; material idol worship they have none. The paganism of the Ho and Moondah in all essential features is shamanistic.

The Oraons, in addition to the Pahan whose business it is to offer sacrifices for the benefit of the community, have recourse to a person called "Ojha" whom they consult regarding the proper spirit to be invoked and the nature of the sacrifice that is required of them, and whose functions appear to me to bear a strong resemblance to those of the medicine man of the African tribes. The Oraons have wooden images or stones to represent the village and domestic spirits that they worship. Thus a carved post in the centre of their dancing arena represents the tutelary deity of the village, "Daroo;" and they have objects of some kind to represent their domestic gods, *penates*.

They never build a house, or select a new site for a village or even a new threshing-floor, without consulting the ojha and omens. When a new house is ready for the reception of its owners, an ojha is called, and he takes earth from the hearth and charcoal, and mixing them together, marks on the floor a magic circle. In the centre of this he places an egg, and on the egg a split twig of the Bel tree. The egg is then roasted and eaten by the people who are to occupy the house. This is followed by a great feast and dancing—a regular house-warming—on the top of the house an image of a fish is hung to avert the evil eye. These peculiarities in the paganism of the Oraon, and only practised by Moondahs who live in the same village with them, appear to me to savour thoroughly of feticism: before affirming this positively, it would be advisable to examine more minutely the customs of the Rajmahal hill tribes; but the elephant gods, depicted by W. Sherwill as seen in their villages, are very fetish in appearance.\*

\* Vide Journal, Asiatic Society Bengal, No. VII. 1851, page 553.

The Moondahs, without applying to an ojha or medicine-man, consult auguries in choosing the site of a house, with prayer to Singbonga. A small quantity of rice is placed in holes made at the four corners of the selected site, where it is left all night ; and if found undisturbed in the morning, the site is good. The same process is gone through in selecting a new site for a village. Prayer is offered to Singbonga twice, first, that the test applied may truly indicate if the site be good or bad ; secondly, for a blessing on the chosen site.

It is the fashion to call the religion of the Kols 'devil worship,' but this is not strictly correct ; for although the minor deities may be mostly of a malevolent nature and therefore devils who have to be propitiated, still Singbonga is worshipped as a beneficent god. This worship of the sun as the supreme deity is the foundation of the religion of the Oraons as well as the Moondahs. By the former he is invoked as Dhurmi, the holy one. He is the creator and the preserver, and with reference to his purity, white animals are offered to him by his votaries. He is not regarded as the author of sickness or calamity ; but he may be appealed to to avert it, and this appeal is often made, when the sacrifices to the minor deities have been unproductive.

But besides these occasional sacrifices, all Moondahs who hold to the faith of their ancestors, are especially bound to make a certain number of offerings to Singbonga during their tenure of the position of head of the family. He may take his own time about them, but he will not be happy in his mind till he completes his complement and clears the account. I obtained this information from the Kheriahs, and on speaking about it to some ancient Pahans and Moondah elders, was told that it undoubtedly is the orthodox practice, but it has been neglected. The sacrifices are five in number : 1st, fowls ; 2nd, a pig ; 3rd, a white goat ; 4th, a ram ; 5th, a buffalo ; and they must be offered in the open plain in front of an ant hill, or with an ant hill as an altar. Sacrifices to other gods are generally offered in the "Saerna,"\* the sacred grove of Sal trees, the remnant of the primeval forest left for the spirits when the settlement was first made.

The names and attributes of the inferior deities are nearly the same amongst the Hos in Singbhoom, the Moondahs and Oraons in Chota-

\* Or 'Saran,' 'Charan.'

Nagpore, and amongst the Sonthals 'passim.' Marang Booroo and Pongla his wife; Desaoilli, Jaer Boori, Eekin Bonga, Boora Bonga, Charee Desoolli and Dara are invoked in Chota-Nagpore.

The Sonthals have Marang Booroo, also Maniko his brother and Jaer his sister. Tickell's paper in Vol. IX, part 2nd of this Journal gives the Singbhoom gods and their attributes. They too have Marang Booroo and Pongala, Desaoilli and Jaer Boori or Jaer Era and others. In cases of sickness the Ho, after ascertaining by augury which of the gods should be propitiated, will go on offering sacrifices till the patient recovers or his live stock is entirely exhausted.

Next to Singbonga I am inclined to place the deity that is adored as "Marang Booroo." Booroo means mountain, but every mountain has its spirit, and the word is therefore used to mean god or spirit\* also. Marang Booroo is the great spirit or great mountain. Not far from the village of Lodmah in Chota-Nagpore one of the most conspicuous hills on the plateau is called Marang Booroo, and here the great spirit is supposed to dwell. It is worshipped by the Sonthals, the Bhoomij, the Hos, the Moondahs and the Oraons. The two latter make pilgrimages to it. The Hos have some vague notion of its situation; the more distant members of the family canonize some hill more conveniently situated.

The Marang Booroo is especially venerated as the lord of rain. Before the rains the women go to the top of the hill, under the leadership of the wives of the Pahans, with drums, which are on this occasion only played on by young ladies, and with offerings of milk and leaves of the Bel tree. On the top of the hill there is a flat mass of rock on which they deposit their offerings.

The wives of the Pahans now kneel down, and with hair loosened invoke the deity, beseeching him to give their crops seasonable rain. They shake their heads violently as they reiterate this prayer, till they work themselves into a phrensy, and the movement becomes involuntary. They go on thus wildly gesticulating, till a "little cloud like a man's hand" is seen. Then they arise, take up the drums, and dance the Kurrin on the rock, till Marang Booroo's response to their prayer is heard in the distant rumbling of thunder, and they go home rejoicing.

\* Thus they have for their altars groves and high places like the idolatrous Jews.

They must go "fasting to the mount," and stay there till "there is a sound of abundance of rain," when they get them down to eat and drink. My informant tells me it always comes before evening. We must conclude that the old women are wonderfully clever at taking a 'forecast,' and do not commence the fast till they sniff the rain.

All the villagers living in the vicinity of the hill make offerings of goats, whenever they think it desirable to propitiate this spirit; but he is not invoked in cases of sickness, unless the ojha declares it necessary. Sometimes bullocks are offered.

The next in importance in Chota-Nagpore appears to be the spirit Dara, whom the Oraons and Moondahs living with them adore in the form of a carved post stuck up where the great *jatras* are held, or in the village dancing place. Dara appears to be a god of rather bacchanalian characteristics, worshipped amidst much revelling and wassail. A sacrifice to him of fowls is followed by a feast in his honour, at which all the elders drink themselves into a state of sottish drunkenness, whilst the young people dance and make love; and next day comes the *jatra* which all the country attend.

The Penates are generally called the "old folks." They are in fact the *manes* of the votaries' ancestors; votive offerings are made to them when their descendants go on a journey, and they are generally the first that are propitiated when there is sickness in the family. By the Singbhoom Kols, the *manes* of the ancestors of the principal lady of the house are also honoured. The offerings to them are made on the path by which she was brought home as a bride. Desaoilli and Jaeroilli are propitiated for harvests and for cattle, Chandoo Seekur, the same probably as the Chanala of the Hos, for children.

The Pahan has to solemnize regularly the following festivals. The Hurihur, at the commencement of the planting season. Every one then plants a branch of the Belowa in his field and each contributes a fowl, a pitcher of beer and a handful of rice to the feast. The sacrifice is offered to Desaoilli, Jaer Boori and others, in the Saerna.

During the Sarhool—when the Sal tree blossoms—the sacrifice of a goat and fowls is offered in the Saerna by the Pahan to the *manes* of the founders of the village and to Dara. The introduction of the Sal blossom, in memory of the forest that was cleared when the village was formed, is very appropriate. At the khurria Poojah, when the rice is

harvested, the sacrifice is offered and the feast takes place on the Pahan's threshing floor.

Dalikattari: every second year a fowl, every third year a ram, every fourth year a buffalo. To provide what is required for this feast, the Pahan holds the Dalikattaree land.

I have already alluded to the division of the Moondahs and their cognates into "Keelles" or clans. Many of the Oraon clans and some of the Moondah in Chota-Nagpore are called after animals, and they must not kill or eat what they are named after.

Thus the Moondah "Enidhi" and the Oraon "Minjrar" or Eel tribe will not kill or eat that fish. The Hawk, Crow, Heron tribes will not kill or eat those birds. Livingstone, quoted in Latham,\* tells us that the sub-tribes of the Bitshaunas (or Bechuanas) are similarly named after certain animals, and a tribe never eats the animal from which it is named, using the term, "*ila*," hate or dread, in reference to killing it.

The above curious coincidence tempts me to give a few more details regarding the Oraon clans.

The "Tirki"—have an objection to animals whose eyes are not yet open, and their own offspring are never shewn till they are wide awake.

The "Ekkar"—will not touch the head of a tortoise.

The "Katchoor"—object to water in which an elephant has been bathed.

The "Amdiar"—will not eat the foam of the river.

The "Kujrar"—will not eat the oil of the Kujri tree, or sit in its shade.

The "Tiga"—will not eat the monkey.

The Ho chiefs could give me no signification for the names in which their families rejoice. The following are the most aristocratic, the Booriooli, the Poorthi, Sincoi, Baipoi, Soondee, Bandri.

I do not know of any people who are more careful in regard to the disposal of their dead than are the tribes of whom I am treating, especially the Singbhoom Kols and best classes of the Moondahs.

On the death of a Ho or Moondah, a very substantial coffin is constructed and placed on faggots of firewood. The body, carefully

\* Latham's *Ethnology*, Vol. II. p. 160.

washed and anointed with oil and turmeric, is reverently laid in the coffin, and all the clothes and ornaments used by the deceased are placed with it, and also any money that he had about him when he died. Then the lid of the coffin is put on and faggots piled above and around it, and the whole is burned. The cremation takes place in front of the deceased's house. Next morning water is thrown on the ashes and search made for the bones; all the larger fragments are carefully preserved, the remainder, with the ashes, are buried then and there. The selected bones are placed in a vessel and hung up in the house in a place where they may be continually viewed by the widow or mother. Thus they remain till the very extensive arrangements necessary for the final disposal are effected. A large monumental stone has to be selected, and it is sometimes so large that the men of several villages are employed to move it. It is brought to the family burial place, which with the Hos is close to their houses, and with the Oraons generally separated from the village by a stream. A deep round hole is dug beside the stone, and when all is ready, a procession is formed consisting of one old woman carrying the bones on a decorated bamboo tray, one or two men with deep sounding wooden drums, and half a dozen young girls, those in the front rank carrying empty and partly broken pitchers, and brass vessels. The procession moves with a solemn ghostly sliding step, in time to the deep sounding drum. The old woman carries the tray on her head, but at regular intervals she slowly lowers it, and as she does so, the girls gently lower and mournfully reverse the pitchers and brass vessels, to shew that they are empty.

In this manner the remains are taken to the house of every friend and relative of the deceased, within a circle of a few miles, and to every house in the village, and as it approaches, the inmates come out and mourn, as they call to mind all the good qualities of the deceased. The bones are thus conveyed also to all his favourite haunts, to the fields he cultivated, to the grove he planted, to the threshing-floor where he worked, and to the *akrah* where he made merry. When this part of the ceremony is completed, the procession returns to the village and moves in circles round the grave, gradually approaching its goal: at last it stops, and a quantity of rice and other food, cooked and uncooked, is now cast into the hole. The bones are then put into a

new earthen vessel and deposited on the rice, and the hole is filled in and covered with the large slab which effectually closes it against desecration.

The collection of these massive grave stones under the fine old tamarind trees is a remarkable feature in Kol villages, and almost an indelible one, for they are found in many places where Kols have not existed for centuries. Besides the grave stones, monumental stones are set up outside the village to the memory of men of note. They are fixed in an earthen plinth, on which, shaded by the pillar, the ghost is supposed to sit. The Kheriahs have collections of these monuments in the little enclosure round their houses, and offerings and libations are constantly made to them.

The funeral ceremonies above described are of a composite order, mingling with the Hindoo custom of cremation, what was in all probability their original mode of burial; but a very profound reverence for the dead pervades them all. I think it is very probable that the Kols originally disposed of their dead differently. The coffin, though put together on the faggots that are to consume it, has projections as if to facilitate transport. Omit the burning and substitute burial, and we have the careful disposal and subsequent adoration of the dead that is practised by the Chinese; but the burning of the body and the long retention of the ashes in a portable form may have been adopted at a time when the tribe could not be certain of continued residence in one place.

Tickell has given at length the Ho legend of the origin of the human race. It is supremely absurd, and very few of the present generation know anything or care anything about it. I have always found such legends changeable and untrustworthy. With no written record to give them permanence, they are altered either to suit new conditions or the fancy of the reciter. Thus though the Kols have known the English for little more than half a century, they assign to them a most honourable place in their genesis. The Assam Abors and Garrows do just the same.

I do not think that the present generation of Kols have any notion of a heaven or a hell that may not be traced to Brahminical or Christian teaching. The old idea is that the souls of the dead become "*bhoots*," spirits, but no thought of reward or punishment is connected with the

change. When a Ho swears, the oath has no reference whatever to a future state. He prays, that if he speak not the truth he may be afflicted in this world with the loss of all, health, wealth, wife, children; that he may sow without reaping and finally may be devoured by a tiger; but he swears not by any hope of happiness beyond the grave. He has in his primitive state no such hope, and I believe that most Indian aborigines, though they may have some vague ideas of continuous existence, will be found equally devoid of original notions in regard to the Judgment to come.

It may be said that the funeral ceremonies I have described, indicate clearly a belief in resurrection, else why should food, clothes and money be burned with the body or buried with the ashes? The Kols have given me the same explanation of this that I once before received from the Chulikutta Mishmees in Upper Assam, who have no notion of any existence beyond the grave. They do not wish to benefit by the loss of their friend, which they would do if they were to appropriate any article belonging to him: they therefore give with him all his personalties, all property that he and he alone used and benefited by; but this does not apply to the stock of the farm and household property that all profit by, or even to new cloth, for that might have been procured for any member of the family. It often happens that a respectable 'Ho' has goods of this nature, that he abstains from using even once, because if once used, the article will be destroyed at his death.

The Moondah Oraon races are passionately fond of field sports, and are so successful that large and small game soon disappear from the vicinity of considerable settlements; and they fear not to make a new settlement, consisting only of a few huts, in the jungles most infested by wild beasts. Every year at the commencement of the hot season, they form great hunting parties which are well described in Tickell's memoir. They are also greatly addicted to cock-fighting. They have periodical meets at assigned places where hundreds of fighting cocks are collected. Cruel steel spurs are used, and the combat is always *à l'outrance*, the victims becoming the property of the owners of the victorious birds. This is, I think, the only stake. They are fond of fishing too, and some of them are very expert in spearing large fish.

The arms of the Kols are to this day what they were in the days of "*Rama*"—the bow and arrow and battle-axe. The bow is simply a piece of bamboo, and the string is of the same material. The war arrows have large broad blades doubly and trebly barbed, but they make them of all shapes: poison they do not use. They commence practice with the bow and arrow at the earliest age. In Singbhoom boys three and four years old and upwards, when herding cattle or otherwise engaged, have always their bow, and blunt and sharp arrows; the former for practice, the latter to bring down birds when they have a chance.

In the villages of Chota-Nagpore where the Oraon and Moondah are mixed up together, the difference of character between the two races is not much marked; but if we compare the Singbhoom Hos or Chota-Nagpore Mankees and the Oraons, we see strong contrasts. The Oraon has the lively happy disposition of the Negro. He is fond of gaiety, decorating rather than clothing his person, and whether toiling or playing, is always cheerful.

The Ho or Moondah has more the dignity and reserve of the North American Indian, at least when he is sober. He appears to less advantage when he is drunk, and he is not unfrequently in that state. At all festivals and ceremonies, deep potations of the rice-beer called "*eeley*" are freely indulged in by both sexes. Inspired by this beverage, the young men and girls dance together all day and half the night; but the dances are perfectly correct, and whenever these meetings have led to improprieties, it is always attributed to a too free indulgence in *eeley*. As a rule, the men are reserved and highly decorous in their treatment of the women; and the girls, though totally free from the prudery that secludes altogether or averts the head of a Hindoo or Mahommedan maiden when seen by a man, have a modest demeanour, combined with frank open manners and womanly grace.

It is said by some, that at the seasons of their great festivals amongst themselves, breaches of chastity are of frequent occurrence; but the mere freedom of intercourse allowed to the sexes is likely to be viewed with unmerited prejudice and misconstrued by their neighbours of different race who place such restrictions upon it, and I believe that this may give rise to false imputations of impropriety. It is, at

all events, a fact that illegitimate births are rare. Out of her own tribe, a Ho girl is hardly ever known to go astray, though from the freedom allowed to her and, for a tropical climate, the ripe age at which she is likely to be sought in marriage, she must have to pass through many temptations.

The Hos are acutely sensitive under abusive language that at all reflects upon them, and may be and often are driven to commit suicide by an angry word. If a woman appears mortified by anything that has been said, it is unsafe to let her go away till she is soothed. The men are almost as sensitive as the women, and you cannot offend them more than by doubting their word. It has often seemed to me that the more a statement tells against themselves, the more certain they are to tell the exact truth about it. It frequently happens that a man is himself the first person to bring to notice that he has committed a crime; he tells all about it, and deliberately gives himself up to be dealt with according to law.

The Oraon is, I think, less truthful, he is more given to vagabondising, and wandering over the face of the earth in search of employment; he soon loses all the freshness of his character. He returns after an absence of years, unimproved in appearance, more given to drink and self-indulgence, less genial and truthful than before, with a bag of money that is soon improvidently spent. Those who have never left their own country have far more pleasing manners and dispositions, than those who return to it after years spent in other parts of India or beyond the seas. The fact is, they are not an improvable people. They are best seen in their wild state.

There is no more pleasing trait amongst all these tribes than their kindly affectionate manner one towards another. I never saw girls quarrelling, and never heard them abuse each other. They are the most unspiteful of their sex, and the men never coarsely abuse and seldom speak harshly of the women. This is remarkable on this side of India where you seldom pass through a bazar without hearing women screeching indecent abuse at each other across the street, whilst the men look on. A Kol girl's vocabulary is as free from bad language of this kind as a Bengalee's is full of it.

The young Oraons of both sexes are intensely fond of decorating their persons with beads and brass ornaments. These they entirely

discard on embracing Christianity, and the converts may be always recognised by the total absence of all such adornment. The converts do not join in the dances, or festivals, and must not even be seen as spectators, when they are going on. They appear indeed to lose all relish for their old amusements, and shrink with horror at the idea of resuming their discarded ornaments. And as Christianity is rapidly spreading amongst them, and in all probability will continue to spread more and more rapidly every year, it is quite possible that in the course of a few generations, the most marked characteristics of the races I am describing, will have been effaced for ever. It is marvellous with what firmness old prejudices are abandoned, old customs discarded, and even tastes changed, when they become Christians; and there is now a widespread feeling amongst the Kols themselves, that this change will inevitably come upon them all.

The Moondah-Oraon are a rapidly increasing people. We may form some calculation as to the rate of increase by the statistics of the Mission. In 1864, the baptised converts numbered 5,923, and in that year there were 195 births to 80 deaths. In 1865 there were 7,828 baptized Christians, and the births during the year were 309 to 86 deaths. The number of professing Christians is probably double the number registered as baptized. I subjoin in a tabular form brief vocabularies of the Moondahs and their cognates, referring to Tickell's memoir for a full notice of the language. I annex notes on the Oraon language with which I have been kindly favoured by the Reverend Frederic Batsch.

APPENDICES.



## APPENDIX A.



*List of words and phrases to be noted and used as test words for the discovery of the radical affinities of languages, and for easy comparison.*

| Numerals. | One to ten. | Twenty.     | Fifty. | Hundred. |
|-----------|-------------|-------------|--------|----------|
| Pronouns. | I.          | Of me.      | Mine.  |          |
|           | We.         | Of us.      | Our.   |          |
|           | Thou.       | Of thee.    | Thine. |          |
|           | You.        | Of you.     | Your.  |          |
|           | He.         | Of him.     | His.   |          |
|           | They.       | Of them.    | Their. |          |
|           |             |             |        |          |
| Hand.     |             | Father.     |        | Sun.     |
| Foot.     |             | Mother.     |        | Moon.    |
| Nose.     |             | Brother.    |        | Star.    |
| Eye.      |             | Sister.     |        | Fire.    |
| Mouth.    |             | Man.        |        | Water.   |
| Tooth.    |             | Woman.      |        | House.   |
| Ear.      |             | Wife.       |        | Horse.   |
| Hair.     |             | Child.      |        | Cow.     |
| Head.     |             | Son.        |        | Dog.     |
| Tongue.   |             | Daughter.   |        | Cat.     |
| Belly.    |             | Slave.      |        | Cock.    |
| Back.     |             | Cultivator. |        | Duck.    |
| Iron.     |             | Shepherd.   |        | Ass.     |
| Gold.     |             | God.        |        | Camel.   |
| Silver.   |             | Devil.      |        | Bird.    |
|           |             |             |        |          |
| Go.       |             | Come.       |        | Die.     |
| Eat.      |             | Beat.       |        | Give.    |
| Sit.      |             | Stand.      |        | Run.     |

|      |      |        |
|------|------|--------|
| Up   | down | before |
| near | far  | behind |
| who  | what | why    |
| and  | but  | if     |
| yes  | no   | alas.  |

|                |              |               |
|----------------|--------------|---------------|
| A Father.      | Two Fathers. | Fathers.      |
| Of a father.   |              | Of fathers.   |
| To a father.   |              | To fathers.   |
| From a father. |              | From fathers. |

|                  |                |                 |
|------------------|----------------|-----------------|
| A daughter.      | Two daughters. | Daughters.      |
| Of a daughter.   |                | Of daughters.   |
| To a daughter.   |                | To daughters.   |
| From a daughter. |                | From daughters. |

|                  |               |                |
|------------------|---------------|----------------|
| A good man.      | Two good men. | Good men.      |
| Of a good man.   |               | Of good men.   |
| To a good man.   |               | To good men.   |
| From a good man. |               | From good men. |

|               |  |             |
|---------------|--|-------------|
| A good woman. |  | Good women. |
| A bad boy.    |  | A bad girl. |

|      |        |         |
|------|--------|---------|
| good | better | best    |
| high | higher | highest |

|             |               |        |         |
|-------------|---------------|--------|---------|
| a horse     | a mare        | horses | mares   |
| a bull      | a cow         | bulls  | cows    |
| a dog       | a bitch       | dogs   | bitches |
| a he-goat   | a female goat | ...    | goats   |
| a male deer | a female deer | ...    | deer.   |

|         |           |            |
|---------|-----------|------------|
| I am    | Thou art  | He is.     |
| We are  | You are   | They are.  |
| I was   | Thou wast | He was.    |
| We were | You were  | They were. |

|           |             |        |              |
|-----------|-------------|--------|--------------|
| Be.       | To be.      | Being. | Having been. |
| I may be. | I shall be. |        | I should be. |

|               |                |          |                    |
|---------------|----------------|----------|--------------------|
| Beat.         | To beat.       | Beating. | Having beaten.     |
| I beat.       | Thou beatest.  |          | He beats.          |
| We beat.      | You beat.      |          | They beat.         |
| I am beating. | I was beating. |          | I had beaten.      |
| I may beat.   | I shall beat.  |          | I should beat.     |
| I am beaten.  | I was beaten.  |          | I shall be beaten. |
| I go.         | Thou goest.    |          | He goes.           |
| I went.       | Thou wentest.  |          | He went.           |
| Go.           | Going.         |          | Gone.              |

What is your name ?

How old is this horse ?

How far is it from here to Kashmir ?

How many sons are there in your father's house ?

I have walked a long way to-day.

The son of my uncle is married to her sister.

In the house is the saddle of the white horse.

Put the saddle upon his back.

I have beaten his son with many stripes.

He is grazing cattle on the top of the hill.

He is sitting on a horse under that tree.

His brother is taller than his sister.

The price of that is two rupees and a half.

My father lives in that small house.

Give this rupee to him.

Take those rupees from him.

Beat him well and bind him with ropes.

Draw water from the well.

Walk before me.

Whose boy comes behind you ?

From whom did you buy that ?

From a shop-keeper of the village.

## APPENDIX B.

Comparative Table of Aboriginal words.

| ENGLISH. | DRAVIDIAN. |                           | KOLARIAN.             |          |           | INDO-CHINESE.  |                   |  |
|----------|------------|---------------------------|-----------------------|----------|-----------|----------------|-------------------|--|
|          | Tamul.     | Gond, Oraon & Rajmehalee. | Hos or Singboom Kols. | Sontals. | Thibetan. | Bodo or Mechi. | Khamti (Siamese.) |  |
| One      | onru       | undi                      | mi                    | mia      | chik      | che            | niong             |  |
| Two      | irandu     | ranu                      | bara                  | baria    | nyis      | ne             | song              |  |
| Three    | munru      | munu                      | apia                  | pia      | sum       | tham           | sam               |  |
| Four     | nalu       | nalu                      | apania                | ponia    | zhi       | bré            | si                |  |
| Five     | angu       | saighan                   | moya                  | monaya   | gna       | ba             | pa                |  |
| Six      | aru        | sarong                    | turia                 | turui    | thu       | do             | pok               |  |
| Seven    | ezhu       | yetu                      | iya                   | iair     | dun       | chin           | tet               |  |
| Eight    | ettu       | anamur                    | irlia                 | iral     | gyé       | ye             | pet               |  |
| Nine     | oubadu     | ...                       | area                  | aré      | guh       | küha           | kan               |  |
| Ten      | pata       | pada                      | gelea                 | gel      | chuh      | te             | sip               |  |
| I        | nan        | enan or en                | aing                  | ing      | gna       | ang            | kaü               |  |
| Thou     | ni         | nien                      | am                    | ang      | khe       | nang           | maü               |  |
| He       | avan       | asan or atti              | ini                   | üni      | khü       | bi             | man               |  |



Comparative Table of Aboriginal words,—(Continued.)

| ENGLISH. | DRAVIDIAN.  |                           | KOLARIAN.              |          | INDO-CHINESE. |                |         |
|----------|-------------|---------------------------|------------------------|----------|---------------|----------------|---------|
|          | Tamul.      | Gond, Oraon & Rajmehalee. | Hos or Singbhoom Kols. | Sontals. | Thibetan.     | Bodo or Mechi. |         |
| Sun      | pakalon     | dharmi or ber             | singi                  | singi    | nisina        | shan           | wan     |
| Moon     | tingal      | bilpe                     | chandū                 | chundo   | dawa          | nokabir        | lun     |
| Star     | vanmin      | suku or binka             | epil                   | ipil     | kurma         | hatot          | naü     |
| Fire     | nirappu     | kis or chik               | sengel                 | sengil   | ma            | wat            | fai     |
| Water    | nir         | yer                       | dah                    | dha      | chu           | doi            | nam     |
| Earth    | nilam       | kekhat                    | oti                    | ot       | sa            | ha             | languim |
| House    | manei       | roon or erpa              | oa                     | ora      | nang          | noü            | häu     |
| Horse    | kudirei     | kondand                   | sadam                  | sadhām   | ta            | korai          | mää     |
| Dog      | nayi        | nai                       | seta                   | seta     | khyi or ayo   | ahoi or ma     | mä      |
| Cat      | pusseior    | birka                     | bilai                  | pusi     | byala or süni | moügi          | miaü    |
| Fish     | min         | min                       | haku                   | hai      | gna           | na             | pa      |
| Cow      | pasu or avu | üdi or oi                 | gundi                  | üri      | ba            | masha          | ngo     |

| English. | Sanscrit.  | Persian.  | Turkish | Hindee.       | Panjabee.  |
|----------|------------|-----------|---------|---------------|------------|
| One      | éka        | ék        | bir     | ék            | ek, eko    |
| Two      | dwi        | do        | iki     | do            | do         |
| Three    | tri        | seh       | üch     | tray or tin   | teen       |
| Four     | chatvr     | chahar    | dürt    | char          | char       |
| Five     | panchan    | panj      | besh    | panch         | panj       |
| Six      | shash      | shas      | altü    | cheh          | chi        |
| Seven    | sapta      | haft      | yeddi   | sat           | süt        |
| Eight    | ashtan     | hast      | sekkiz  | ath           | uth        |
| Nine     | navan      | nah       | dokküz  | nava, or nau  | nou        |
| Ten      | dashan     | deh       | own     | das           | das        |
| Twenty   | vingsati   | best      | yirmi   | bis, or koree | vee, koree |
| Fifty    | panchásat  | punjah    | elli    | puchas.       | punjah     |
| Hundred  | sata       | sád       | yüz     | sow           | sow        |
| I        | aham       | man       | ben     | main          | mnen       |
| Of me    | mama or me | i-man     | benin   | mujhka        | mujhda     |
| Mine     | madiya     | man or Am | -m,-in  | merá          | mera       |

Comparative Table of Northern and Arian Words,—(Continued.)

| English.                 | Sanscrit.                           | Persian.                             | Turkish.                       | Hindee.                    | Panjabee.                 |
|--------------------------|-------------------------------------|--------------------------------------|--------------------------------|----------------------------|---------------------------|
| We<br>Of us<br>Our       | vayam<br>asmakam, nah<br>asmadiya   | ma<br>i-ma<br>ma or an               | biz<br>bizim<br>miz, imiz      | ham<br>hamka<br>hamara     | assi<br>assi da<br>sada   |
| Thou<br>Of thee<br>thine | twan<br>tava, te<br>twadiya, távaka | to<br>i-to<br>to or at               | sen<br>senin<br>-n, in         | tu<br>tujhka<br>tera       | too<br>tugh-da<br>tera    |
| You<br>of you<br>Your    | yuyam<br>yusmákam, vah<br>yusmadiya | shuma<br>i-shuma<br>shuma            | siz<br>sizne<br>niz, iniz      | toom<br>toom ka<br>toomara | tassi<br>tasi da<br>tohda |
| He<br>of him<br>his      | sa<br>tadiya<br>tasya               | an or oe<br>i-an<br>ash or oe        | ol<br>aniün<br>i, si           | wuh<br>uska<br>us-ka       | o'<br>o' da<br>oéda       |
| They<br>of them<br>their | te<br>tesam<br>tadiya               | aishan<br>i-aishan<br>aishan or shan | aular<br>aularüm<br>larü, leri | wè<br>un-ka<br>un-ka       | oèe<br>ohee da<br>ohee da |

|          |                |          |             |                |                |
|----------|----------------|----------|-------------|----------------|----------------|
| Hand     | hasta          | dast     | el          | hat            | húth           |
| Foot     | pada           | pay      | ayak        | pair, paon     | pyr            |
| Nose     | násiká         | beenee   | burün       | nák            | nuk            |
| Eye      | Chaxú, netra   | chashm   | güz         | ánkh           | ukh, neta      |
| Mouth    | mukha          | dehan    | aghuz       | mooh           | mook           |
| Tooth    | danta          | dandan   | deesh       | dánt           | dund           |
| Ear      | karna          | gosh     | kúlák       | kán            | kan            |
| Hair     | kesh, bála     | moo      | múí         | bal            | wal, kes       |
| Head     | sirah, mastaka | sir      | bash        | sir, kulla     | sir, kulla     |
| Tongue   | jihwá          | zabán    | deel        | jib            | jeebe, zuban   |
| Father   | pítá           | pedr     | bábá        | peeta, bap     | bap, pita      |
| Mother   | mátá           | mádr     | ama         | ma             | ma, unuma      |
| Brother  | bhrátá         | brádr    | kárdásh     | bhai           | bhao           |
| Sister   | swashá         | hamshira | küz kárdásh | bahin          | bhyn           |
| Man      | mánusha, jana  | mardám   | mard        | manooos, admee | monookh, admee |
| Woman    | stri           | zun      | karü        | aurat          | teemee, stree  |
| Wife     | bharyá         | zöuja    | karü        | joroo          | bohoo          |
| Child    | santána        | farzund  | chojúk      | bal, chokra    | baluk          |
| Son      | putra          | pesr     | oghül       | pootra, beta   | putra          |
| Daughter | duhitá, kanyá  | dokhtr   | küz         | pootree, betee | putree         |

## Comparative Table of Northern and Arian Words,—(Continued.)

| English.      | Sanscrit.         | Persian.         | Turkish. | Hindee.        | Panjabee.   |
|---------------|-------------------|------------------|----------|----------------|-------------|
| Sun           | sûrya             | aftab            | ghûnesh  | suraj          | sooraj      |
| Moon          | chandra           | mah              | ay       | chand          | chand       |
| Star          | naxatra, târaka   | sitara           | yildiz   | tara           | tara        |
| Fire          | agni              | atash            | átash    | ag             | ág          |
| Water         | ápa, jala         | áb               | soo      | jul, panee     | jul, panee  |
| Earth         | prithwi, mrittika | zameen           | toprak   | prithwi, matee | bhomeen     |
| Wood          | gahan, káshtha    | chob             | ágáj     | lakrí, kath    | kath        |
| House         | griha             | khana            | ev       | ghur           | ghur        |
| Horse         | ghotaka, aswa     | asp              | át       | ghoira         | ghoða       |
| Cow           | gábhi, go         | gāo              | inek     | gai            | gou, goru   |
| Dog           | kukkura, swan     | sug              | kúpek    | kootha         | kootha      |
| Cat           | bidála            | gurbah           | keci     | billee         | billee      |
| Fish          | matsya            | mahi             | balúk    | muchee         | muchee, mas |
| Of a father   | pitûh             | i-pedr           | bábânün  | pittee ka      | peethe da   |
| To a father   | pitaram           | ba-pedr, pedr-ra | bábáyah  | pithee ko      | peethe nu   |
| From a father | pitûh             | az pedr          | bábádan  | pithee se      | peethe, to  |

|                                      |                                                     |                                            |                                   |                                         |                                    |
|--------------------------------------|-----------------------------------------------------|--------------------------------------------|-----------------------------------|-----------------------------------------|------------------------------------|
| Two fathers<br>Bad father<br>Fathers | pitaran<br>dushta pitá<br>pitarah                   | do-pedran<br>pedr bad<br>padran            | iki bábá<br>.....<br>.....        | do pithee<br>bud pitha<br>pithee        | do peethe<br>bad peetha<br>peethe  |
| Good man                             | saj-jana                                            | ek mardum khoob                            | ayü mard                          | acha adnee, bhala<br>manus              | changa manuk                       |
| Two good men                         | saj-janau                                           | do marduman<br>khoob                       | iki ayü mard                      | do bhale manus                          | do change manuk                    |
| Good men                             | saj-janáh                                           | marduman khoob                             | ayü mardlar                       | bhale manus                             | change manuk                       |
| Good<br>Better<br>Best               | sat<br>sat-tara<br>sat-tama                         | khoob<br>khoobtar<br>khoobtareen           | ayü<br>daha ayü<br>au ayü         | achha, suth<br>aur achha<br>subse achha | changa<br>oodumee                  |
| I am<br>Thou art<br>He is            | asmi, bhavámi<br>asi, bhavasi<br>asti, bhavati      | man hastam<br>tu hasti<br>oe hast          | olürüm<br>olürsum<br>olür         | main hoon<br>tu hai<br>wuh hai          | main hon<br>tu hai<br>o' hai       |
| We are<br>You are<br>They are        | smah, bhavámah<br>stha, bhavatha<br>santi, bhavanti | ma hasteem<br>shuma hasted<br>anan hastand | olürüz<br>olüstünüz<br>olürlar    | hum hain<br>toom hain<br>wee hain       | assi hain<br>tussi hain<br>oe hain |
| I was<br>Thou wast<br>He was         | ásam, abhavam<br>ásih, abhavah<br>ásít, abhavat     | man boodam<br>tu boodee<br>oe bood         | olürdüm<br>olürdüin<br>olürdü     | main tha<br>tu the<br>wuh the           | main tha<br>tu the<br>o' the       |
| We were<br>You were<br>They were     | ásma, abhaváma<br>ástá, abhavata<br>ásan, abhavun   | ma boodeem<br>shuma booded<br>anan boodand | olürdak<br>olürdündz<br>olürdülar | hum the<br>toom the<br>we the           | assi the<br>tassi the<br>oe the    |

## Comparative Table of Northern and Arian Words,—(Continued.)

| English.      | Sanscrit.       | Persian         | Turkish.   | Hindee.     | Panjabee.   |
|---------------|-----------------|-----------------|------------|-------------|-------------|
| Be            | bhava           | bash            | ol         | ho          | ho          |
| To be         | bhavitum        | boodan          | olnak      | hona        | hona        |
| Having been   | bhutwá          | boodah          | olmüsh     | hokar, hoke | hoke        |
| I shall be    | bhavishyami     | man khaham bood | olajagüm   | hoga        | hoga        |
| I should be   | abhavishyám     | man khaham bood | olsüm      | honga       | honga       |
| I beat        | aham hanmi      | man zadam       | wurüm      | main maron  | main maren  |
| Thou beatest  | twam hansí      | tu zadee        | wursüm     | tu mare     | tu mare     |
| He beats      | sa hanti        | oe zad          | wurür      | wuh mare    | o' mare     |
| We beat       | vayam hanma     | ma zudeem       | wurürüz    | hum maren   | assi maren  |
| You beat      | yuyam hatha     | shuma zaded     | wurürsünüz | toom maren  | tassi maren |
| They beat     | te ghnanti      | anan z adand    | wurürlar   | we maren    | oee maren   |
| Beat          | jahi            | be-zan          | wur        | mar         | mar         |
| To beat       | hantum          | zadan           | wurmak     | marna       | marna       |
| Having beaten | hatwá           | zadah boodah    | wurmüsh    | markar      | markee      |
| I did beat    | aham jaghána    | man zad boodam  | wurürdüm   | marahon     | marahon     |
| I shall beat  | aham hanishyámi | man khaham zad  | wurajagüm  | maronga     | maronga     |

| English. | Pushtoo. | Aboriginal Caucasian. | Cashmeree. | Khas of Nepal. | Singalese. |
|----------|----------|-----------------------|------------|----------------|------------|
| One      | you      | ach                   | akh        | ék             | ekai       |
| Two      | dwá      | du                    | zuh        | dwi            | dekai      |
| Three    | dare     | tre                   | trae       | tin            | thumai     |
| Four     | salor    | tsadda                | tsoar      | chár           | hatherai   |
| Five     | punz     | punz                  | pántsah    | páncsh         | pahai      |
| Six      | sh'paj   | su                    | shesh      | cbhah          | hihai      |
| Seven    | avo      | sut                   | sat        | sát            | hathai     |
| Eight    | atha     | ast                   | aaít       | áth            | atai       |
| Nine     | nah      | nu                    | noun       | nou            | namai      |
| Ten      | las      | dos                   | dah        | das            | dhahayai   |
| Twenty   | schil    | biis                  | wuh        | bis            | vissai     |
| Fifty    | pinzúst  | du-isa-dos            | pantsah    | pachás         | panahai    |
| Hundred  | sil      | punc                  | hat        | sai            | séyái      |
| I        | zu       | ei                    | boh        | man            | mamey      |
| Of me    | zma      | ima                   | müne       | meró           | magey      |
| Mine     | zma      | ima                   | meum       | .....          | magey      |
| We       | manga    | ima                   | ass        | hami hera      | matey      |
| Of us    | zmuj     | imna                  | soné       | hami heruko    | apey       |
| Ours     | zmuj     | imna                  | meüm       | .....          | apey       |

Comparative Table of Arian Words,—(Continued.)

| English. | Pushtoo. | Aboriginal Caucasian. | Cashmeree.    | Khas of Nepal. | Singalese.    |
|----------|----------|-----------------------|---------------|----------------|---------------|
| Thou     | ta       | tu                    | tsu           | ton, tan       | thamoosay     |
| Of thee  | da ta    | tua                   | choan         | tero           | thamoosaygey  |
| Thine    | sta      | tua                   | theum         | .....          | thamoosaygey  |
| You      | taso     | vi                    | tsuhu         | timi heru      | umbe          |
| Of you   | da taso  | ya                    | tahoond       | timi heruko    | umbegey       |
| Your     | staso    | ya                    | tuhaindi      | .....          | umbegey       |
| He       | hagha    | sega                  | su            | ú              | āya           |
| Of him   | da hagha | séga                  | taha          | uskò           | āyagey        |
| His      | da hagha | séga                  | tamsand       | .....          | āyagey        |
| They     | hago     | sige                  | tum           | úní heru       | awan          |
| Of them  | da hago  | sigā                  | tila or tunun | uni heruko     | awānegey      |
| Their    | da hago  | sigā                  | tuhand        | .....          | awanegey      |
| Hand     | las      | das                   | atha          | háth           | hathey        |
| Foot     | .....    | kur                   | kor, padu     | górá           | payá, kakoole |
| Nose     | paza     | nasuri                | nast          | náka           | nahaye        |
| Eye      | stirgha  | ānsi                  | nag, anch     | an̄ka          | áha           |
| Mouth    | .....    | asi                   | aás, kiát     | mukha          | kate          |
| Tooth    | .....    | dont                  | dand          | dánt           | dhathe        |

|          |          |               |               |             |       |       |
|----------|----------|---------------|---------------|-------------|-------|-------|
| Ear      | ghwaj    | kane          | kan           | kan         | kan   | kan   |
| Hair     | zoolf    | kes, tssakaya | raon          | mast, wal   | dru   | dru   |
| Head     | .....    | oloowe        | tau, tou      | kállá       | sa    | sa    |
| Tongue   | .....    | dhewe         | .....         | jian        | ..... | ..... |
| Father   | plár     | appa, thatha  | bábá          | maul        | dai   | dai   |
| Mother   | mor      | amma          | amma          | maij        | arau  | arau  |
| Brother  | uror     | tya           | doju          | boi         | bla   | bla   |
| Sister   | chor     | nanyee        | bahini        | benjí       | sus   | sus   |
| Man      | sarrae   | miniya        | manis         | mohnyn      | mats  | mats  |
| Woman    | khadza   | ganee         | swasú         | zanana, bya | istri | istri |
| Wife     | mandinah | ishteree      | jo'i          | bya         | ..... | ..... |
| Child    | balak    | lamaya        | .....         | shur, nechu | ..... | ..... |
| Son      | dzoe     | pootha        | chóra         | nechu       | sagga | sagga |
| Daughter | jmai     | .....         | chóri         | kori        | su    | su    |
| Sun      | .....    | surya, ouwa   | surj          | saria       | ..... | ..... |
| Moon     | spazma   | handhe        | chánd         | zun         | ..... | ..... |
| Star     | storè    | istharookawe  | tará          | tarukh      | ..... | ..... |
| Fire     | or       | gindhere      | ago           | agan, nār   | ana   | ana   |
| Water    | oba      | wathoore      | pani          | tresh       | abu   | abu   |
| Earth    | .....    | polawa        | prithwi, mati | zameen      | boom  | boom  |

## Comparative Table of Arian Words,—(Continued.)

| English.      | Pushtoo.        | Aboriginal Caucasian. | Cashmeree.      | Khas of Nepal.         | Singalese.                |
|---------------|-----------------|-----------------------|-----------------|------------------------|---------------------------|
| Wood          | owani           | dau                   | agar            | káth                   | gadhère                   |
| House         | kor             | ama                   | gar, car        | ghar                   | aspeya                    |
| Horse         | ás              | guru                  | gür             | ghora                  | gona                      |
| Cow           | ghwa            | ga                    | goop            | gai                    |                           |
| Dog           | spái            | kuri                  | hoon            | kukar                  | balla                     |
| Cat           | púshee          | bisas                 | broar           | biralo                 | ballelee                  |
| Fish          | .....           | .....                 | gad             | machha                 | matsya, maloo             |
| Of a father   | da plara        | dai-wa or dá          | malu sand       | bábá ko                | thathagey                 |
| To a father   | plara ta        | dai-e                 | malis           | bábá lai               | thathali                  |
| From a father | la plara        | dai-da                | malinishi       | .....                  | thathageng                |
| Two fathers   | dwa plaruna     | du dai                | zu mail         | dwi baba               | thathadhenna              |
| Fathers       | plaruna         | dai                   | mail            | bábá heru              | thathagey                 |
| Bad father    | nakar plar      | abaru dai             | yech maul       | naniko bábá            | narake thattha            |
| A good man    | khah sarrae     | mats maista           | ek rut mohuyn   | ek niko manis          | hondhe mineya             |
| Two good men  | dwa khaha sarri | du mats maista        | zu ruch mohnivi | dwi niko manis<br>heru | hondhe minissu-<br>dhenna |
| Good men      | khaha sarri     | mats maista           | ruch mohnivi    | niko manis heru        | hondhe minissu            |

|             |             |           |               |       |        |
|-------------|-------------|-----------|---------------|-------|--------|
| Good        | khah        | maista    | rut or jan    | niko  | hondhe |
| Better      | der khah    | .....     | yats rut      |       |        |
| Best        | tol khah    | .....     | sitah rut     |       |        |
| I am        | zu yaim     | ei sum    | boh chus      |       |        |
| Thou art    | ta ye       | tu sis    | tsa chuk      |       |        |
| He is       | hagha dhè   | sega se   | su chu        |       |        |
| We are      | munga yoo   | ima simis | áass ché      |       |        |
| You are     | taso yast   | vee sik   | tohi chewak   |       |        |
| They are    | hagha deè   | sege sin  | tim ché       |       |        |
| I was       | zu woom     | ei su     | boh asus      |       |        |
| Thou wast   | ta we       | tu suus   | tsu asuk      |       |        |
| He was      | hagha woo   | sega se   | su aus        |       |        |
| We were     | manga wōō   | ima sumis | áass ais      |       |        |
| You were    | taso wéé    | vee sus   | tohi asawa    |       |        |
| They were   | hagha wōō   | sige sin  | tim assis     |       |        |
| Be          | aos         | sales     | sta-as        | honee |        |
| To be       | aosdal      | .....     | asan          |       |        |
| Having been | .....       | .....     | asnut-asas    |       |        |
| I shall be  | zu bah yáim | ei salam  | boh yats asan |       |        |
| I should be |             |           |               |       |        |

Comparative Table of Arian Words,—(Continued.)

| English.                           | Pushtoo.                               | Aboriginal Caucasian.                         | Cashmeree.                                           | Khas of Nepal. | Singalese.                      |
|------------------------------------|----------------------------------------|-----------------------------------------------|------------------------------------------------------|----------------|---------------------------------|
| I beat<br>Thou beatest<br>He beats | zu wajam<br>ta wajò<br>hagha wajé      | ei veeyansam<br>tu veeyansis<br>siga veeyansi | boh layan chus<br>tsu layan chuk<br>su layan chu     | .....          | mamey ghahanown                 |
| We beat<br>You beat<br>They beat   | munga wajó<br>taso wajo<br>hagha wajeè | .....<br>.....<br>.....                       | aass layan che<br>tohi layan chewak<br>tim layan ché | .....<br>..... | gahapan<br>gahande              |
| Beat<br>To beat<br>Having beat     | waj<br>wajdal<br>wajhalee              | veeyans<br>.....<br>.....                     | layan or maron<br>layan<br>asmat layan               | .....<br>..... | mumey gahanwa<br>mumey gahanowa |
| I did beat<br>I shall beat         | zu wajdam<br>zu bah wájam              | ei veeyansa<br>ei veeyansalam                 | boh layan asus<br>boh yats layan                     | .....<br>..... |                                 |

## Comparative Table of Arian Words,—(Continued.)

| English. | Bengalee.    | Ooryah.  | Maharatta. | Guzeratee. |
|----------|--------------|----------|------------|------------|
| One      | ek           | eko      | ek         | ek         |
| Two      | dui          | doo-i    | don        | be         |
| Three    | tin          | tini     | ten        | tran, ton  |
| Four     | chár         | chari    | chár       | chár       |
| Five     | pánch        | pancho   | pánch      | pánch      |
| Six      | chhay        | chho     | sahá       | chhá       |
| Seven    | sát          | shato    | sát        | sát        |
| Eight    | át           | atho     | át         | át         |
| Nine     | nay          | no-o     | nou        | nou        |
| Ten      | das          | doshó    | dáhá       | dás        |
| Twenty   | bish, kuri   | kore-e   | vis        | bis        |
| Fifty    | panchás      | panchaso | pánnás     | pachás     |
| Hundred  | sata         | shoye    | sámhär     | sou        |
| I        | ámi          | ambhay   | mi         | hún        |
| Of me    | ámár, mör    | ambhor   | májhe      | márún      |
| Mine     | mama, madiya | ambhor   | májhe      | márún      |

## Comparative Table of Arian Words,—(Continued.)

| English. | Bengalee.      | Oorya.           | Maharatta.            | Guzratee.   |
|----------|----------------|------------------|-----------------------|-------------|
| We       | ámrá           | ambkoo           | amhi                  | apre, hámon |
| Of us    | ámáder, moder  | ambha mankoo     | ápás-che, ápás        | aprun       |
| Ours     | "              | ambha manunkoo   | amhálokáche           | aprun       |
| Thou     | tumi           | toombhay         | tomhi                 | tún         |
| Of thee  | tomar, tor     | toombhar         | tujhe                 | thárú       |
| Thine    | taba, twadiya  | toombhar         | tujhe, tomche         | thárú       |
| You      | tomrá          | toombho man      | tomhi lok             | tome        |
| Of you   | tomáder, toder | toombho manko    | tomhá lokáche         | tomárú      |
| Your     | jushmadiya     | toombho manunkoo | tumche, tomhá lokáche | tomárú      |
| He       | tini, se       | tahar            | to                    | te          |
| Of him   | tár, thár      | tankor           | tyáchá                | tenu        |
| His      | tadiya         | tankor           | tyáchá                | tenu        |
| They     | tárá, thárá    | samanay          | tyálokáchá            | teo         |
| Of them  | táder, tháder  | tahankor         | tyálokási             | teonu       |
| Their    | tadiya         | tahankor         | tyálokáche            | teonu       |
| Hand     | hát            | hato             | háth                  | háth        |
| Foot     | pá             | goro             | pád                   | pág         |
| Nose     | nák            | nako             | nák                   | nák         |

|          |               |               |                 |                 |
|----------|---------------|---------------|-----------------|-----------------|
| Eye      | chok<br>mukha | akhi<br>mooho | däre<br>tond    | ápkh<br>máhrú   |
| Mouth    | dánt          | danto         | dát             | dánt            |
| Tooth    | kán           | kano          | kán             | kán             |
| Ear      |               |               |                 |                 |
| Hair     | chul          | balo          | kes             | bál             |
| Head     | máthá         | motha         | doká, sir       | máthu           |
| Tongue   | jib           | jihba         | jibh            | jibh            |
| Father   | báp           | bapo          | báp             | báp             |
| Mother   | má            | ma            | mái, ái         | máh             |
| Brother  | bháí          | bhai          | bháú            | bháí            |
| Sister   | bon           | bhownee       | báhin           | ben             |
| Man      | mánush        | minipo        | mánús           | mánús           |
| Woman    | máyá, má      | maikinya      | boiká           | strí, boiré     |
| Wife     | mág, strí     | mipo          | boikú           | pannellí, boire |
| Child    | santán        | chha, pila    | sántáli, lekre. | bachehhon       |
| Son      | chhelya       | poo-o         | loyk, putro     | dikro           |
| Daughter | máyá          | jhiyo         | lyek.           | dikré           |
| Sun      | surja         | soorjyo       | súriyo.         | súraj           |
| Moon     | cháand        | chando        | cháandrá        | cháand          |
| Star     | tará          | tora          | lakshtá         | tará            |

## Comparative Table of Arian Words,—(Continued.)

| English.      | Bengalee.   | Oorya.         | Maharatta.     | Guzratee.    |
|---------------|-------------|----------------|----------------|--------------|
| Fire          | águn        | nian           | agni, bistu    | ágni, ág     |
| Water         | jal         | pani           | pani           | pani         |
| Earth         | máti, bhui  | proothwee      | prithwí, zamin | mitté, zámín |
| Wood          | kát         | katho          | lákre, lákúr   | lákron       |
| House         | ghar        | ghur           | ghár, wára     | ghár         |
| Horse         | ghora       | gorha          | ghorá          | ghoro        |
| Cow           | goru        | gai            | gai            | gai          |
| Dog           | kukur       | kootha         | kutrá          | kutro        |
| Cat           | birál       | birarhee       | mánjer         | belári       |
| Fish          | mách        | machhee        | mássá          | máchlí       |
| Of a father   | báper       | bapur          | bápá che       | bápnú        |
| To a father   | bápke       | bapungko       | bápás          | bápne        |
| From a father | báper thain | bapungko tharo | bápá pásún     | báp pásethi  |
| Two fathers   | dui báp     | doce bapo      | don báp        | be báp       |
| Fathers       | bápera      | bapwanay       | bahu báp       | bápá         |
| Bad father    | manda báp   | manda bap      | wáet báp       | kháráb báp   |

|                                        |                                               |                                                                       |                                                |
|----------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------|
| A good man<br>Two good men<br>Good men | ek bhála lok<br>dwi bhála lok<br>bhála lokera | ek changle mánús<br>don changle mánúsá<br>changle mánúsá              | ek sáro mánús<br>be sáru mánúsá<br>sáru mánúsá |
| Good<br>Better                         | bhála<br>uttamatara                           | chángle<br>te apekshá chángle, or<br>te áhúm chángle<br>bahut chángle | sáru<br>bodháre sáru                           |
| Best                                   | uttamottama                                   | mi áhe<br>tú áhas or tomhi áhet<br>to áhe                             | [sáru<br>bodáthé                               |
| I am<br>Thou art<br>He is              | ámi áchi<br>tumi ácha<br>tini áchen           | amhilok áhot<br>tumhilok áhót<br>tya lok áhet                         | hún chháún<br>tún chhe<br>te chhe              |
| We are<br>You are<br>They are          | ámrá áchi<br>tomrá ácha<br>tará áchen         | me hoto<br>tu hotásh<br>to hotá                                       | hamon chheyé<br>tomen chho<br>teo chhe         |
| I was<br>Thou wast<br>He was           | ámi chhilám<br>tumi chhilá<br>tini chhilen    | amhilok hoto<br>tumhilok hotá                                         | hún hoto<br>tún hoto<br>te hoto                |
| We were<br>You were                    | ámrá chhilám<br>tomrá chhilá                  | tyalok hote                                                           | hāmon hotá<br>tomeñ hotá                       |
| They were                              | tará chhilen                                  | honá<br>honáche<br>jhále                                              | teo hotá                                       |
| Be<br>To be<br>Having been             | hao<br>haite<br>haiyá, haile                  |                                                                       | houñ, thobon<br>thowáne<br>thayún hoton        |

Comparative Table of Arian Words,—(Continued.)

| English.                           | Bengalee.                             | Oorya.                                                          | Maharatta.                                  | Guzratee.                                         |
|------------------------------------|---------------------------------------|-----------------------------------------------------------------|---------------------------------------------|---------------------------------------------------|
| I shall be<br>I should be          | ámi haibo<br>ámi haitám               | ambhay haybon<br>.....                                          | mi eyén<br>mi álačh                         | hún thowás<br>mäne tháú joiã                      |
| I beat<br>Thou beatest<br>He beats | ámi mári<br>tumi máro<br>tini máren   | ambhay maree<br>toombhay maro<br>say maronti                    | mi mártá he<br>tu máritos<br>to márito      | hún máruéhon<br>ton márechhe<br>te márechhe       |
| We beat<br>You beat<br>They beat   | ámrá mári<br>tomrá máro<br>tará máren | ambhay manay marie<br>toombhay manay maro<br>say manay maroonte | amhilok márito<br>tumhi márá<br>telok márlé | hãmon máriéhhyé<br>tomen márochho<br>teo márechhe |
| Beat<br>To beat<br>Having beaten   | már<br>márite<br>máryá                | mará<br>mariba<br>marce                                         | már<br>márálá<br>márlé láhe                 | maróún<br>márváne<br>máreo                        |
| I did beat<br>I shall beat         | ámi máryáchhi<br>ámi máribo           | ambhay mareethala<br>ambhay marreebo                            | mi márlé<br>mi máren                        | me máreo<br>húñ máris                             |

## APPENDIX D.

*Kashmiree Vocabulary and Grammatical Forms.*

In consequence of recent discussions in the Society, Mr. L. Bowring, Commissioner of Mysore, was kind enough to let me know that he had many years ago compiled and sent to the Society a Kashmiree Vocabulary. The result has been the discovery of a paper as valuable as the hereditary reputation of the author would lead us to expect, which the Society now loses no time in publishing, and which it has been thought well to put in this place in connection with our Ethnological inquiries. Mr. Bowring's paper gives us a far fuller and better knowledge of the Kashmiree language than anything that we have yet had. The Vocabularies are very full, exact, and well arranged, and the grammatical forms of the verb especially are very fully set forth. It is only necessary (treating the matter ethnologically) to observe that since Persian has been for several hundred years the language of Government, religion and literature in Kashmir, and there has also been a long connection with Hindustan and the Punjab, a vast number of Persian words and phrases, and some Hindustanee and Punjabee expressions have necessarily incorporated themselves in the modern Kashmiree, especially as spoken by the better classes. In fact, that wonderful language Persian infuses itself wherever it comes in contact, and it abounds in Kashmiree just as in the upper class Hindustanee and in fact in Turkish also. Hence a faithful specimen of the Kashmiree of the present day will be found to contain many foreign words. But they are easily distinguishable, still wearing their foreign dress and little adapted to the native forms; and for the most part such words need not be confounded with original native words in such a way as to mislead us regarding the radical affinities of the language.

I have taken the liberty of omitting from Mr. Bowring's vocabularies a few evidently Persian words of a literary, and for the most part compound character, as I thought that these would not serve our present purpose. Some remain as now part of the ordinary vulgar tongue, but looking both to the vocables and to the grammar, I think it will be found that Kashmiree is certainly allied to the Indian languages rather than to the Persian.

Mr. Bowring has, perhaps, in the examples which he has given, put the declension of the noun rather too simply. He has used the uninflected Indian form 'Manush' for man and the Persian word 'Zananah' for woman. He shows, however, that most Kashmiree nouns are inflected to form the plural, and I think it will be found that almost all real Kashmiree nouns are inflected for cases also. Both my own observations and those of Messrs. Edgeworth and Leech, as well as Mr. Bowring's dialogues give the proper Kashmiree form for man 'Mohynyn,' plural 'Mohnivi.' And the following which I take from Leech is, I believe, the true declension of the Kashmiree noun 'Nichu,' a son.

|                        |                            |
|------------------------|----------------------------|
| A son, nichu           | Sons, nichivi.             |
| Of a son, nichivi-sand | Of sons, nichiven-sand.    |
| To a son, nichivis     | To sons, nichiven.         |
| From a son, nichinishi | From sons, nichiven-nishi. |

With respect to the variations of the genitive case, Mr. Edgeworth seems to differ from Mr. Bowring, saying that the genitive affix is, like Hindustanee, governed in point of gender by the noun which follows rather than by that which precedes it. So far as I could make out from cursory inquiry on the spot, it seemed to me that in fact the form of this affix is affected by *both* the preceding and the following nouns. Indeed it seems to have the most extraordinary chameleon-like variety of shapes, according to the positions in which the words are placed, and the only conclusion of my inquiries was, that the rules of Kashmiree declension are so complicated, that nothing but careful and scientific study will reduce them to shape.

It may be added that feminines are formed from masculines by inflections, as—

| <i>Masculine.</i> | <i>Feminine.</i>    |
|-------------------|---------------------|
| Gur, horse.       | guir, mare.         |
| Kokur, cock,      | kokair, hen.        |
| Tsawal, he goat,  | tsavij, she goat.   |
| Batak, drake,     | batich, duck.       |
| Kav, male crow,   | kavin, female crow. |

The language is evidently altogether subject to very many post-inflections, and abounds in affixes and postpositions.

G. CAMPBELL.

*Vocàbulary of the Kashmíri Language.*—By L. BOWRING, Esq.,  
Commissioner of Mysore.

The following vocabulary was prepared in Kashmíri in 1851, after comparison with another copy in Úrdú.

It may be observed of the Kashmíri that the pronunciation of the letter *ó* is very broad, resembling the *aw* in *awful*, as for instance ‘*mól*,’ father, read ‘*mawl*.’ The language also affects the compound letter *ts* in lieu of ‘*ch*,’ as ‘*tsor*,’ four.

The formation of the plurals of substantives is irregular, but they generally take the affixes ‘*cha*’ and ‘*chi*.’ The genitive of substantives takes its gender from the noun preceding, not from that following as in Úrdú.

The particle *ني* is not used with verbs. The great number of Sanskrit words existing in Kashmíri is evident, but there are many words peculiar to the language. The character is generally written with Persian letters, but a form of Nágri is also in use.

*Substantives.*

|            |        |          |              |
|------------|--------|----------|--------------|
| Air        | ákásh  | Boat     | nau, shikári |
| Apple      | tsúnt  | Brick    | sír          |
| Ass        | khar   | Book     | púth         |
| Arm        | nar    | Buffalo  | moesh        |
| Army       | fauj   | Bread    | tsút         |
| Age        | bujar  | Breast   | vachh        |
| Assistance | yári   | Badness  | yach         |
| Answer     | uttar  | Beard    | dór          |
| Arrow      | tír    | Bone     | adij         |
| Abuse      | lêk    | Bill     | tont         |
| Bird       | pak    | Breath   | sháh         |
| Brother    | bói    | Brass    | sartal       |
| Boy        | lokat  | Business | kóm          |
| Branch     | lang   | Basket   | phut, dák    |
| Barley     | úshak  | Bush     | kradzál      |
| Butter     | thain  | Blood    | rath         |
| Blackberry | bar    | Bag      | thíl         |
| Birth      | parsun | Bow      | kámán        |
| Bridge     | kadul  | Blow     | chók         |

|           |          |               |                 |
|-----------|----------|---------------|-----------------|
| Butterfly | didar    | Deceit        | bram            |
| Burglary  | san      | Darkness      | gath            |
| Bee       | tilar    | Dream         | supan           |
| Child     | bálak    | Danger        | khatar          |
| Cucumber  | lór      | Drop          | phiúr           |
| Cherry    | glás     | Dram          | henur           |
| Clothes   | kapar    | Dance         | nagmah          |
| City      | shahr    | Earth         | zamín           |
| Copper    | trám     | Elephant      | hasth           |
| Cow       | gáo      | Egg           | thól            |
| Cat       | barúr    | Eye           | úchh            |
| Camel     | únth     | Ear           | kan             |
| Chin      | hongain  | Eyebrow       | bumah           |
| Coat      | farán    | Evil          | yach            |
| Ceiling   | tálaú    | Edge          | buṭh            |
| Cotton    | kapás    | East          | púr             |
| Cheese    | cháman   | Elbow         | khõn            |
| Claim     | dáwá     | Enemy         | shitar          |
| Corner    | kón      | Exertion      | talásh [gul     |
| Colour    | rang     | Fire          | tungul, nártun- |
| Chesnut   | bún      | Father        | mól, bãb        |
| Cedar     | deodár   | Father-in-law | zámtúr          |
| Carrot    | gajar    | Fruit         | mewah           |
| Cloud     | abar     | Flower        | pósh            |
| Crossbeam | thathar  | Flour         | ót              |
| Chair     | sandal   | Fowl          | kukkur          |
| Corpse    | mur      | Fox           | patsló          |
| Chalk     | siap     | Fish          | gáḍ             |
| Candle    | soyět    | Frog          | niñimondij      |
| Day       | dúh      | Food          | bat             |
| Dew       | shabnam  | Field         | khyetí          |
| Daughter  | kúr      | Foot          | khór            |
| Death     | maran    | Forehead      | dek             |
| Dog       | hún      | Fear          | bayí            |
| Deer      | loh, rús | Flesh         | shun            |
| Duck      | battuk   | Firebasket    | kángar          |
| Dirt      | mal      | Foreigner     | bishahrú        |

|              |                |              |              |
|--------------|----------------|--------------|--------------|
| Fraud        | daghá          | Hand         | ath          |
| Face         | bút            | Height       | thazar       |
| Feather      | par            | Heap         | dér, anbár   |
| Fever        | tap            | Hunger       | búchí        |
| Fireplace    | bukhári        | Health       | balan        |
| Friend       | mitar          | Hedge        | vár          |
| Family       | shírbóts       | Hoof         | padur        |
| Ferry        | ghát           | Honey        | mách         |
| Finger       | anguj          | Horn         | hiang        |
| Fisher       | gáḍhanj        | Hour         | gar          |
| Fist         | musht          | Hemp         | bang         |
| Funeral-pile | chentá         | Ice          | yak          |
| Flea         | pish           | Insect       | kím          |
| Fly          | mach           | Iron         | shistar      |
| God          | dé             | Indian corn  | makhai       |
| Girl         | lókat kúr      | Interest     | súdh         |
| Grass        | gás            | Interference | khalal, toth |
| Gram         | chholá         | Ink          | míl          |
| Garlic       | ruhan          | Juice        | ras          |
| Gold         | són            | Jest         | thathá       |
| Goat         | tsáwíj, tsáwul | Jackal       | shál         |
| Goose        | ans            | Knife        | srák         |
| Grain        | anáj           | Leaf         | barak        |
| Garden       | bágh           | Leg          | lang         |
| Goodness     | ján            | Lip          | úth          |
| Greatness    | bajar          | Length       | zechar       |
| Grape        | dach           | Lie          | apuz         |
| Groom        | sáis           | Life         | umar         |
| Game         | gindun         | Light        | gásh         |
| Girth        | tang           | Letter       | achar, harf  |
| Husband      | rún            | Linseed      | alish        |
| Hail         | dóṭ            | Lime         | chunah       |
| House        | garh, lur      | Liver        | jigar        |
| Horse        | gúr            | Lock         | kuluf        |
| Head         | kalah          | Load         | bár          |
| Hair         | wál            | Log          | haṭ          |
| Heart        | vandah         | Lizard       | hadzúng      |

|           |               |               |               |
|-----------|---------------|---------------|---------------|
| Moon      | zún           | Neck          | gardan        |
| Mountain  | koh, parvat   | Needle        | súzan         |
| Mist      | vunar         | Nest          | ól            |
| Month     | riat          | Noise         | shor, kraknád |
| Morning   | subah, prabat | Number        | ganzrun       |
| Midday    | dopáhar       | Nettle        | swái          |
| Man       | manush, mohnú | Net           | zál           |
| Mother    | mój           | North         | vutar         |
| Mushroom  | heḍar         | Onion         | parán         |
| Marriage  | khándar       | Oil           | tíl           |
| Mosque    | mashíd        | Oar           | kúr, chapá    |
| Money     | nakd          | Oath          | drí           |
| Mule      | kátir         | Pumpkin       | alah          |
| Mouth     | ós            | Pear          | ṭank          |
| Moustache | gónch         | Partridge     | tsar          |
| Measure   | minun         | Pearl         | mukt          |
| Medicine  | dawá          | People        | lok           |
| Milk      | dódh          | Platter       | thál          |
| Molasses  | gor           | Pain          | dód           |
| Manure    | páh           | Price         | mól           |
| Minute    | lazá, pal     | Pair          | joṛá          |
| Market    | koṭh          | Poplar        | farast        |
| Mat       | vagú          | Piece         | tukṛá         |
| Mine      | kán           | Peg           | mekh          |
| Monkey    | vándur        | Pepper        | marach        |
| Mortgage  | band          | Pace          | púr           |
| Mustard   | ásur          | Paper         | kághaz        |
| Mint      | podín         | Pen           | kalam         |
| Musquito  | mah           | Pillar        | tham          |
| Meteorite | trath         | Pillow        | vatron        |
| Mouse     | anmúr         | Pit           | khad          |
| Name      | nav           | Plough        | ālah          |
| Night     | rát           | Pole          | chób          |
| Nephew    | bápitár       | Power         | kowwat        |
| Niece     | bápitár beñí  | Pocketpicking | thappul       |
| Nose      | nast          | Question      | prachun       |
| Nail      | nam           | River         | daryá         |

|            |              |           |                |
|------------|--------------|-----------|----------------|
| Rain       | rúd          | Smallness | shikaslad      |
| Rains      | barsát       | Strength  | zór            |
| Rice       | tumal        | Shadow    | sáyah          |
| Raspberry  | chanchh      | Shoe      | paizár         |
| Road       | vat          | Sleep     | nindar         |
| Rat        | gagar        | Skin      | cham           |
| Rump       | mandul       | Sound     | áváz           |
| Roof       | báin         | Seed      | beul           |
| Relation   | rishta       | Sugar     | shakar         |
| Rope       | raz          | Stick     | lúr            |
| Red pepper | martsuwángan | South     | duchan         |
| Rind       | diyál        | Shop      | ván            |
| Rate       | mol          | Sugarcane | waishakar      |
| Rein       | lákam        | Staircase | hér            |
| Remedy     | iláj         | Saddle    | zín            |
| Ring       | vój          | Sorrow    | azáb           |
| Rose       | guláb        | Sack      | gun            |
| Rust       | khái         | Stool     | rayat, garusth |
| Sea        | samandar     | Spider    | zallur         |
| Sun        | áftab, saría | Species   | ķism           |
| Star       | táراك        | Sand      | siak           |
| Snow       | shín         | Saw       | lotar          |
| Son        | nichú        | Scale     | trak, háyúk    |
| Sister     | beñí         | Screw     | pech           |
| Son-in-law | heúr         | Sheath    | kum            |
| Spring     | behár        | Sheet     | chádár         |
| Summer     | rathkól      | Shield    | sipar          |
| Stem       | múl          | Side      | ṭarí           |
| Salt       | nún          | Silk      | pót            |
| Strawberry | kandachh     | Sleeve    | núr            |
| Street     | dúr, kocha   | Smoke     | duh            |
| Stone      | kain         | Soap      | sabun          |
| Silver     | chánd        | Spot      | dágh           |
| Sheep      | gobh         | Sting     | toph           |
| Snake      | sarp         | Scorpion  | bich           |
| Shoulder   | phiúk        | Steel     | folád          |
| Stomach    | yaḍ          | Straw     | gás            |

|          |               |            |            |
|----------|---------------|------------|------------|
| Sweat    | gumah         | Venom      | zahar      |
| Storm    | váú           | Velvet     | makhmal    |
| Spoon    | choncha       | Vein       | rag        |
| Thunder  | gagrái        | Vice       | páp        |
| Tree     | kul           | Village    | gám        |
| Temple   | mandir        | Water      | áb, poñ    |
| Teeth    | dand          | Wind       | háwá       |
| Tongue   | jiau          | Woman      | zenánah    |
| Thigh    | rán           | Wife       | kolai      |
| Truth    | puz           | Winter     | vand       |
| Time     | vakt, vél     | Wheat      | kanak      |
| Throat   | hut           | Wood       | zun        |
| Turban   | dastár        | Wrist      | mats       |
| Thirst   | tresh         | Width      | khajar     |
| Tank     | taláu         | Well       | cháh, krúr |
| Tea      | cháhi         | Weight     | tolún      |
| Tail     | dumah         | West       | pachum     |
| Trade    | saudágarí     | Washerman  | dub        |
| Toe      | khórij anguj  | Watermelon | handwand   |
| Tomato   | ruvangan      | Wall       | dos        |
| Turnip   | gogaj         | Worm       | ámkhiúm    |
| Thread   | pan           | Whore      | háfiz      |
| Tent     | khema         | Weed       | gás        |
| Table    | mez           | Wager      | dau        |
| Taste    | maza, swád    | Wax        | móm        |
| Thorn    | kanth         | Wheel      | hagur      |
| Theft    | tsúr          | Widow      | mond       |
| Trust    | itimád, pats  | Wing       | par        |
| Uncle    | pitar, chácha | Wire       | tár        |
| Umbrella | tábdán        | Wool       | wón        |
| Udder    | than          | Yard       | gaj        |
| Urine    | mutr          | Year       | varih      |
| Use      | kám           |            |            |

## Declensions.

|                  |   |                  |                |
|------------------|---|------------------|----------------|
| <i>Singular.</i> | { | N. A man         | manush         |
|                  |   | G. Of a man      | manush-sund    |
|                  |   | Acc. A man       | manush-is      |
|                  |   | Ab. From a man   | manush-nishin  |
| <i>Plural.</i>   | { | N. Men           | manash         |
|                  |   | G. Of men        | manash-sund    |
|                  |   | Acc. Men         | manash-is      |
|                  |   | Ab. From men     | manash-nishin  |
| <i>Singular.</i> | { | N. A woman       | zenání         |
|                  |   | G. Of a woman    | zenání-hund    |
|                  |   | Acc. A woman     | zenání         |
|                  |   | Ab. From a woman | zenání-nishin  |
| <i>Plural.</i>   | { | N. Women         | zenánah        |
|                  |   | G. Of women      | zenánah-hund   |
|                  |   | Acc. Women       | zenánah        |
|                  |   | Ab. From women   | zenánah-nishin |

## Examples of Plurals.

|        |           |           |          |
|--------|-----------|-----------|----------|
| Beñí   | a sister  | Beñícha   | sisters  |
| Bóí    | a brother | Báí       | brothers |
| Mól    | a father  | Mail      | fathers  |
| Mój    | a mother  | Májí      | mothers  |
| Nichu  | a son     | Nichii    | sons     |
| Kul    | a tree    | Kuil      | trees    |
| Barak  | a leaf    | Barakchi  | leaves   |
| Gám    | a village | Gámchi    | villages |
| Gás    | a grass   | Gáscha    | grasses  |
| Jánwár | an animal | Jánwarchi | animals  |

## Adjectives.

|         |            |        |            |
|---------|------------|--------|------------|
| Active  | takrá      | Blind  | un         |
| Blunt   | mund       | Blue   | niúl       |
| Boiling | tut, bahar | Black  | karhún     |
| Broken  | phuṭmuṭ    | Bitter | tsok, chok |

|            |          |          |             |
|------------|----------|----------|-------------|
| Bad        | yach     | Hard     | dúr         |
| Cheap      | sug      | Hungry   | buch        |
| Clever     | gaṭul    | Heavy    | gubh        |
| Clear      | sái      | Hot      | garm, ushan |
| Coarse     | viuṭ     | Ill, bad | yach        |
| Crooked    | hul      | Low      | past, tsut  |
| Cold       | turun    | Long     | dsiút, khul |
| Certain    | pats     | Little   | kam         |
| Deep       | sun      | Less     | kehna       |
| Dear       | drug     | Last     | brunṭhun    |
| Dark       | anigut   | Lame     | lung        |
| Deaf       | zúr      | Leprous  | hitrilad    |
| Dumb       | kul      | Lazy     | sust        |
| Dead       | múdmud   | Light    | lut         |
| Double     | zuh      | Loose    | diyul       |
| Dry        | huk      | Left     | hul         |
| Dirty      | malburut | Lower    | tal         |
| Drunk      | muṭ      | Many     | sitáh       |
| Easy       | ásán     | Mad      | dewána      |
| Empty      | kháli    | Middle   | sum         |
| Expert     | fázil    | New      | nó          |
| First      | pathiúm  | Naked    | nathnun     |
| Former     | bronṭh   | Old      | purón, buḍh |
| Fat        | viuṭ     | Proud    | kibar       |
| False      | ápuz     | Putrid   | dudriyomut  |
| Frightened | khochún  | Poor     | gharíb      |
| Fine       | zayul    | Quick    | tikán       |
| Full       | barit    | Ready    | tayyár      |
| Fond       | ṭóṭh     | Right    | sind        |
| Good       | ján      | Ripe     | papiúmúd    |
| Great      | bód      | Raw      | khám        |
| Glad       | khúsh    | Small    | lúk         |
| Greedy     | lúlachí  | Sweet    | miúṭ        |
| Green      | sabz     | Stupid   | nádan       |
| Generous   | dátah    | Straight | siud        |
| General    | ám       | Square   | chankunjal  |
| High       | thud     | Sharp    | tej         |

|          |         |       |           |
|----------|---------|-------|-----------|
| Slippery | pishul  | Weak  | liyad     |
| Thirsty  | treshut | Well  | ján       |
| Thin     | lissá   | White | safid     |
| Tight    | tang    | Wet   | tar, udar |
| Ugly     | yach    | Young | jawán     |
| Upper    | piath   |       |           |

*Declension.*

|      |                 |                      |                    |
|------|-----------------|----------------------|--------------------|
| N.   | A good man      | ján manush           | } <i>Singular.</i> |
| G.   | Of a good man   | ján manush-sund      |                    |
| Acc. | A good man      | ján manush-is        |                    |
| Ab.  | From a good man | ján manush-nishin    |                    |
| N.   | Good men        | jánchi manash        | } <i>Plural.</i>   |
| G.   | Of good men     | jánchi manash-sund   |                    |
| Acc. | Good men        | jánchi manash-is     |                    |
| Ab.  | From good men   | jánchi manash-nishin |                    |

*Comparison.*

|        |           |
|--------|-----------|
| Good   | Ján       |
| Better | Yuts ján  |
| Best.  | Sitáh ján |

*Verbs.*

|           |             |            |              |
|-----------|-------------|------------|--------------|
| To awake  | votun       | To Burn    | zálun        |
| „ Avoid   | bachun      | „ Blow     | phok diun    |
| „ Ascend  | khasun      | „ Bury     | gárhun       |
| „ Advance | bron khasun | „ Buy      | miúl hiún    |
| „ Ask     | prutsun     | „ Come     | iyun         |
| „ Be      | soñpanun    | „ Cut      | tsatun       |
| „ Be able | hekkun      | „ Call     | nádun        |
| „ Bring   | ánun        | „ Conquer  | jítun        |
| „ Begin   | lagun       | „ Choose   | tsárun       |
| „ Bite    | tsátun      | „ Cover    | vatun        |
| „ Believe | patskarun   | „ Chew cud | drámun karun |
| „ Boil    | pakinwun    | „ Drink    | chiun        |
| „ Beg     | mangun      | „ Die      | marun        |

|            |              |             |                 |
|------------|--------------|-------------|-----------------|
| To Dwell   | basun        | To Move     | alaráwun        |
| „ Do       | karun        | „ Open      | mussurun        |
| „ Decrease | kamgachun    | „ Play      | gindun          |
| „ Draw     | lamun        | „ Put on    | gandun, chháwun |
| „ Drive    | patrozun     | „ Put off   | mutsurun, wálun |
| „ Drown    | phatun       | „ Pain      | dod karun       |
| „ Expel    | kađit tsumun | „ Place     | tháwun          |
| „ Erase    | kađun        | „ Pass      | guzaráwun       |
| „ Enter    | andar atsun  | „ Plague    | dek karun       |
| „ End      | makoláwun    | „ Pour      | đalun           |
| „ Find     | labhun       | „ Push      | dhakdiun        |
| „ Fight    | lađun        | „ Read      | párhun          |
| „ Fly      | uphún        | „ Roast     | buzun           |
| „ Fall     | pařun        | „ Run away  | tsalun          |
| „ Fasten   | lágun        | „ Reap      | fasl tsatun     |
| „ Forget   | mashun       | „ Reckon    | gansrun         |
| „ Frighten | kotsunáwun   | „ Recollect | yad karun       |
| „ Go       | gasun        | „ Return    | phir diun       |
| „ Give     | diun         | „ Repel     | nibar kadun     |
| „ Gamble   | záras gindun | „ Retire    | pat nerun       |
| „ Hear     | bozun        | „ Ride      | khasun          |
| „ Increase | bađun        | „ Rise      | vathun          |
| „ Join     | melanáwun    | „ Row       | vayun           |
| „ Kill     | márun        | „ Rouse     | uzanáwun        |
| „ Know     | janun        | „ Run       | dáúwun          |
| „ Kick     | lat diun     | „ Rub       | mathun          |
| „ Lose     | hárun        | „ Stick     | lagun           |
| „ Live     | zindásun     | „ Swim      | tsátwáyun       |
| „ Leave    | chhorun      | „ Swell     | hunun           |
| „ Laugh    | ásun         | „ Sweep     | dún             |
| „ Learn    | hichun       | „ Suckle    | cháwun          |
| „ Hide     | khaditrozun  | „ Sing      | gewun           |
| „ Lift     | tolun        | „ Spit      | taktráwun       |
| „ Leap     | khařun       | „ Sell      | kunun           |
| „ Lie      | apuz vanun   | „ Sit       | bihun           |
| „ Meet     | melun        | „ Show      | hawidun         |
| „ Melt     | galun        | „ Send      | sozun, ludun    |

|           |             |         |             |
|-----------|-------------|---------|-------------|
| To Strain | chhánun     | To Take | hiun        |
| „ Seek    | tsáqun      | „ Taste | tsuhun      |
| „ Sow     | váwun       | „ Teach | hichunáwun  |
| „ Strike  | márun       | „ Throw | trevitsunun |
| „ Stand   | istádrozun  | „ Touch | lágun       |
| „ Seize   | ratun       | „ Vomit | khai karun  |
| „ Shut    | bandh karun | „ Weave | vonun       |
| „ Say     | vanun       | „ Weigh | tolun       |
| „ See     | uchhun      | „ Wait  | prárun      |
| „ Smell   | mushakhiun  | „ Wish  | yatsun      |
| „ Sleep   | shongun     | „ Wash  | chhalun     |
| „ Speak   | vanun       |         |             |

## CONJUGATIONS.

Sompanun, to be.

*Present.*

|          |                        |
|----------|------------------------|
| I am     | buh chus               |
| Thou art | tsuh chukuh            |
| He is    | suh chuh <i>or</i> chó |
| We are   | as chih                |
| Ye are   | tahí chiwuh            |
| They are | tim chih               |

*Imperfect.*

|           |             |
|-----------|-------------|
| I was     | buh ósus    |
| Thou wast | tsuh ósukuh |
| He was    | suh óús     |
| We were   | as óús      |
| Ye were   | tahí ósuwuh |
| They were | tim óús     |

*Perfect.*

|                |                     |
|----------------|---------------------|
| I have been    | buh ósus osmutun    |
| Thou hast been | tsuh ósukuh osmutun |
| He has been    | suh óús osmutun     |
| We have been   | as óús osmutun      |
| Ye have been   | tahí ósuwuh osmutun |
| They have been | tim óús osmutun     |

*Pluperfect.*

|                 |                         |
|-----------------|-------------------------|
| I had been      | buh ósus sompunwatun    |
| Thou hadst been | tsuh ósukuh sompunwatun |
| He had been     | suh óús sompunwatun     |
| We had been     | as óús sompunwatun      |
| Ye had been     | tahí ósuwuh sompunwatun |
| They had been   | tim óús sompunwatun     |

*Future.*

|               |                    |
|---------------|--------------------|
| I shall be    | buh heksompanit    |
| Thou shalt be | tsuh hekaksompanit |
| He shall be   | suh hekisompanit   |
| We shall be   | as hekáúsompanit   |
| Ye shall be   | tahí hekiúsompanit |
| They shall be | tim hekáúsompanit  |
| To be         | sompanun           |
| Being         | sompanit           |
| Been          | sompun             |

## Vanun, to speak.

*Present.*

|                        |                   |
|------------------------|-------------------|
| I speak or am speaking | buh chus vanán    |
| Thou speakest          | tsuh chukuh vanán |
| He speaks              | suh chuh vanán    |
| We speak               | as chih vanáú     |
| Ye speak               | tahí chiwuh vanáú |
| They speak             | tim chih vanáú    |

*Imperfect.*

|              |                |
|--------------|----------------|
| I spoke      | mi vun         |
| Thou spakest | tsuh vanut     |
| He spoke     | suh vun        |
| We spoke     | as vanwutun    |
| Ye spoke     | tahí vanwutun  |
| They spoke   | timáú vanwutun |

*Perfect.*

|                  |                     |
|------------------|---------------------|
| I have spoken    | mi chum vanwutun    |
| Thou hast spoken | tsuh chuh vanwutun  |
| He has spoken    | tim chá vanwutun    |
| We have spoken   | as chá vanwutun     |
| Ye have spoken   | tahí chuh vanwutun  |
| They have spoken | timáú chuh vanwutun |

*Pluperfect.*

|                   |                   |
|-------------------|-------------------|
| I had spoken      | mi ós vanwutun    |
| Thou hadst spoken | tsuh ósí vanwutun |
| He had spoken     | tim ós vanwutun   |
| We had spoken     | as ósus vanwutun  |
| Ye had spoken     | tahí ósú vanwutun |
| They had spoken   | timáú ós vanwutun |

*Future.*

|                  |                  |
|------------------|------------------|
| I shall speak    | buh hek vanit    |
| Thou shalt speak | tsuh hekak vanit |
| He shall speak   | suh hekí vanit   |
| We shall speak   | as hekáú vanit   |
| Ye shall speak   | tahí hekiú vanit |
| They shall speak | tim hekáú vanit  |

*Potential.*

|                   |            |
|-------------------|------------|
| I may speak       | buh vanah  |
| Thou mayest speak | tsuh vanak |
| He may speak      | suh vaní   |
| We may speak      | as vanáú   |
| Ye may speak      | tahí vaniú |
| They may speak    | tim vanáú  |
| Speak             | van        |
| Speaking          | vanán      |
| Spoken            | vanwutun   |

## CONJUGATION OF THE PASSIVE VOICE OF MÁRUN TO STRIKE.

*Present.*

|                 |                       |
|-----------------|-----------------------|
| I am struck     | buh gasa márah        |
| Thou art struck | tsuh gasak márah      |
| He is struck    | suh gasa márah        |
| We are struck   | as chih márah gasán   |
| Ye are struck   | tahí chuh márah gasán |
| They are struck | tim chih márah gasán  |

*Imperfect.*

|                  |                |
|------------------|----------------|
| I was struck     | buh gós márah  |
| Thou wast struck | tsuh gók márah |
| He was struck    | suh gáu márah  |
| We were struck   | as gayé márah  |
| Ye were struck   | tahí gáu márah |
| They were struck | tim gayé márah |

*Future.*

|                      |                   |
|----------------------|-------------------|
| I shall be struck    | buh gatsa márah   |
| Thou shalt be struck | tsuh gatsak márah |
| He shall be struck   | suh gatsa márah   |
| We shall be struck   | as gatsáú márah   |
| Ye shall be struck   | tahí gatsiú márah |
| They shall be struck | tim gatsáú márah  |

## PRONOUNS.

| <i>Personal.</i>                  |            | <i>Possessive.</i> |         |
|-----------------------------------|------------|--------------------|---------|
| I                                 | buh        | Mine               | miún    |
| Thou                              | tsuh       | Thine              | chhón   |
| He, she                           | suh        | His                | tasun   |
| We                                | asi, mi    | Our                | miún    |
| Ye                                | tahí       | Your               | chhón   |
| They                              | tim, timáú | Their              | tasun   |
| <i>Relative and Interjective.</i> |            | <i>Indicative.</i> |         |
| Who?                              | kus?       | This               | ih      |
| Which?                            | kyá        | That               | uh, suh |
| Whoever                           | yus        | These              | yum     |
| Whatever                          | yih        | Those              | tium    |
| He who                            | yus        |                    |         |
| <i>Miscellaneous.</i>             |            |                    |         |
| Self                              | páné       | Another            | duyum   |
| Such                              | yithúi     | Any                | kánh    |
| All                               | sári       | Every              | yusaká  |
| Same                              | sáru       | Own                | panun   |
| Other                             | bék        |                    |         |

*Declension of Pronouns.*

|               |              |                |                                            |
|---------------|--------------|----------------|--------------------------------------------|
| N. I          | buh          | N. We          | } mi<br>as in singular                     |
| G. Of me      | miún         | G. Of us       |                                            |
| Acc. Me       | mi           | Acc. Us        |                                            |
| Ab. From me   | mi nishin    | Ab. From us    |                                            |
| N. Thou       | tsuh         | N. You         | } tsih<br>as in singular                   |
| G. Of thee    | chhon        | G. Of you      |                                            |
| Acc. Thee     | tsih         | Acc. You       |                                            |
| Ab. From thee | tsih nishin  | Ab. From you   |                                            |
| N. He         | suh          | N. They        | } tim<br>as in singular                    |
| G. Of him     | tasun        | G. Of them     |                                            |
| Acc. Him      | humis        | Acc. Them      |                                            |
| Ab. To him    | humis nishin | Ab. To them    |                                            |
| N. This       | Ih           | N. These       | } yum<br>yuhund<br>yiman<br>yiman nishin   |
| G. Of this    | yimsun       | G. Of these    |                                            |
| Acc. This     | yimis        | Acc. These     |                                            |
| Ab. From this | yimis nishin | Ab. From these |                                            |
| N. That       | uh, suh      | N. Those       | } tium<br>tinhund<br>timan<br>timan nishin |
| G. Of that    | yusun        | G. Of those    |                                            |
| Acc. That     | humis        | Acc. Those     |                                            |
| Ab. From that | humis nishin | Ab. From those |                                            |
|               | Myself       | buh páné       |                                            |
|               | Of myself    | buh pánas      |                                            |
|               |              | &c.            |                                            |

*Adverbs.*

|            |          |           |               |
|------------|----------|-----------|---------------|
| Above      | piat     | Below     | tal           |
| Always     | dohái    | Backwards | pat           |
| Almost     | jaljal   | Except    | síwái         |
| Also       | bíyih    | Exactly   | thík          |
| As         | yiut     | Enough    | thayú         |
| Already    | wuini    | Far       | dúr           |
| Alone      | kunui    | From      | piath, nishin |
| Altogether | sári sán | Forwards  | brúnt         |

|             |          |           |             |
|-------------|----------|-----------|-------------|
| How         | kiut     | Still     | támat       |
| How much }  | kótá     | Then      | til         |
| How many }  |          | Thus      | ithui       |
| Hither      | yúr      | There     | tati        |
| Inside      | andar    | Thither   | hór         |
| Immediately | jhatpaṭ  | Therefore | imbápat     |
| Near        | nakh     | Together  | sán         |
| Now         | vuin     | Very      | sitáh       |
| Nothing     | kechnú   | When      | yil         |
| No          | nah      | Where ?   | kati        |
| Outside     | nebar    | Why       | kyázi       |
| Perhaps     | dewuh    | Yes       | ón, áu      |
| Quickly     | jalpáhan | How       | kitpóthin   |
| So          | ithui    | sA }      | yithipóthin |
| Slowly      | lut      | So }      | tithipóthin |
| Suddenly    | yekáyek  |           |             |

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*Prepositions.*

|             |       |         |       |
|-------------|-------|---------|-------|
| According   | ithuí | In      | andar |
| After       | pat   | On      | piaṭ  |
| Among       | mauz  | Towards | ṭarf  |
| Before      | brúnt | With    | satín |
| Besides     | varái | Without | siwá  |
| For sake of | bápat |         |       |

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*Conjunctions.*

|          |         |        |        |
|----------|---------|--------|--------|
| And      | ta      | If     | hargáh |
| Although | hargáh  | Either | yá     |
| But      | lekin   | Or     | yá     |
| Because  | yudvane |        |        |

---

*Interjections.*

|        |         |        |       |
|--------|---------|--------|-------|
| Alas ! | afsús ! | Lo !   | uch ! |
| Ho !   | hatá !  | What ! | kya ! |

## Cardinal Numbers.

|          |            |             |              |
|----------|------------|-------------|--------------|
| One      | ak         | Seventeen   | saddah       |
| Two      | dzuh       | Eighteen    | aḥdah        |
| Three    | tré        | Nineteen    | kunuwúh      |
| Four     | tsór, chór | Twenty      | wúh          |
| Five     | páns       | Twenty-one* | ekwúh        |
| Six      | shah       | Thirty      | truh         |
| Seven    | sat        | Forty       | chatjí       |
| Eight    | áth        | Fifty       | pansa        |
| Nine     | náú        | Sixty       | shet         |
| Ten      | dah        | Seventy     | satat        |
| Eleven   | káh        | Eighty      | shít         |
| Twelve   | báh        | Ninety      | namat        |
| Thirteen | trowáh     | Hundred     | hat          |
| Fourteen | chaudah    | Two hundred | zahat        |
| Fifteen  | pandah     | Thousand    | dahshat, sás |
| Sixteen  | shurah     | Lakh        | lach         |

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|     |            |    |            |
|-----|------------|----|------------|
| *22 | dzitówúh   | 49 | nwanzah    |
| 23  | trawúh     | 51 | ekwanzah   |
| 24  | cháúwúh    | 52 | dowanzah   |
| 25  | pántsuh    | 53 | trewanzah  |
| 26  | shawwúh    | 54 | chauwanzah |
| 27  | satowúh    | 55 | panswanzah |
| 28  | aḥowúh     | 56 | shahwanzah |
| 29  | untruh     | 57 | satwanzah  |
| 31  | ektruh     | 58 | aḥwanzah   |
| 32  | daitruh    | 59 | unhath     |
| 33  | tchtruh    | 61 | ekhath     |
| 34  | chaitruh   | 62 | dohath     |
| 35  | pánstruh   | 69 | kunsátat   |
| 36  | shahtruh   | 71 | eksatát    |
| 37  | sattruh    | 72 | dosatát    |
| 38  | aḥtruh     | 79 | kunshít    |
| 39  | kuntazi    | 81 | ekshít     |
| 41  | ektazi     | 89 | kunánamat  |
| 42  | } as above | 91 | eknamat    |
| 43  |            | 99 | namánamat  |
| 44  |            |    |            |
| 45  |            |    |            |
| 46  |            |    |            |
| 47  |            |    |            |
| 48  |            |    |            |

## Ordinal Numbers.

|          |         |          |             |
|----------|---------|----------|-------------|
| First    | godniuk | 21st     | ekwúhiúm    |
| Second   | duyum   | 22nd     | dzitowuhium |
| Third    | treyum  | 23rd     | trawuhium   |
| Fourth   | tsurum  | 24th     | cháúwuhium  |
| Fifth    | panchum | 25th &c. | &c.         |
| Sixth    | shayum  |          |             |
| Seventh  | satum   |          |             |
| Eighth   | aṭhtum  |          |             |
| Ninth    | nawum   |          |             |
| Tenth    | dahiúm  |          |             |
| Eleventh | káhiúm  |          |             |

## Sentences.

|                                             |                                     |
|---------------------------------------------|-------------------------------------|
| What is your name ?                         | chhón náú kyá chũh ?                |
| What is the name of this village ?          | yit gámas kyá chũh náú ?            |
| How far is it to Kashmir ?                  | Kashmír támut kótá chũh dúr ?       |
| How many houses are there in this village ? | yit gámas kuts garh chuh ?          |
| Who is the head man ?                       | mokaddam kus chuh ?                 |
| What is the time ?                          | kótá chuh dũh ?                     |
| Three o'clock.                              | sihpahar chuh.                      |
| Bring that.                                 | uh anun.                            |
| Take away this.                             | ih niun.                            |
| What crops are grown here ?                 | yithi kyá fasl chuh sompanán ?      |
| Are the pears ripe or unripe ?              | ṭank chó paminmud ki na khám chuh ? |
| Go away.                                    | gats.                               |
| Come here.                                  | vol yúr.                            |
| Come quickly.                               | jald volah.                         |
| What does this man want ?                   | ih monhyú kyá chuh mangán.          |
| Ask him.                                    | humis prichú.                       |
| I cannot say.                               | buh chus sasna vanit hekán.         |
| I shall go to-morrow.                       | buh gats phagá.                     |
| It rained yesterday.                        | rát volun rúd.                      |
| It is very hot.                             | sitáh garm chuh.                    |

|                                         |                                                  |
|-----------------------------------------|--------------------------------------------------|
| The road is good.                       | vat chuh ( <i>or</i> chavuh) ján.                |
| The road is bad.                        | vat do. yach.                                    |
| One must ascend that hill.              | yit kohas piat baniá khasun.                     |
| What is the price of this?              | yit kyá chuh kímat?                              |
| It is dear.                             | drug chuh.                                       |
| It is cheap.                            | sug chuh.                                        |
| You ask too much.                       | tsuh chukuh sitáh mangán.                        |
| Are there any manufactures here?        | yithi baniá ki tyár karun?                       |
| Is cloth woven?                         | kapar baniá vanun?                               |
| What pay do you get?                    | tsuh kyá chuh talab inelan?                      |
| Is the Kardar a good man?               | Kárdár chó ján monhyu?                           |
| I wish to find out.                     | buh chus yatsán zi maálúm kar.                   |
| Is he able to carry that load?          | hekyá uh bór tulit?                              |
| My horse is lame.                       | miun gur lung chuh.                              |
| Can you shoe him?                       | tsuh hekak yimis gurís nál lágit?                |
| What rent do you pay for this shop?     | yit vánas kot chukuh diwan kiráya<br>tsuh?       |
| Six rupees a year.                      | shah rúpí varíhas.                               |
| He began to get tired.                  | suh lug thakne.                                  |
| They began to fight together.           | tim lég pánawin harhar karani.                   |
| Can you read and write?                 | tsuh hekak likhit, parhit?                       |
| A little.                               | kam kam.                                         |
| How do you know?                        | tsuh kitpóthin zának?                            |
| In what way will you repair this?       | tsuh kitpóthin karan ih durust                   |
| In what month is saffron gathered?      | kat retas andar chih kongposh                    |
| In Kártik.                              | Kártikas andar. [tsatán?                         |
| What colour is best?                    | kyá rang chuh sáríkot ján?                       |
| If he takes it what will you do?        | hargáh ih heki timsritit, tsuh kyá<br>karakadah? |
| Has he gone before, or is he following? | suh chuh brúnt gomut, kin-pat<br>chuh áwán?      |
| Why are you making such a noise?        | tahíkyá zi churyút krakanád karán?               |
| Put on this dress and put off that.     | ih kaparu mutsar, uh tsun nóil.                  |
| I went with him.                        | buh chus gomut humis satin.                      |
| He walks without shoes.                 | suh chuh paizár siwái pakán.                     |
| When he comes tell me.                  | yili suh yi tili gasi mi khabar.                 |
| Is it near or far?                      | nazdík chó, kinh dúr chuh?                       |

|                                                      |                                                    |
|------------------------------------------------------|----------------------------------------------------|
| You always delay.                                    | tsuh chukúh dóhí tsér karan.                       |
| We are almost ready.                                 | as chih thikán thikán tyár.                        |
| I am hungry and thirsty.                             | buh chus pháké bi treshut.                         |
| Don't eat raw apples.                                | khám tsunt ma khiú.                                |
| I have ate enough.                                   | thaiú, khiaú.                                      |
| Where is my servant ?                                | miun naukar kati chuh ?                            |
| Is he here or there ?                                | yithi chó, kinh tathi chuh ?                       |
| It is still raining.                                 | vunyas tányat chuh válán.                          |
| Shall you sleep inside or outside ?                  | andar shongak kinh nibar ?                         |
| This dog is exactly like mine.                       | yih hún chuh manis húnis hiú.                      |
| I have already heard that story.                     | mi búz suh kissa brúnt.                            |
| There is a bridge opposite.                          | brohun kani chuh kadul.                            |
| Do as I say.                                         | yithipóthim buh dapán chus, tithi<br>póthin kariú. |
| Write accordingly as I do.                           | manis lekhinas hiú likhiú.                         |
| Are you alone ?                                      | tsuh chukuh kunezun ?                              |
| He fell from his horse.                              | suh piau guri piat visit.                          |
| Throw down that blanket.                             | uh kamal sun bonkun trevit.                        |
| Come up here.                                        | yúr khas hiúr.                                     |
| How far is it from here ?                            | ithi piat kótá chuh dúr ?                          |
| It is five kos.                                      | páns króh chuh.                                    |
| My brother and I went home.                          | ak buh bi miún bóí gaye garh.                      |
| Either you or he will be punished.                   | yá tsuh nat humis meliwuh sazá.                    |
| Why should I be punished ?                           | mi kyá zi diú sazá.                                |
| Because you are a thief.                             | awé bapat zi tsuh chukuh tsúr.                     |
| Unless you have witnesses you will<br>be imprisoned. | hargáh tsuh gawá ashinah, ta kaid<br>sompanak.     |
| This horse is better than that.                      | ih gur chuh humsin kotján.                         |
| What do you call that basket ?                       | hut fiatis kya chuh vanán ?                        |
| Don't be frightened.                                 | kots muh.                                          |
| He ought to have done so.                            | timis guts ih karun.                               |
| Can you swim ?                                       | tsuh hekak tsánt vayut ?                           |
| Listen ! show me the road.                           | hatá ? mi háu vat.                                 |
| You must do it.                                      | tsuh gatsi zarúr karun.                            |
| Taste this peach.                                    | ih tsunun gatsi tsuhun.                            |
| I cannot find my coat.                               | miún kurtah chuh nah melán.                        |
| Look behind that wall.                               | hut dewáras pat kani uchhú.                        |

|                                        |                                    |
|----------------------------------------|------------------------------------|
| He lost Rs 50 in gambling.             | hum hárí záras andar pantsáh rúpí. |
| I won Rs. 100 „ „                      | mi ziún „ „ hat „                  |
| A snake bit him in the leg.            | humis dítsnas sarpan langas tiop.  |
| She laughed much.                      | humi us sitáh.                     |
| We seized 10 thieves.                  | asi rit dah tsúr.                  |
| They all escaped.                      | timáú tsail sári.                  |
| They shall leave this country.         | tim tsalan yihu mulk.              |
| I will punish them.                    | buh dimak adh timan sazá. [dit ?   |
| Can you lend me a rupee ?              | tsuh hekak asi rúpiyahak wozum     |
| What do you teach these children ?     | im shiúr kyá chiwak hichanáwan ?   |
| Let him come, why do you stop          | ziu ih kyá zi chuwan rañan ?       |
| him ?                                  |                                    |
| I beat him soundly.                    | mi dint humis sitáh már.           |
| His house has been burnt.              | humis lug garhas nár.              |
| He will be buried to-morrow.           | phagá ihi daffan karanah. [tánah.  |
| Choose one of these apples.            | yimáútsuntáú andar tsuhun ak tsun- |
| Cover that pan.                        | hut degchas piať thavin sarposh.   |
| Send me some fruit.                    | asi mishin ladiu kinh mewah.       |
| He answered me falsely.                | tim vunasi mishin apuz jawáb.      |
| Hang up these clothes.                 | ih kapar tsinun awezán.            |
| What are you doing ?                   | tsuh kyá chukuh karan ?            |
| I am cutting corn.                     | buh chus kanak tsaťán.             |
| Are these cows chewing the cud ?       | ih gáú chuh drámun karán ?         |
| Go and see.                            | gatsit vuch.                       |
| Feed them with grass.                  | yim khiáwúk gás.                   |
| Give them water to drink.              | yim chúviúk tresh.                 |
| Has the room been swept ?              | at kothis duwah kinh nah ?         |
| Can this be washed ?                   | ih yiyá chhalanah ?                |
| I have two horses.                     | mi chuh dzuh gur.                  |
| He had three wives.                    | timas áсах tre koleyih.            |
| I shall have plenty.                   | mi nishin ási ih sitáh.            |
| I rode 10 kos without stopping.        | buh gós dahan krohun guris kia     |
|                                        | lákim varái.                       |
| What is to be done ?                   | kyá gatsi karun ?                  |
| They are drunk.                        | suh chuh mut.                      |
| We are poor.                           | as chih kangál.                    |
| This room is 12 ft. long, 10 ft. wide, | ih koth báh páwah dsut, dah páwah  |

|                                                                 |                                                               |
|-----------------------------------------------------------------|---------------------------------------------------------------|
| and 9 ft. high.                                                 | khúshadah, bi chuh náú páwah thúd.                            |
| He was very lazy.                                               | suh ós sitáh sust.                                            |
| Give me rather less than one seer.                              | mi gatsi ak sír akieh kih kom diún.                           |
| Weigh this ghee.                                                | ih ghiáu tuliun.                                              |
| How much honey for a rupee?                                     | rúpía kótá chuh mách?                                         |
| Change this rupee into pice.                                    | yit rupía aniu tiunk.                                         |
| Is there any batta taken?                                       | kinh chuh hewán rúpía vat?                                    |
| Give that blind man, that lame man and that leper each an anna. | humis anis ta humis langis ta humis hitriládas, akak áná diú. |
| Tare care how you carry that.                                   | uh chíz gatsi khabardarí san niun.                            |
| I shall be very glad.                                           | buh gatsa sitáh khúsh.                                        |
| All the people came to see.                                     | sári lok áye uehhini.                                         |
| Is this the same horse or another?                              | ih chuh suhí gur kinh bék chuh?                               |
| Every man was killed.                                           | pratakáh gáu márah.                                           |
| His father and mine are cousins.                                | humsund mól bi miun mól chih pánaion bóí bóí.                 |
| His uncle is rich.                                              | humsund pitar chuh dáúlatmand.                                |
| Her mother is poor.                                             | humsanz mój chuh kangál.                                      |
| Your horse is lame.                                             | chhón gur chuh lung.                                          |
| My servant is ill.                                              | miún monhyú chuh bemár.                                       |
| Put this and that together.                                     | ak ih bi ih gachi vátun.                                      |
| This is my own watch.                                           | ih chuh mi panin gar.                                         |
| Why was I beaten?                                               | buh kyá zi gós márah?                                         |
| Shall I be beaten?                                              | buh gatsa márah?                                              |
| Why should I give you anything?                                 | buh kyá zi dimái tsuh kih?                                    |
| You should go quickly.                                          | chhon gatsi jald gatsun.                                      |
| There are rocks above and below.                                | koh chuh piat ti tá tal ti.                                   |
| This language is rather difficult.                              | ih zabán chuh kentsa mushkil.                                 |
| With practice it will become easy.                              | ádat satin gatsi ásán.                                        |
| Never mind, speak every day.                                    | ki parwar chunah duhí van.                                    |
| Shall I go with or without my horse?                            | buh gatsah garheth knih nah?                                  |
| Why do you follow me?                                           | tsuh kyá zi chukuh mi patpat wán?                             |
| I want alms.                                                    | buh chus bechán.                                              |
| Perhaps it will rain.                                           | dewah válik.                                                  |
| I was wet through.                                              | buh ós sitáh baranah.                                         |

|                                               |                                                                 |
|-----------------------------------------------|-----------------------------------------------------------------|
| Dry my clothes in the sun.                    | miún kapar hoknawú tápas. [phiat.                               |
| He and his brother were drowned in the river. | suh bi tasun bóí daryávas andar                                 |
| The maharájá is very kind to artists.         | Maharájá chuh karigaran piat sitáh miharbání karan.             |
| They are never fined.                         | amis chun zehtí chit iván hinah.                                |
| He sent me a good 'ziafat.'                   | tim laz asi zabar ziafat.                                       |
| I laughed and she wept.                       | mi us ta tim wud. [hund.                                        |
| This shawl is not worth Rs. 400.              | ih doshálah chuh nah tsorhatun                                  |
| This is not the first time.                   | ih chuh nah godiniúk dó.                                        |
| The Government takes half the produce.        | sirkár chuh nisf paidaish hewán.                                |
| I and you and he will go together.            | ak buh bí tsuh bi suh gatsán ikwatén.                           |
| You will never come back.                     | tsuh guk nah biyi zá yór.                                       |
| The people here are very dirty and poor.      | yithik lók chih sitáh mail talryi [Kashmír? chih kangál.        |
| How many boats are there in Kashmir?          | Kashmíras andar kotsa náú chih?                                 |
| About two thousand.                           | aṣṣat chih dósás.                                               |
| Do they pay any tax?                          | kinh chih mahsúl diwán?                                         |
| If he ever do so, beat him.                   | hargáh suh biyi ithui kare, adh márún. [wot tarít.              |
| If you can jump over this ditch.              | hargáh tsuh hekak yit khandakas                                 |
| I cannot jump over it.                        | buh hek nah tarít. [tan?                                        |
| Can you shoot birds flying?                   | tsuh hekak wuphun janáwar márl-                                 |
| Is there any game in these hills?             | yit kohas chó kinh shikár?                                      |
| Yes, a great deal.                            | áú, sitáh.                                                      |
| Of what kind?                                 | kyá kyá chuh?                                                   |
| There are bears and deer.                     | hápat chó kinh rús chuh.                                        |
| How do you know?                              | tsuh kitpothin zának?                                           |
| I am a sportsman.                             | buh chus shikári.                                               |
| What do the bears eat?                        | hápat kyá chih khiawán?                                         |
| Indian corn, walnuts and fruit.               | makhai chih khiawán, dun chih khiawán, kinh mewah chih khiawán. |
| Are there any white bears?                    | kanu chah safíd hápat?                                          |
| Not here, but there are beyond.               | ithi chuh nah, amma wehin chuh                                  |
| In what district?                             | kut pergannahs andar?                                           |

- On this or on that side of the hill? kohas ihpár kinh chuh kinh apár  
kinh chuh?
- Beyond it. aparé.
- What kind of fish are there in the daryávas andar kami reng chih gád?  
river?
- A great many kinds. sitáhi reng chih.
- Do people catch them or not? low chih gád ratan kinh nah?
- Attend to what I am saying. ih kinh tsuh buh vanánchus, tat  
piaṭ tháú dhián.
- If you do not, you will repent it. hargah nah karak, adh pashtáwak.
- If you do not go, I will beat you. hargáh nah gasak, adh marut.
- Had you done as I told you, this yithi póṭhin mi dah piumāú, hárgah  
misfortune would not have hap- tithi póihin karihiu, adh ih  
pened. hauwinan kánthi balái.
- If I were rich, I would repair this hargah buh daulatmand áсах, adh  
house. karahah yit kothas marammat.
- If he had gone there, he would hargáh suh ór gatsaheh adh bilá-  
undoubtedly have been killed. shak gatse suh márah.



## APPENDIX E.



*Language of Dravidian Aborigines. Notes on the Oraon Language.—*  
By the Rev. F. BATSCH.

## NOUNS.

The language is very defective in nouns. It is evident that the Oraons have lost much of their own language, and that they have made up their losses from the languages of the people amongst whom they have dwelt, chiefly Sanskrit and Hindustani. They have no original religious terms, no abstract ideas, no words for actions of the mind or thoughts.

## GENDER.

In Oraon there are two genders, the masculine and the feminine, but there are very few nouns of the latter.

Whether the noun is a masculine or feminine is only to be found in the termination of the verb. In the declension, the gender is not or only very seldom expressed.

## DECLENSION.

There are all the usages of the Hindi language to be found in the Oraon. The oblique cases are also formed by postpositions.

---

*Note.* Pronunciation of the Roman characters as used in writing the Oraon words.

|   |      |   |    |        |    |              |       |      |        |
|---|------|---|----|--------|----|--------------|-------|------|--------|
| à | like | a | in | father | e  | like         | e     | in   | peg    |
| u | „    | u | „  | rule   | o  | „            | o     | „    | so     |
| ì | „    | i | „  | police | ai | „            | ai    | „    | aisle  |
| a | „    | a | „  | roman  | au | „            | ow    | „    | owl    |
| u | „    | u | „  | full   | ch | „            | ch    | „    | church |
| i | „    | i | „  | still  | ch | as in German | doch, | loch |        |

## SINGULAR.

|            |                                |
|------------|--------------------------------|
| Nom.       | kukos, the boy.                |
| Gen.       | kukosgahi, of the boy.         |
| Dat.       | kukosge, for to the boy.       |
| Acc.       | kukosin, the boy.              |
| Abl.       | kukosgusti, from the boy.      |
| Instr. (?) | kukusanti, from or by the boy. |
| Loc.       | kukosnu, on, in, upon the boy. |
| Agent.     | kukosim (?)                    |
| Voc.       | ana ko, oh boy.                |

## PLURAL.

|        |             |
|--------|-------------|
| Nom.   | kukor.      |
| Gen.   | kukorgahi.  |
| Dat.   | kukorge.    |
| Acc.   | kukorin.    |
| Abl.   | kukurgusti. |
| Instr. | kukoranti.  |
| Loc.   | kukornu.    |
| Voc.   | ana koe.    |

## SINGULAR.

|        |                  |
|--------|------------------|
| Nom.   | kukoi, the girl. |
| Gen.   | kukoigahi.       |
| Dat.   | kukoige.         |
| Acc.   | kukoidin.        |
| Abl.   | kukoigusti.      |
| Instr. | kukointi.        |
| Loc.   | kuknu.           |
| Agent. | kukoidim.        |
| Voc.   | an koi.          |

## PLURAL.

|      |                   |
|------|-------------------|
| Nom. | kukoier.          |
| Gen. | kukoiergahi, etc. |

## SINGULAR.

|      |                      |
|------|----------------------|
| Nom. | chad, the boy.       |
| Gen. | chadasgahi.          |
| Dat. | chadge.              |
| Acc. | chadin, or chadasin. |

|        |            |
|--------|------------|
| Abl.   | chadgusti. |
| Instr. | chadanti.  |
| Loc.   | chadnu.    |
| Agont. | chadasim.  |
| Loc. - | ana chad.  |

## PLURAL.

|      |             |
|------|-------------|
| Nom. | chadar.     |
| Gen. | chadargahi. |
|      | etc.        |

The plural is mostly expressed in the termination of the verb, the noun remaining unaltered in the singular and plural.

## NOUNS.

*Masculine.**Feminine.*

|         |         |        |          |
|---------|---------|--------|----------|
| tangdas | son     | tangri | daughter |
| kukos   | boy     | kukoi  | girl     |
| belas   | king    | belri  | queen    |
| meüt    | husband | mukka  | woman    |

## NOUNS.

|            |           |          |          |
|------------|-----------|----------|----------|
| mercha     | firmament | chebda   | ear      |
| chechal    | earth     | tatcha   | tongue   |
| binko      | star      | cheka    | hand     |
| birı       | sun       | chochal  | bone     |
| chando     | moon      | pall     | tooth    |
| pairi      | morning   | chesar   | shoulder |
| ulla       | day       | chocha   | back     |
| màchè      | night     | kul      | belly    |
| ucha       | darkness  | umbalcho | liver    |
| āl         | man       | ?        | heart    |
| meth       | male      | ?        | lungs    |
| mukka      | female    | cheso    | blood    |
| kuku       | head      | ched     | foot     |
| kes, chuti | hair      | chosga   | leg      |
| chan       | eye       | angli    | finger   |
| kapre      | forehead  | eroch    | nail     |
| moy        | nose      | gurchi   | heel     |
| boi        | mouth     | màka     | knee     |
| gale       | cheek     | bàri     | arm      |

|        |              |         |        |
|--------|--------------|---------|--------|
| thapri | palm of hand | bercha  | cat    |
| gunri  | cow          | lakra   | tiger  |
| ado    | ox           | harha   | wolf   |
| era    | goat         | tsigalo | jackal |
| paṭha  | lamb         | cher    | fowl   |
| allah  | dog          | cokro   | cock   |

## PRONOUNS.

|     |      |     |                    |
|-----|------|-----|--------------------|
| En  | I    | nām | we (both)          |
| nin | thou | em  | we (more than two) |
| ās  | he   | nim | you                |
| ād  | it   | ar  | they               |
| ād  | she  |     |                    |
| ne  | who  |     |                    |
| end | what |     |                    |

*Declension of pronouns.*

|        | <i>Singular.</i> | <i>Plural.</i>  |
|--------|------------------|-----------------|
| Nom.   | En, I &c.        | Em, we, &c.     |
| Gen.   | enghai, of me    | emhai.          |
| Dat.   | engage           | emage           |
| Acc.   | engan            | eman            |
| Abl.   | engusti          | emgustim        |
| Instr. | enganti          | emanti          |
| Loc.   | engnu            | emanu or emanum |
| Agent. | enim             | emim            |
|        |                  |                 |
| Nom.   | nin, thou        | nim, you        |
| Gen.   | ninghai          | nimhai          |
| Dat.   | ningāge          | nimāge          |
| Acc.   | ninin            | nimin, nimanun  |
| Abl.   | ningusti         | nimgustim       |
| Instr. | ninanti          | nimanti         |
| Loc.   | ninganu          | nimganu         |
| Agent. | ninim (?)        | nimim (?)       |

|        |         |          |
|--------|---------|----------|
| Nom.   | ās, he  | ar, they |
| Gen.   | āsgahi  | ārgahi   |
| Dat.   | āsge    | āрге     |
| Acc.   | āsin    | ārin     |
| Abl.   | āsgusti | argustim |
| Instr. | āsanti  | aranti   |
| Loc.   | āsganu  | argnu    |
| Agen.  | āsim    | arim.    |

The dual may be formed, but does not really exist,—as

|     |               |      |                |
|-----|---------------|------|----------------|
| nām | irab, we both | nim  | irib, you both |
| nām | irbghi        | nim  | irbargahi      |
| nām | irbge         | nima | irbarge        |
| nām | irbati        | nim  | irbarim        |
| nām | irbgusti      | nim  | iribgusti      |
| nām | irbanti       | nim  | iribanti       |
| nām | irbnu         | nim  | iribnu         |

## POSTPOSITIONS.

|                   |               |
|-------------------|---------------|
| gane, with        | chocha, after |
| gusti, from       | mechha, above |
| gusan, unto       | kuti, beside  |
| ge, to, for       | hiri, near    |
| anti, by, through | kaṭha, beyond |
| nu, upon          | gechha, far   |
| num, in           | menya, up     |
| kīnya, beneath    | mund, before  |

## ADJECTIVES.

The adjectives, which are only a few, take no part in the declension.

|      |                           |
|------|---------------------------|
| Nom. | sanni alas, little man    |
| Gen. | sanni alasgahi            |
| Dat. | sani alasge               |
| Acc. | sani alasin               |
| Abl. | sani alasgusti            |
|      | etc. etc.                 |
| Nom. | sanni mukka, little woman |
| Gen. | sanni mukkgahi            |

|                    |                             |
|--------------------|-----------------------------|
| Dat.               | sanni mukbage               |
| Loc.               | sanni mukkasin              |
| Abl.               | sanni mukkasgusti, etc.     |
| <i>Comparison.</i> |                             |
| Pos.               | sanni, small                |
| Comp.              | adinti sanni, smaller       |
| Superl.            | ad hurminti sanni, smallest |
| Pos.               | koha, great                 |
| Comp.              | adinti koha, greater        |
| Superl.            | ad hurminti koha, greatest  |

## ADJECTIVES.

|          |             |               |                   |
|----------|-------------|---------------|-------------------|
| pānru,   | white       | gari,         | deep              |
| mochāru, | black       | oṭṭa,         | heavy             |
| cheso,   | red         | nebba,        | light (not heavy) |
| hariar,  | green       | marchia,      | dirty             |
| pīyar,   | yellow      | kuri,         | hot               |
| dīgha,   | long        | kurna,        | warm              |
| pudda,   | short       | kiri,         | cold              |
| mōt,     | thick       | bariar,       | strong            |
| sarhua,  | thin        | jukki,        | little            |
| chaika,  | lean        | chaiga,       | wet               |
| kuba,    | } crooked   | chaika,       | dry               |
| benko,   |             | kiṛa,         | hungry            |
| ujgo,    | straight    | didirna,      | satisfied (full)  |
| mechha,  | high        | nidi,         | empty             |
| phuda,   | low         | ninka,        | full              |
| maldan,  | ugly        | chandrna,     | sleepy            |
| sobhdas, | } beautiful | ejrna,        | watchful          |
| koṛe,    |             | landi,        | slow              |
| bens,    | good        | kitka,        | rotten            |
| malbens, | bad         | panjka,       | ripe              |
| malkoṛe, | ill         | chena,        | unripe            |
| pachgi,  | old         | ghutum otaro, | round             |
| joch,    | young       | tissa,        | sour              |
| sanni,   | small       | phāri,        | pure              |
| bhircha, | hard        |               |                   |

## NUMERALS.

|          |       |
|----------|-------|
| onta,    | one   |
| enr,     | two   |
| mund,    | three |
| nách,    | four  |
| pantche, | five  |
| soi,     | six   |
| sate,    | seven |
| aṭhe,    | eight |
| nawe,    | nine  |
| dase,    | ten   |

In numbering human beings,  
these are the following numerals:

|               |           |
|---------------|-----------|
| ort ālas,     | one man   |
| irib ālar,    | two men   |
| núb ālar,     | three men |
| naib ālar,    | four men  |
| pantche ālar, | five men  |
| etc.          |           |

There are no ordinals.

|                |            |
|----------------|------------|
| tára,          | half       |
| onghon thauna, | once       |
| pánr enr,      | twice      |
| pánr mund,     | thrice     |
| pánr nách,     | four times |
| etc.           |            |

## VERBS.

*The auxiliary to be, mannáge.*

## INDICATIVE MOOD.

*Present.*

I am &c.

|     |           |               |
|-----|-----------|---------------|
| En  | ra : adan | rain          |
| nin | ra : aday | ra : adi      |
| ās  | ra : adas | ád ray ad rai |
| em  | ra : adam | raim          |
| nim | ra : adar | ra : aday     |
| ār  | ra : anar | ar ra : nay   |

*Imperfect.*

I was.

|     |             |               |
|-----|-------------|---------------|
| En  | ra : achkan | ra : achan    |
| nin | ra : achkay | ra : achki    |
| ās  | ra : achas  | ád ra : acha  |
| em  | ra : achkam |               |
| nim | ra : achkar | ra : ach kay  |
| ār  | ra : achar  | ád ra : achay |

*Perfect.*

I have been.

|     |         |           |     |          |           |
|-----|---------|-----------|-----|----------|-----------|
| En  | manjkan | be : edan | en  | manjkan  | be : en   |
| nin | manjkai | be : eday | nin | manjki   | be : edi  |
| ās  | manjkas | be : edas | ād  | manjki   | be : i    |
| em  | manjkam | be : edam | em  | manjkeem | be : em   |
| nim | manjkar | be : edar | nim | manjkay  | be : eday |
| ār  | manjkar | be : enar | ad  | manjkay  | be : enay |

*Pluperfect.*

I had been.

|     |         |              |    |         |             |
|-----|---------|--------------|----|---------|-------------|
| En  | manjkan | ra : achkan  | en | manjkin | ra : achan  |
| nin | manjkai | ra : achkaij |    | manjki  | ra : achki  |
| ās  | manjkas | ra : achas   | ad | manjki  | ra : acha   |
| em  | manjkam | ra : achkam  |    | manjkam | ra : achkam |
| nim | manjkar | ra : achkar  |    | manjkay | ra : achkay |
| ār  | manjkar | ra : achar   |    | manjkay | ra : achay  |

*Future.*

I shall or will be.

|     |        |         |
|-----|--------|---------|
| En  | manon  |         |
| nin | manoy  |         |
| ās  | manos  | ad mano |
| em  | manom  |         |
| nim | mannor |         |
| ār  | mannor |         |

*Future complete.*

I shall have been.

|     |               |
|-----|---------------|
| En  | manj chachon, |
| nin | manj chachoy  |
| ās  | manj chachos  |
| em  | manj chachom  |
| nim | manj chachor  |
| ār  | manj chachor  |

## IMPERATIVE MOOD.

|     |        |                            |
|-----|--------|----------------------------|
| En  | manon, | let me be.                 |
| nin | mana   | manai, be thou.            |
| ās  | mana   | ad mani, let him, etc. be. |
| em  | mannom |                            |
| nim | mannor |                            |
| ār  | mannor |                            |

## POTENTIAL MOOD.

*Present.*

I can be.

|     |                       |
|-----|-----------------------|
| En  | manna ong <u>on</u> , |
| nin | mana ong <u>oi</u>    |
| ās  | manna ong <u>os</u>   |
| em  | manna ong <u>om</u>   |
| nim | manna ong <u>or</u>   |
| ār  | manna ong <u>or</u>   |

*Imperfect.*

I might, could, &amp;c. be.

|     |                      |
|-----|----------------------|
| En  | manna ong <u>don</u> |
| nin | manna ong <u>day</u> |
| ās  | manna ong <u>das</u> |
| em  | manna ong <u>dam</u> |
| nim | manna ong <u>dar</u> |
| ār  | manna ong <u>mar</u> |

*Perfect.*

I may have been.

|     |              |           |
|-----|--------------|-----------|
| En  | manna ongkan | be : edan |
| nin | manna ongkay | be : eday |
| ās  | manna ongkar | be : edar |
| em  | manna ongkam | be : edam |
| nim | manna ongkar | be : edar |
| ār  | manna ongkar | be : enar |

*Pluperfect.*

I might, could, &amp;c. have been.

|     |              |             |
|-----|--------------|-------------|
| En  | manna ongkan | ra : achkan |
| nin | manna ongkay | ra : achkay |
| ās  | manna ongkar | ra : achas  |
| em  | manna ongkam | ra : achkam |
| nim | manna ongkar | ra : achkar |
| ār  | manna ongkar | ra : achar  |

## CONDITIONAL MOOD.

*Present.*

If I be.

|       |                 |     |       |
|-------|-----------------|-----|-------|
| Te en | man <u>on</u> , | em  | manom |
| nin   | man <u>oy</u>   | nim | manor |
| ās    | man <u>os</u>   | ār  | manor |

*Appendix E.**Imperfect.*

If I were.

|       |        |     |       |
|-------|--------|-----|-------|
| Te en | holle, | em  | holle |
| nin   | holle  | nim | holle |
| ās    | holle  | ār  | holle |

## INFINITIVE MOOD.

manṇa, being  
manṇāge, to be

*Kālage, to go.*

## INDICATIVE MOOD.

*Present.*

|     | <i>Masc.</i> | <i>Fem.</i> | <i>Dual.</i>        |
|-----|--------------|-------------|---------------------|
| En  | kālakdan,    | kālagin,    | nām irbatim kālakda |
| nin | kālakday,    | kālakdi,    |                     |
| ās  | kālakdas, ad | kālgi,      |                     |
| em  | kālakdam,    | kālagem,    |                     |
| nim | kālakdar,    | kālakday,   |                     |
| ār  | kālaknar,    | kālaknay,   |                     |

*Imperfect.*

|    |          |          |
|----|----------|----------|
| En | kālakkan | kālakkam |
|    | kālakday | kālakkar |
|    | kālakyas | kālakyar |

*Perfect.*

|    |        |           |
|----|--------|-----------|
| En | kerkan | be : edan |
|    | kerkay | be : eday |
|    | kerkas | be : edas |
|    | kerkam | be : edam |
|    | kerkar | be : edar |
|    | kerkar | be : enar |

*Pluperfect.*

|    |        |             |
|----|--------|-------------|
| En | kerkan | ra : achkan |
|    | kerkay | ra : achkay |
|    | kerkas | ra : achas  |
|    | kerkam | ra : achkam |
|    | kerkar | ra : achkar |
|    | kerkar | ra : achar  |

*Future.*

|    |      |      |
|----|------|------|
| En | kāun | kāom |
|    | kāoy | kāor |
|    | kāos | kāor |

*Future complete.*

|    |              |              |
|----|--------------|--------------|
| En | kāla chachor | kāla chachom |
|    | kāla chachoy | kāla chachor |
|    | kāla chachos | kāla chachor |

## IMPERATIVE MOOD.

|     |      |           |      |       |
|-----|------|-----------|------|-------|
| En  | kāun | kālon     | kāum | kālom |
| nin | kaoy | kālakaloi | kāor | kāla  |
|     | kāos |           | kāor |       |

## POTENTIAL MOOD.

*Present.*

## I can go

|    |             |            |
|----|-------------|------------|
| En | kāla ongon, | kāla ongom |
|    | kāla ongoy  | kāla ongor |
|    | kāla ongos  | kāla ongor |

*Imperfect.*

|    |             |             |
|----|-------------|-------------|
| En | kāla ongdan | kāla ongdam |
|    | kāla ongday | kāla ongdar |
|    | kāla ongdas | kāla ongnar |

*Perfect.*

|     |             |           |
|-----|-------------|-----------|
| En  | kāla unghan | be : edan |
| nin | kāla unghay | be : eday |
| as  | kāla unghas | be : edas |
| em  | kāla ungham | be : edam |
| nim | kāla unghar | be : edar |
| ār  | kāla unghar | be : edar |

*Pluperfect.*

|     |             |             |
|-----|-------------|-------------|
| En  | kāla unghan | ra : achkan |
| nin | kāla unghay | ra : achkay |
| ās  | kāla unghas | ra : achkas |
| em  | kāla ungham | ra : achkam |
| nim | kāla unghar | ra : achkar |
| ār  | kāla unghar | ra : achar  |

## CONDITIONAL MOOD.

*Present.*

## If I go.

|       |       |     |      |
|-------|-------|-----|------|
| Te en | kāun, | em  | kāum |
| nin   | kāe   | nim | kāor |
| ās    | kāus  | ār  | kāor |

*Imperfect.*

|       |        |     |        |
|-------|--------|-----|--------|
| Te en | kerkan | em  | kerkam |
| nin   | kerkay | nim | kerkar |
| as    | kerkas | ār  | kernar |

## PARTICIPLE.

kālke  
 kālar  
 kālnosim

## INFINITIVE MOOD.

kāna, going  
 kālage, to go

*Nanáge, to do.*

## INDICATIVE MOOD.

*Present.*

|    |        |        |
|----|--------|--------|
| En | nandan | nandam |
|    | nanday | nandar |
|    | nandas | nandar |

*Imperfect.*

|    |         |         |
|----|---------|---------|
| En | nanjkan | nanjkam |
|    | nanjkar | nanjkar |
|    | nanjas  | nanjar  |

*Perfect.*

Enim nanjkan be : edan  
 ninim nanjkay be : eday  
 āsim nanjas be : edas  
 emim nanjkam be : edam  
 nimim nanjkar be : edar  
 ārim nanjkar be : enar

*Pluperfect.*

|       |         |             |
|-------|---------|-------------|
| Enim  | nanjkan | ra : achkan |
| ninim | nanjkae | ra : achkay |
| āsīm  | nanjkas | ra : achas  |
| emim  | nanjkam | ra : achkam |
| nimim | nanjkar | ra : achkar |
| ārim  | nanjkar | ra : achar  |

*Future.*

|     |        |     |        |
|-----|--------|-----|--------|
| En  | nannon | em  | nannom |
| nin | nannoy | nim | nannor |
| ās  | nannos | ār  | nannor |

*Future completive.*

|     |             |     |             |
|-----|-------------|-----|-------------|
| En  | nanjchachon | em  | nanjchachom |
| nin | nanjchachoy | nim | nanjchachor |
| ās  | nanjchachos | ār  | nanjchachor |

## IMPERATIVE MOOD.

|     |        |     |        |
|-----|--------|-----|--------|
| En  | nannon | em  | nannom |
| nin | nannoi | nim | nanor  |
| ās  | nannos | ār  | nannor |

---

 VERBS.

|           |          |
|-----------|----------|
| to beat   | laona    |
| to drink  | ona      |
| to sleep  | chandrna |
| to walk   | ekna     |
| to swim   | ogna     |
| to plough | oyna     |
| to cut    | choina   |
| to sow    | cháchna  |
| to eat    | mochna   |
| to eat    | ona      |
| to ride   | argna    |
| to fall   | katrna   |
| to rise   | cho : na |
| to see    | erna     |
| to hear   | menna    |

|          |              |
|----------|--------------|
| to speak | kochna karna |
| to sing  | párna        |
| to blow  | úrna         |
| to dance | nalna        |
| to sit   | okna         |
| to tie   | chotna       |
| to go    | kána         |
| to cook  | biitna       |

---

 ADVERBS.

|         |          |
|---------|----------|
| below   | kinya    |
| near    | hiri     |
| within  | ekatará  |
| whence  | ekaiants |
| how     | ekane    |
| not     | ambo     |
| yes     | hae      |
| whence  | ekaianti |
| whither | ekatará  |
| alone   | oatoch   |

---

 CONJUNCTIONS.

|         |         |
|---------|---------|
| and     | dara    |
| then    | antle   |
| but     | pahe    |
| or      | bhel    |
| because | igune   |
| also    | hon     |
| when    | ekabiri |
| if      | je      |

*The Lord's Prayer.*

He embai je mercha nu ra: aday. Ninghai náme pavitr mano, Ninghai ráji bar: o; ninghai suuwak ekane mercha nu, aneho chochal nu ho mano. Emhai ulla ullanta asma ina emáge chia. Antle emhai dosan muaf nana, ekane omho emhai dosnanurin muaf nandan. Antle oman pariksha nu amba cha: a, pahe burainti ehhar a ba: a Ráji, sáwang antle mahatm sadau sadau ninghai rai. Amin.

*Creed.*

En bishwás nandan Dhames embas nu, ás je mercha dara che-  
 chalgahi sángias sirjanhāras taliás, antle ásgahi ortostonka tangdas.  
 Prabhus Jisus Christúsnú, je Dharmatmanti Kulnu barchhas dindam  
 Mariamauts kundrus, Pontius Pilatus tarti dukhan chedas, Krusnu  
 kilras keras, ketchas keras, mándras keras, antle naraknu itiás, ulmund-  
 nu ketch ka gusti ujias dara chochus mercha nu argias, antle sawan-  
 gias tambas Dharmeshgahi mandi cheka tara uk : as be : edas ; eksanti  
 ás ujnárin antle ketch karin nisáb nanáge phen bar : os.

En bishwás nandan dharmatma nu : Dharmir Christáner gahi go  
 honda nu dhar mir gahi salha me, pápgahi chhema, med gahi jia cho :  
 ona antle jug jug gahi jia nu. **Amin.**

*Ten Commandments.*

1. Dharme nimhai Dharme entol konnek anum dosar Dharmesin  
 amba man : a.
2. Indri im juthi gahi dewt a puja amba nana.
3. Dharme ninghai Dharmes gahi namin begar bujhra : am amba ana.
4. Dharmes gahi ulan paoits niáge amba modr a.
5. Ninghai ágo babásin mahá tmchia.
6. Alawein amba chetár chia.
7. Nanna mukkargane amba naña bekamma drál tarah amba mana.
8. Chalal amba chara.
9. Phásiar amba ana, ninghai orsi porsir un phásiar gawáhi amba  
 chia
10. Ninghai orsi porsir gahi erpa erpanta tálach amba nana.

## APPENDIX

*Brief Vocabulary of the Moondah and*

| <i>English.</i> | <i>Moondah.</i> | <i>Ho.</i> | <i>Kherriah.</i> |
|-----------------|-----------------|------------|------------------|
| Man             | horo            | ho         | hibo             |
| Woman           | era             | era        | kanseldo         |
| Boy             | coora           | cooa       | baboo            |
| Girl            | corsi           | cooi       | buij             |
| Head            | bohu            | bo         | boko             |
| Hair            | ub              | ub         | ulloi            |
| Ear             | lutur           | lutur      | lutur            |
| Eye             | med             | met        | mud              |
| Mouth           | .....           | a          | tamode           |
| Tooth           | data            | danta      | goineh           |
| Hand            | tihi            | tih        | tih              |
| Foot            | kata            | kata       | katta            |
| Bone            | jang            | jang       | .....            |
| Blood           | myam            | myum       | enjam            |
| Egg             | billi           | .....      | .....            |
| To-day          | tiping          | tiping     | mupoo            |
| Night           | .....           | nida       | eedib            |
| Sky             | sirma           | sirma      | o                |
| Sun             | singi           | singi      | borho            |
| Moon            | chandu          | chundu     | lerung           |
| Star            | epil            | epil       | sencom           |
| Heat            | lolo            | lola       | lolo             |
| Fire            | singil          | sèngil     | tìngson          |
| Water           | dah             | dah        | dah              |
| Wind            | hoyo            | hogo       | kogo             |
| River           | .....           | .....      | .....            |
| Stone           | .....           | .....      | .....            |
| Tree            | daru            | daru       | .....            |
| Village         | .....           | .....      | .....            |
| House           | ora             | ora        | o                |
| Snake           | .....           | beeng      | bungham          |

## F.

*cognate Languages of the Kolarian type.—By Lieut.-Col. DALTON.*

| <i>Putoons or<br/>Juang.</i> | <i>Sonthal.</i> | <i>Bhumiz<br/>(Latham.)</i> | <i>Coour<br/>(Dr. Voysey.)</i> |
|------------------------------|-----------------|-----------------------------|--------------------------------|
| juang                        | horh            | horro                       | hoko                           |
| mukha                        | .....           | .....                       | suttan                         |
| lunda                        |                 |                             |                                |
| lundi                        |                 |                             |                                |
| bocob                        | buho            | buho                        |                                |
| juta (H)                     | ub              | ub                          | ap                             |
| lutur                        | lutur           | lutur                       |                                |
| emor                         | met             | met                         | meht                           |
| tamon                        | mocha           | alang                       | ah                             |
| goneh                        | dátha           | dátta                       |                                |
| .....                        | thi             | thi                         |                                |
| .....                        | kata            | kata                        |                                |
| har (H)                      | jang            | jang                        |                                |
| iyam                         | myum            | myun                        |                                |
| susuté                       | billi           | pito                        |                                |
| missing                      | teheng          | tising                      |                                |
| berote                       | níndhá          | nídhá                       |                                |
| akas (H)                     | sirma           | reiumil                     |                                |
| suruj (H)                    | singi           | singi                       |                                |
| lerung                       | chandu          | chandú (H)                  |                                |
| konjinda                     | ipil            | ipil                        | ipil                           |
| lalai                        | sengel          | sengel                      | singhél                        |
| dah                          | dah             | dah                         | da                             |
| koyo                         |                 |                             |                                |
| noi (H)                      | garra           | garra                       |                                |
| olag                         | dirrí           | dirrí                       |                                |
| sumsing                      | dáré            | dárú                        | darao                          |
| jaon (H)                     | athú            | hathúgé                     |                                |
| .....                        | óra             | ora                         | oarru                          |
| bubung                       | bing            | bing                        |                                |

## APPENDIX G.

*Language of the Kolarian Aborigines;—Grammatical construction of the Ho language.—By Lieut.-Col. TICKELL.\**

I hope due allowances will be made for the imperfectness of the grammatical details here given, when it is remembered that the Ho language has no written character, nor does there exist a person, native of the Kolehan or otherwise, who could give me the slightest assistance on this point.

It would be trite to observe that grammar is as inherent and essential to all languages, even the most barbarous, as a vocabulary itself. By first learning a number of the words and sentences arbitrarily, the system on which they are founded may be detected in due time by patient comparisons of them, even when the speakers themselves are unable to give the inquirer the least information on the construction of what they are saying. With this difficulty once mastered, it is inconceivable with what ease the most (apparently) complex and difficult languages become familiar.

The sounds of the Ho language are exceedingly pure and liquid, without strong aspirates or gutturals, and may be well rendered by the English alphabet, or still better the French one, as that admits of the slight nasal inflection which prevails in many words in the Ho dialect.

Let the following conventions be made to the sound of the vowels, in the ensuing dialogues, &c.

|          |           |       |                                |                       |
|----------|-----------|-------|--------------------------------|-----------------------|
| á        | ————      | as in | “father,”                      | “rather,”             |
| é        | ————      | „     | “prey,”                        | “été,”                |
| ī        | ————      | „     | “skip,”                        | “trip,”               |
| ee       | ————      | „     | “sheep,”                       | “peep,”               |
| ÿ        | ————      | „     | “fly,”                         | “try,”                |
| aï or aÿ | ———       | „     | longer sound as in “aye, aye?” |                       |
| ō        | ————      | „     | “bone,”                        | “stone,”              |
| oo       | ————      | „     | “fool,”                        | “stool,”              |
| †ñ       | (nasal n) | „     | “Ton”                          | “Fanfaron,” (French.) |

\* Reprinted from *As. Soc. Journal*, Vol. IX. p. 1063.

† Also g, as the French liquid g, in Cologne, Boulogne.

The long acute vowel sounds, such as *oo* and *ee*, also the letter *r*, are pronounced too liquidly and subtly to be easily imitated by a stranger, and in some words the inflections of the vowels are inconceivably complex and mellifluous. The general euphony or cadence of the language is sprightly and cheerful; if the subject be of a complaining nature, it subsides into a strange chaunt, the sentences being linked together by such see-saw sounds, as “ná-do na-do enété ná-do” which have no meaning, but serve to connect together the speaker’s ideas.

When two or more words come together, the former ending, and the latter beginning with similar vowels, they are joined by ellipsis. as “*Hola lé seniéna,*” instead of “*Hola allé seniéna,*” *we went yesterday.*

## ARTICLE.

There is none, (properly speaking), definite or indefinite.

## NOUN.

There is no distinction of genders, marked or influenced by termination, it being determined by the sense or meaning of the word, whether referring to a *male* or *female* being. Besides *man* and *woman*, “*erril*” and “*èra,*” *boy* and *girl*, “*koá*” and “*koóee,*” names of relations, and those of a few domestic animals, all other nouns are distinguished in their gender by prefixing “*Sandee*” *male*, or “*Enga*” *female*, as in Persian or English *رینگ نر رینگ* *و مادان* *he-bear, she-bear.*

A noun has three numbers, singular, dual, and plural, as in Greek.

The nouns can scarcely be said to have declension, as the terminal does not vary either according to number or case, although a distinguishing adjunct, which may be called a ‘Pronoun article,’ from its nature and use, is added.

## Singular.

## Dual.

## Plural.

|                                 |                                     |                               |
|---------------------------------|-------------------------------------|-------------------------------|
| Nom. Sètá, <i>a dog.</i>        | Seta king, <i>two dogs.</i>         | Sèta ko, <i>dogs.</i>         |
| Gen. Sètá-á, <i>of a dog.</i>   | Seta kingya, <i>of two dogs.</i>    | Seta koà, <i>of dogs.</i>     |
| Ab. Seta-té, <i>from a dog.</i> | Seta king tè, <i>from two dogs.</i> | Seta ko tè, <i>from dogs.</i> |

The dative, accusative, and vocative cases do not differ from the nominative, being only known from their position in a sentence.

In composition, the noun in an accusative case takes the first place in the sentence, if the nominative be a pronoun; otherwise the noun-nominative precedes, the accusative follows, and the oblique or dative case comes immediately before the verb, sometimes immediately after

it. "En ho kajikeeái áya èra," *that man said to his wife*, "Dendka oé tootigoikeea," *Dendka shot the bird*. "Eeán hōn do chowlee seta emadā," *my son gave the dog some rice*.

## ADJECTIVE.

The adjective does not alter in termination, either in number, case, or gender; and always precedes the noun it qualifies. As "Boogee ho," *a good man*; "Boogee ho-á," *of a good man*; "Boogee ho lo té," *with a good man*, &c. There are no degrees of comparison, but as in Hindustani the qualifying words *very*, or *most of all*, are prefixed to denote grades of quality, as "Etka," *bad*, "Ená té neeá o etka," *this is worse than that*. "Sabee ré nee o etka minna," *this is worst of all*. "Boogee lèka èra," *a pretty woman*. "Boogee lèka èra ko," *pretty women*.

## PRONOUN.

The first personal pronoun has four numbers, the singular, dual, plural, and plural comprehensive. The others only the three first, as noticed in the noun-substantives.

The possessive pronouns are the same as the personal, with the genitive inflection *á* added.

## PERSONAL PRONOUNS.

|      | Singular.              | Dual.                  | Plural. Pl. comprehensive. |                     |
|------|------------------------|------------------------|----------------------------|---------------------|
| 1st. | Eeng or aing, <i>I</i> | Alleeng, <i>we two</i> | Allé, <i>we</i>            | Aboo, <i>we all</i> |
| 2d.  | Um, <i>thou</i>        | Abben, <i>you two</i>  | Appé, <i>you</i>           | "                   |
| 3d.  | Aÿ or áÿo, <i>he</i>   | Aking, <i>they two</i> | Ako, <i>they</i>           | "                   |

In speaking, if the person include the person addressed, himself, and every one present, as nominatives or agents, he uses the plural comprehensive. If he exclude the person addressed, he employs the first person plural, as "Hola aboo seniéna," *yesterday we went* (i. e. you and all of us.) "Hola allé seniéna," *yesterday we went* (i. e. not you, we alone.)

The personal pronouns in the nominative case both precede and terminate the verb, optionally with the speaker, as, *I speak*, "Eeng kajitanna" or "Eeng kajitannaing" or "Kajitannaing."

*I go*, "Eeng senotana," or "Eeng senotannaing," or "Senotannaing."

And to give energy to the sentence, the pronoun is repeated, with the connect "do" between them, as "Eeng do eeng kajitanna," *'Tis I who speak*," Um do um kombookenna," *Thou alone statest it*.

The most difficult part of their construction is in the dative and accusative cases, which are absorbed in the verbs they are governed by, in a manner unknown to other languages, being placed in the centre of the verb, after the root, and before the tense terminal.

As, *I speak to thee*, "Eeng kajimetanna;" *he spoke to me*, "áyo kajikedíngia;" *he spoke to them*, "kajiked koái;" *the tiger saw me* "koola do neldedingia;" *he killed him*, "áyo goikedáya." Here I have underlined the oblique or accusative pronoun, where it comes in, just before the tense terminal of the verb.

## POSSESSIVE PRONOUNS.

| Singular.                        | Dual.     | Plural. | Pl. comp. |
|----------------------------------|-----------|---------|-----------|
| 1st. Eenga* or áingia, <i>my</i> | alleengia | alléa   | abooá     |
| 2d. Umma, <i>thy</i>             | abbena    | appéa   | „         |
| 3d. Aya, <i>his</i>              | akingia   | akoá    | „         |

These always precede their substantives.

## DEMONSTRATIVE PRONOUNS.

| Singular                                              | Dual.                          | Plural.                 |
|-------------------------------------------------------|--------------------------------|-------------------------|
| Nee or inee, <i>this</i>                              | neeking, <i>these two</i>      | niko, <i>these</i>      |
| Neeá or ineeá, <i>of this</i>                         | neekingia, <i>of these two</i> | neekoá, <i>of these</i> |
| Neeté, or ineeté, <i>to, with,</i><br>&c. <i>this</i> | neekingté,                     | neekoté,                |

---

|                                         |                              |                        |
|-----------------------------------------|------------------------------|------------------------|
| En, <i>that</i>                         | enking, <i>those two</i>     | enko, <i>those</i>     |
| Ená, <i>of that</i>                     | enkingá, <i>of those two</i> | enkoá, <i>of those</i> |
| Enté, <i>by, from with &amp;c. that</i> | enkingté,                    | enkoté,                |

"Nee" *this*, is sometimes used idiomatically by a person referring to himself. If a Kole were to be asked what countryman he was? he would answer, "Ho nee gé," *I am*; or literally, *this is a Kole*. Of what clan are you? Answer, "Poortee neegé," *I am a Poortee*.

## INTERROGATIVE PRONOUNS.

|                      |                           |                    |
|----------------------|---------------------------|--------------------|
| Okoï, <i>who?</i>    | chikan, <i>which?</i>     | chiá, <i>what?</i> |
| Okoíá, <i>whose?</i> | chikaná, <i>of which?</i> |                    |

## RELATIVE PRONOUNS.

Relative pronouns are very vague, the sentence being generally so rendered as to obviate the necessity of them, thus, instead of saying, *The man who went*; a Kole would say, *The gone man*, "Senien Horo."

\* Pronounced, as 'mignon,' 'Ligne,' &c. in French.

But at times "Chikana," *whatever*, and "Ena," *that*, are used relatively, as "Chikana um kajeeá, èna eeng áiooma," *what you say, that I will listen to.*

#### VERBS.

Verbs are either active or neuter. There is no passive voice.

The Infinitive mood is formed by adding *téa* to the root.

The present participle by adding *tan* or *té*.

The Past participle by affixing *kedté*.

In the active or transitive voice, the Present tense Indicative mood adds to the root "*tanna*," in the neuter voice, "*akanna*."

Imperfect tense there is none, the Present tense being used, and its Imperfect signification understood by the context.

The Perfect tense is formed by adding in the active voice, "*kidda*, *keea*, *kenna*, *lidda*, or *tadda*," to the root. In the neuter voice, "*lena*," or "*ièna*," sometimes "*kenna*."

There is no Pluperfect tense, but greater completion is expressed by conjugating the verb "*chabteá*," *to finish*, added to the root; much the same way as "*chookna*" in Hindustanee.

The Future is formed by adding to the root *eea* or *oá*, or sometimes simply *á*, in which latter case the sound of the root is prolonged. Except "*nooiteá*," *to drink*, which makes "*noonooá*;" and "*roteá*," *to gore* (as a bull) "*roroá*."

The Imperative is formed by adding (in the 2nd person singular) to the root, "*mèn*" and "*omén*" or "*ymén*," if the root end with a consonant. In the other persons *ká* precedes the pronoun, and the simple root of the verb, which will be more clearly shown in conjugating. In a negative sense, "*alum*" or "*alo*" is prefixed to the 2nd personal pronoun, *á* being added to the root; if in the 3rd person, singular, dual, or plural "*aloka*" is prefixed to the pronoun, and the root alone of the verb is used.

The Subjunctive mood is vague and imperfect. In the Present and Future tenses "*rèdo*" is added to the root, sometimes together with the word "*honang*," "*derang*," or "*torá*" (signifying conditionality) affixed.

The Past tense is formed in the same way; indeed there appears to be no Past Subjunctive tense; but sometimes the conditional terminal "*rèdo*" is added to the Past perfect Indicative.

This word "rèdo" admits the vowel to be affixed to it, or to come immediately before it and after the root.

Conjugation of the verb "Kajëeteá," to speak.

INFINITIVE MOOD.

Present tense—Kajëeteá, *to speak*,

Present Participle—Kajitan, or Kajienté, *speaking*,

Past Participle—Kajikedté, *having spoken*.

INDICATIVE MOOD.

*Present tense.*

| Sing.                                                 | Dual.                                        | Plural.                           |
|-------------------------------------------------------|----------------------------------------------|-----------------------------------|
| 1st. Person, Aïng, }<br>2d. ,, Um, }<br>3d. ,, Aÿo, } | Alleeng—Allé,<br>Abben—Appé,<br>Aking—Ako, } | Kajitanna,<br>I &c. am speaking . |

*Perfect tense.*

|                                                                          |                                                                   |
|--------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1st. Aïng—Alleeng—Allé,<br>2d. Um— Abben—Appé,<br>3d. Aÿo— Aking— Ako, } | Kajikidda, Kajilidda or Kajitadda.<br>I &c. spoke or have spoken. |
|--------------------------------------------------------------------------|-------------------------------------------------------------------|

*Future tense.*

Aïng, Um, &c. &c.—Kajëea, *I &c. &c. will speak.*

IMPERATIVE MOOD.

| Sing.                                                                                                                                     | Dual.                                                                                                                                                                                                                                                                                                                                                  | Plural. |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Eng Kakajëe, <i>Let me speak.</i><br>Um Kajeemén, <i>Speak thou.</i><br>Aÿo Kakajëe or } <i>Let him</i><br>Kakajëe o kái, } <i>speak,</i> | Kajëeaboo or Abookakajëe, <i>Let us all, &amp;c.</i><br>Kajëeben or Abbenkakajëe, <i>Speak you,</i><br><i>&amp;c.</i><br>Kajëealling or Allingkakajëe, <i>Let us, &amp;c.</i><br>Kajëeallé or Alléokakajëe <i>Let us, &amp;c.</i><br>Kajëeako or Akokakajëe <i>Let them, &amp;c.</i><br>Kajëeaking or Akingkakajëe, <i>Let them,</i><br><i>&amp;c.</i> |         |

NEGATIVE.

| Sing.                                                                                                                          | Dual.                                                                                                                      | Plural.                                                           |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Alokäïng kajëea, <i>Do not let me speak.</i><br>Alum kájëea, <i>Speak not.</i><br>Alo kái kajëea, <i>Do not let him speak.</i> | Alo k'aboo kajëea.<br>Alo k'allé kajëea.<br>Alla'bben kajëea.<br>Al'appé kajëea.<br>Alo ka'ko kajëea.<br>Aloka'king kajëea | } <i>Do not let us</i><br><i>&amp;c. &amp;c.</i><br><i>speak.</i> |

## SUBJUNCTIVE MOOD.

*Present tense.*

|                                        |                                          |
|----------------------------------------|------------------------------------------|
| Eeng Kajeerèdo, <i>If I speak.</i>     | } Kajeerèdo, <i>If we &amp;c. speak.</i> |
| Um Kajeeredo, <i>If thou speakest.</i> |                                          |
| Aïo Kajeeredo, <i>If he speak.</i>     |                                          |
| Aboo,                                  |                                          |
| Allé,                                  |                                          |
| Abben,                                 |                                          |
| Appé,                                  |                                          |
| Ako,                                   |                                          |
| Aking,                                 |                                          |

*Perfect or Pluperfect.*

Eeng, Um, &c. &c. &c. Kajeekedrèdo, *If I &c. &c. &c. had spoken.*

## CONDITIONAL, OR POTENTIAL.

|                                             |                                                                  |
|---------------------------------------------|------------------------------------------------------------------|
| Eeng Kajeáing honang, <i>I would speak.</i> | } Allé &c. &c. Kajeëa honang,<br><i>We might or would speak.</i> |
| Um Kajeëum honang, <i>Thou &amp;c.</i>      |                                                                  |
| Aïo Kajeëa honang, <i>He, &amp;c.</i>       |                                                                  |

NOTE. As has been before explained, in all these tenses and persons (except in the Imperative) the pronoun may be either prefixed, or affixed, or both.

## The same Verb, Conjugated with its Objective pronoun.

## INDICATIVE MOOD

*Present tense.*

|              |                    |                              |
|--------------|--------------------|------------------------------|
| Eeng or Aÿng | Kajeëing tanna,    | <i>I speak to myself.</i>    |
| „            | Kajeë metanna,     | <i>I speak to thee.</i>      |
| „            | Kajeë áitanna,     | <i>I speak to him.</i>       |
| „            | Kajeë' létanna,    | <i>I speak to ourselves,</i> |
| „            | Kajeë' ling tanna, | <i>I speak to us two.</i>    |
| „            | Kajeë' ben tanna,  | <i>I speak to you two.</i>   |
| „            | Kajeë' pètanna,    | <i>I speak to you.</i>       |
| „            | Kajeë king tanna,  | <i>I speak to them two.</i>  |
| „            | Kajeë kotanna,     | <i>I speak to them.</i>      |

The same exactly for all the other persons, and tenses, &c.

*Perfect tense.*

|                               |                               |                 |                    |                    |
|-------------------------------|-------------------------------|-----------------|--------------------|--------------------|
| Aïng, Um, Aÿó,<br>&c. &c. &c. | } I, thou, he,<br>&c. &c. &c. | Kajikedingiá.   | } spoke to myself. |                    |
|                               |                               | Kajiked'mia.    |                    | spoke to thee.     |
|                               |                               | Kajikedáíá.     |                    | spoke to him.      |
|                               |                               | Kajikede'lia.   |                    | spoke to ourselves |
|                               |                               | Kajiked'lingia. |                    | spoke to us two.   |
|                               |                               | Kajiked'bena.   |                    | spoke to you two.  |
|                               |                               | Kajikedpéá.     |                    | spoke to you.      |
|                               |                               | Kajikedkingiá   |                    | spoke to them two. |
| Kajiked'koá.                  | spoke to them.                |                 |                    |                    |

Examples of this construction, especially in the Imperative mood, will be given in the Vocabulary, so need not be further dwelt on here.

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It is scarcely possible to reduce the verb "to be" to conjugation, unless we suppose the varied forms in which it is used as inflections of separate verbs, wanting in many tenses. For "to be" is expressed by different verbs, according to its allusion to time, a person, or a thing; and its relation to mere existence or to the nature of existence. In short, there is no auxiliary verb "to be" which can be independently conjugated. The unchangeable word "minna," or "minnakana," is applicable in the present tense alone, to denote a *state* of existence, as "Eeng, um, aýó, &c. menna, or minnakana," *I am, thou art, he is, &c.* But in past and future tenses some other verb denoting *presence*, as the verb "to come," "to reside," &c. must be employed.

But the verb "to be," when implying the *nature* of existence, can be rendered in the past and future tenses, as well as the present, by adding to the participle or adjective, *oá* in the future, and *iena* in the past, as "eeng laga akanna," *I am tired*; "eeng lagaoá," *I shall be tired*; "eeng lâgièna," *I have become tired*; "eeng rènga akanna, or renga akannaing," *I am hungry*; "eeng rengaoá or rengaoing," *I shall be hungry*; "eeng rengaièna," *I was hungry*. *Oá* and *iena*, it is to be remembered, are inflections of the future and past tenses in all neuter verbs.

Again the verb "to be" can be simply represented in the future and past tenses, when speaking of a *thing*, by the word "hobawa," *it shall or will be*, and "hobiena," *it has been*; also in the present, "hobowtanna," *it is*. This mode of expression commonly refers to the success or accomplishment of any project. In the English idiom we should say for "hobawa," *it will do, or it will answer*; "hobiena," *it is all over, or has succeeded*; "hobowtanna," *it is going on*.

*That boy will be a thief*, could not be rendered, "En koá do komboo hobawa," but "En koá do komboo oá."

*Your business will be done to-morrow*, not, "Umma kajee gappa oá," but, "Umma kajee gappa hobawa."

*This will never do*, "Ka hobawa," *go away, it is all over* "Mar-senomén hobièna."

In English and other languages, state, nature or condition, is rendered by affixing or prefixing the various tenses of the verb "to be" to the adjective, as to be hungry, *I am hungry, I was hungry*; "to be glad, *I am glad, &c. &c.*" But in the Ho dialect the adjective itself becomes a neuter verb, and is conjugated by affixing to it the different inflections denoting time and mood—to be hungry, "rengatéá;" *I am hungry*, "renga akannaing;" *I was hungry*, "rengaiénaing;" &c.

#### NEUTER VERBS.

After what has been said, it would be unnecessary to give any example of the conjugation of neuter verbs. It only requires to be remembered that their present terminal is "akanna" instead of "tanna;" and their past inflection "iéna," instead of "kidda, tadda, lidda, or eea," all of which latter are transitive forms.

Some verbs are both neutral and transitive, as "chabateá" to finish. They have therefore both inflections. In the transitive form "chabatea" is frequently added to the root of some other verb, to denote completion; but it may also be used alone: in the neuter form, it is of course confined to the third person.

#### EXAMPLES.

Yómchabakiddái, *He ate it all up.*

Býchabakidallé, *We finished (making) it.*

Kajeechabýmén, *Finish speaking.*

Gappa miang chabawa, *It will be done to-morrow or next day.*

Nádo chabiéna, *It is now finished.*

The word "hereá" is placed between the root and terminal of a verb to denote positiveness or certainty; as when the speaker means to state something as an incontrovertible fact, as, "Kajee hereákiddái," *most assuredly he spoke.* "Oodoob hereámén," *speak positively.*

The causal form is rendered by putting "chee" between the root and terminal—as "landateá," to laugh, makes "landacheeteá" to cause to laugh; "aioomtea," to hear, "aioomcheetea," to cause to hear, as in Hindustani á is inserted (with a few exceptions) for the same purpose, as Hunsna, Hunsána; Soonna, Soonána, &c.

Continuity (in the Imperative mood alone) is expressed by adding "akán" to the root, as "doobmén," *sit down*, "doobakánmen," *remain sitting*; "Aioom mén," *listen*, "Aioomakánmén," *continue listening.*

Finally, the thoroughly performing an act, is often rendered by adding

the verb, "jōmeteá," *to eat*, to the root of the expletive verb, as "nel-joomkidallé," *we all saw it (thoroughly)*; "aioomjōmmén," *listen (attentively)*; "Geetee jōm-meén," *sleep (soundly)*. And should the verb be of a violent nature (referring to some violent act) the particle "táb" between the root and inflection gives force to the meaning, as "Goitabkiddai," *he slew him (outright)*; "Toltab kidallé," *we bound him (forthwith)*; "Neertabmén," *Run (quickly) fly!* so "Ooiteá" is *to jump*, and "Ooitabtea," *to bound (as a tiger)*.

Ká before the pronoun gives the verb a negative form, as has been before explained in describing the Imperative mood.

There is no verb "to have," possession being denoted in the same manner as in Hindustani. *I have*, "Eengtra minna"—"Méré pas h̄ye."

From the foregoing remarks may be gathered, that in the active or transitive voice—

The present terminal is, "Tanna."

The past, "Kidda, tadda, lidda, kenna or keea."

In the Neuter Voice—

The present terminal is, "akénna."

The past, "ièna or lèna ;"

In either Voice—

The conditional, subjunctive, } "redo" or "kedrado,"  
or potential mood terminate in }

All these terminals being of course subject to the inflections of their pronouns, which are, as has been said, as often affixed as prefixed.

A nondescript species of Verb is used in rendering the sentence "what shall or can I, (thou, he, &c.) do?"

*Future and Present.*

|                                                                                                                                                                                                    |   |                          |                                                                                                |   |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------|------------------------------------------------------------------------------------------------|---|------------|
| Ch'eeng chik̄yā,<br>Chee'm chikya,<br>Chee chik̄yā,<br>Cheeboo chikya,<br>Chee'lé chikya,<br>Chee'pé chik̄yā,<br>Chee'ben chik̄yā,<br>Chee'ko chik̄yā,<br>Chee'king chik̄yā,<br>Chee'ling chik̄yā, | } | <i>what shall or can</i> | {<br>I,<br>Thou,<br>He,<br>We all,<br>We,<br>You,<br>You two,<br>They,<br>They two,<br>We two, | } | <i>do?</i> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------|------------------------------------------------------------------------------------------------|---|------------|

*Past tense.*

Chee'ng chikakidda, *what could I have done?* &c. &c. &c.

The verb "to be able" is rendered by "Dýtea" in its moods and tenses, as "Niádo eeng býdya," *I can make this*; "Umdokadya," *you cannot*; "K'ái dyaó," *he will not be able*.

Many little exceptions and variations occur to these general rules, which it would be impossible to become familiar with, without constant practice in their arbitrary use; but the foregoing remarks comprise all that would be of practical utility. The constant elision and confluence of words beginning and ending with vowels must be remembered, and that the particle *do*, has no meaning whatever. This will render the examples above given to the different rules simple and illustrative.

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*Meteorological Observations.*

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.*

Latitude 22° 23' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the Sea-level, 18 ft. 11 in.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | 30.056                                    | 30.147                                 | 30.006  | 0.141   | 68.3                       | 76.4                                     | 61.0 | 15.4  |
| 2     | .045                                      | .134                                   | 29.993  | .141    | 68.0                       | 77.8                                     | 60.4 | 17.4  |
| 3     | .029                                      | .113                                   | .987    | .126    | 69.1                       | 79.4                                     | 60.2 | 19.2  |
| 4     | .001                                      | .082                                   | .930    | .152    | 72.0                       | 82.8                                     | 62.8 | 20.0  |
| 5     | 29.961                                    | .061                                   | .886    | .175    | 73.4                       | 83.6                                     | 65.8 | 17.8  |
| 6     | .906                                      | 29.971                                 | .848    | .123    | 73.1                       | 81.2                                     | 66.4 | 14.8  |
| 7     | 30.007                                    | 30.073                                 | .948    | .125    | 68.4                       | 73.8                                     | 64.6 | 9.2   |
| 8     | .113                                      | .221                                   | 30.057  | .164    | 64.0                       | 73.0                                     | 55.8 | 17.2  |
| 9     | .119                                      | .219                                   | .064    | .155    | 63.4                       | 72.9                                     | 56.0 | 16.9  |
| 10    | .068                                      | .158                                   | .004    | .154    | 65.2                       | 75.5                                     | 57.6 | 17.9  |
| 11    | .042                                      | .112                                   | 29.992  | .120    | 66.9                       | 77.0                                     | 58.6 | 18.4  |
| 12    | .068                                      | .158                                   | 30.003  | .155    | 66.1                       | 76.6                                     | 57.0 | 19.6  |
| 13    | .060                                      | .140                                   | .015    | .125    | 65.5                       | 76.8                                     | 56.0 | 20.8  |
| 14    | .060                                      | .133                                   | 29.995  | .138    | 67.8                       | 79.0                                     | 58.0 | 21.0  |
| 15    | .082                                      | .183                                   | 30.019  | .164    | 68.8                       | 78.6                                     | 60.0 | 18.6  |
| 16    | .036                                      | .123                                   | 29.969  | .154    | 67.5                       | 77.2                                     | 59.2 | 18.0  |
| 17    | .012                                      | .098                                   | .955    | .143    | 67.1                       | 77.4                                     | 58.9 | 18.5  |
| 18    | .018                                      | .107                                   | .959    | .148    | 68.2                       | 78.7                                     | 59.2 | 19.5  |
| 19    | 29.990                                    | .056                                   | .923    | .133    | 69.9                       | 81.4                                     | 61.0 | 20.4  |
| 20    | 30.028                                    | .106                                   | .967    | .139    | 70.1                       | 81.2                                     | 61.0 | 20.2  |
| 21    | .044                                      | .113                                   | .962    | .151    | 71.3                       | 81.0                                     | 62.6 | 18.4  |
| 22    | .080                                      | .161                                   | 30.033  | .128    | 73.1                       | 81.3                                     | 65.0 | 16.3  |
| 23    | .096                                      | .165                                   | .029    | .136    | 70.5                       | 79.8                                     | 62.2 | 17.6  |
| 24    | .105                                      | .185                                   | .020    | .165    | 71.6                       | 81.2                                     | 62.8 | 18.4  |
| 25    | .077                                      | .148                                   | 29.989  | .159    | 73.1                       | 82.0                                     | 64.4 | 17.6  |
| 26    | .085                                      | .173                                   | 30.013  | .160    | 74.5                       | 83.8                                     | 66.4 | 17.4  |
| 27    | .066                                      | .152                                   | 29.983  | .169    | 74.0                       | 84.7                                     | 67.0 | 17.7  |
| 28    | .042                                      | .083                                   | 30.001  | .082    | 68.3                       | 77.8                                     | 63.4 | 14.4  |
| 29    | .005                                      | .079                                   | 29.935  | .144    | 68.6                       | 75.2                                     | 63.4 | 11.8  |
| 30    | 29.975                                    | .056                                   | .929    | .127    | 68.2                       | 72.2                                     | 63.8 | 8.4   |
| 31    | 30.003                                    | .094                                   | .937    | .157    | 63.4                       | 64.6                                     | 62.2 | 2.4   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations made, during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—*Continued.*

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| 1     | 62.5                            | 5.8                 | 57.9                | 10.4                         | 0.488                            | 5.38                                             | 2.22                                                                | 0.71                                                                |
| 2     | 61.8                            | 6.2                 | 56.8                | 11.2                         | .470                             | .19                                              | .34                                                                 | .69                                                                 |
| 3     | 63.2                            | 5.9                 | 58.5                | 10.6                         | .498                             | .48                                              | .30                                                                 | .70                                                                 |
| 4     | 67.3                            | 4.7                 | 63.5                | 8.5                          | .588                             | 6.43                                             | .07                                                                 | .76                                                                 |
| 5     | 68.2                            | 5.2                 | 64.0                | 9.4                          | .597                             | .53                                              | .34                                                                 | .74                                                                 |
| 6     | 68.2                            | 4.9                 | 64.3                | 8.8                          | .603                             | .60                                              | .19                                                                 | .75                                                                 |
| 7     | 62.2                            | 6.2                 | 57.2                | 11.2                         | .476                             | 5.25                                             | .37                                                                 | .69                                                                 |
| 8     | 56.8                            | 7.2                 | 50.3                | 13.7                         | .377                             | 4.20                                             | .45                                                                 | .63                                                                 |
| 9     | 57.3                            | 6.1                 | 51.8                | 11.6                         | .397                             | .42                                              | .11                                                                 | .68                                                                 |
| 10    | 58.7                            | 6.5                 | 53.5                | 11.7                         | .421                             | .68                                              | .23                                                                 | .68                                                                 |
| 11    | 60.3                            | 6.6                 | 55.0                | 11.9                         | .442                             | .90                                              | .38                                                                 | .67                                                                 |
| 12    | 58.8                            | 7.3                 | 53.0                | 13.1                         | .414                             | .59                                              | .51                                                                 | .65                                                                 |
| 13    | 58.4                            | 7.1                 | 52.7                | 12.8                         | .409                             | .55                                              | .43                                                                 | .65                                                                 |
| 14    | 62.1                            | 5.7                 | 57.5                | 10.3                         | .481                             | 5.32                                             | .16                                                                 | .71                                                                 |
| 15    | 61.8                            | 7.0                 | 56.2                | 12.6                         | .461                             | .07                                              | .64                                                                 | .66                                                                 |
| 16    | 60.5                            | 7.0                 | 54.9                | 12.6                         | .441                             | 4.87                                             | .55                                                                 | .66                                                                 |
| 17    | 60.6                            | 6.5                 | 55.4                | 11.7                         | .449                             | .96                                              | .36                                                                 | .68                                                                 |
| 18    | 61.1                            | 7.1                 | 55.4                | 12.8                         | .449                             | .95                                              | .63                                                                 | .65                                                                 |
| 19    | 64.4                            | 5.5                 | 60.0                | 9.9                          | .523                             | 5.75                                             | .23                                                                 | .72                                                                 |
| 20    | 64.1                            | 6.0                 | 59.3                | 10.8                         | .511                             | .61                                              | .42                                                                 | .70                                                                 |
| 21    | 66.7                            | 4.6                 | 63.0                | 8.3                          | .578                             | 6.35                                             | 1.98                                                                | .76                                                                 |
| 22    | 65.6                            | 7.5                 | 59.6                | 13.5                         | .516                             | 5.64                                             | 3.15                                                                | .64                                                                 |
| 23    | 63.1                            | 7.4                 | 57.2                | 13.3                         | .476                             | .23                                              | 2.90                                                                | .64                                                                 |
| 24    | 64.2                            | 7.4                 | 58.3                | 13.3                         | .494                             | .42                                              | .98                                                                 | .65                                                                 |
| 25    | 67.2                            | 5.9                 | 62.5                | 10.6                         | .568                             | 6.21                                             | .58                                                                 | .71                                                                 |
| 26    | 69.5                            | 5.0                 | 66.0                | 8.5                          | .638                             | .95                                              | .23                                                                 | .76                                                                 |
| 27    | 69.3                            | 4.7                 | 66.0                | 8.0                          | .638                             | .97                                              | .07                                                                 | .77                                                                 |
| 28    | 65.5                            | 2.8                 | 63.3                | 5.0                          | .584                             | .44                                              | 1.16                                                                | .85                                                                 |
| 29    | 66.5                            | 2.1                 | 64.8                | 3.8                          | .613                             | .78                                              | 0.89                                                                | .88                                                                 |
| 30    | 66.2                            | 2.0                 | 64.6                | 3.6                          | .609                             | .73                                              | .85                                                                 | .89                                                                 |
| 31    | 61.8                            | 1.6                 | 60.4                | 3.0                          | .580                             | 5.91                                             | .62                                                                 | .91                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January, 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahc. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 30.046                                    | 30.119                                                 | 29.921  | 0.198   | 65.5                       | 72.4                                                     | 60.0 | 12.4  |
| 1          | .039                                      | .113                                                   | .902    | .211    | 64.8                       | 72.4                                                     | 58.8 | 13.6  |
| 2          | .030                                      | .106                                                   | .886    | .220    | 64.2                       | 72.0                                                     | 57.8 | 15.2  |
| 3          | .021                                      | .099                                                   | .867    | .232    | 63.6                       | 71.8                                                     | 57.4 | 14.4  |
| 4          | .014                                      | .094                                                   | .848    | .246    | 62.9                       | 70.4                                                     | 57.0 | 13.4  |
| 5          | .022                                      | .103                                                   | .861    | .242    | 62.3                       | 69.7                                                     | 56.4 | 13.3  |
| 6          | .038                                      | .120                                                   | .867    | .253    | 62.1                       | 69.5                                                     | 55.8 | 13.7  |
| 7          | .059                                      | .156                                                   | .885    | .271    | 61.8                       | 67.4                                                     | 56.0 | 11.4  |
| 8          | .088                                      | .190                                                   | .927    | .263    | 63.7                       | 69.2                                                     | 57.8 | 11.4  |
| 9          | .114                                      | .215                                                   | .957    | .258    | 67.2                       | 73.2                                                     | 61.2 | 12.0  |
| 10         | .122                                      | .221                                                   | .971    | .250    | 70.8                       | 77.7                                                     | 63.8 | 13.9  |
| 11         | .105                                      | .197                                                   | .960    | .237    | 73.2                       | 79.4                                                     | 63.6 | 15.8  |
| Noon.      | .075                                      | .167                                                   | .935    | .232    | 75.2                       | 81.6                                                     | 62.6 | 19.0  |
| 1          | .035                                      | .124                                                   | .897    | .227    | 76.5                       | 82.8                                                     | 62.4 | 20.4  |
| 2          | .007                                      | .091                                                   | .871    | .220    | 77.5                       | 84.0                                                     | 62.8 | 21.2  |
| 3          | 29.989                                    | .077                                                   | .861    | .216    | 78.0                       | 84.7                                                     | 63.8 | 20.9  |
| 4          | .983                                      | .064                                                   | .851    | .213    | 76.8                       | 82.8                                                     | 64.4 | 18.4  |
| 5          | .992                                      | .077                                                   | .864    | .213    | 75.5                       | 81.5                                                     | 63.8 | 17.7  |
| 6          | .999                                      | .076                                                   | .880    | .196    | 72.6                       | 79.2                                                     | 62.6 | 16.6  |
| 7          | 30.018                                    | .088                                                   | .904    | .184    | 70.9                       | 77.0                                                     | 62.8 | 14.2  |
| 8          | .035                                      | .109                                                   | .929    | .180    | 69.5                       | 75.3                                                     | 62.8 | 12.5  |
| 9          | .050                                      | .121                                                   | .941    | .180    | 68.1                       | 74.1                                                     | 62.6 | 11.5  |
| 10         | .056                                      | .137                                                   | .940    | .197    | 67.0                       | 73.4                                                     | 61.8 | 11.6  |
| 11         | .052                                      | .132                                                   | .927    | .205    | 66.1                       | 72.5                                                     | 60.6 | 11.9  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the Observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.*

Hourly means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 62.1                            | 3.4                 | 59.4                | 6.1                          | 0.513                            | 5.69                                             | 1.29                                                                | 0.82                                                                |
| 1              | 61.7                            | 3.1                 | 59.2                | 5.6                          | .509                             | .66                                              | .17                                                                 | .83                                                                 |
| 2              | 61.2                            | 3.0                 | 58.5                | 5.7                          | .498                             | .53                                              | .16                                                                 | .83                                                                 |
| 3              | 60.7                            | 2.9                 | 58.1                | 5.5                          | .491                             | .46                                              | .11                                                                 | .83                                                                 |
| 4              | 60.2                            | 2.7                 | 57.8                | 5.1                          | .486                             | .43                                              | .00                                                                 | .84                                                                 |
| 5              | 59.7                            | 2.6                 | 57.4                | 4.9                          | .480                             | .36                                              | 0.95                                                                | .85                                                                 |
| 6              | 59.7                            | 2.4                 | 57.5                | 4.6                          | .481                             | .38                                              | .89                                                                 | .86                                                                 |
| 7              | 59.4                            | 2.4                 | 57.2                | 4.6                          | .476                             | .32                                              | .89                                                                 | .86                                                                 |
| 8              | 60.7                            | 3.0                 | 58.0                | 5.7                          | .489                             | .44                                              | 1.15                                                                | .83                                                                 |
| 9              | 62.7                            | 4.5                 | 59.1                | 8.1                          | .508                             | .62                                              | .73                                                                 | .77                                                                 |
| 10             | 64.4                            | 6.4                 | 59.3                | 11.5                         | .511                             | .60                                              | 2.60                                                                | .68                                                                 |
| 11             | 65.3                            | 7.9                 | 59.0                | 14.2                         | .506                             | .53                                              | 3.29                                                                | .63                                                                 |
| Noon.          | 65.9                            | 9.3                 | 59.4                | 15.8                         | .513                             | .58                                              | .79                                                                 | .60                                                                 |
| 1              | 66.3                            | 10.2                | 59.2                | 17.3                         | .509                             | .54                                              | 4.21                                                                | .57                                                                 |
| 2              | 66.7                            | 10.8                | 59.1                | 18.4                         | .508                             | .50                                              | .54                                                                 | .55                                                                 |
| 3              | 66.8                            | 11.2                | 59.0                | 19.0                         | .506                             | .47                                              | .72                                                                 | .54                                                                 |
| 4              | 66.2                            | 10.6                | 58.8                | 18.0                         | .503                             | .45                                              | .38                                                                 | .55                                                                 |
| 5              | 65.9                            | 9.6                 | 59.2                | 16.3                         | .509                             | .55                                              | 3.91                                                                | .59                                                                 |
| 6              | 65.8                            | 6.8                 | 60.4                | 12.2                         | .530                             | .81                                              | 2.85                                                                | .67                                                                 |
| 7              | 65.1                            | 5.8                 | 60.5                | 10.4                         | .532                             | .85                                              | .38                                                                 | .71                                                                 |
| 8              | 64.4                            | 5.1                 | 60.3                | 9.2                          | .528                             | .82                                              | .06                                                                 | .74                                                                 |
| 9              | 63.7                            | 4.4                 | 60.2                | 7.9                          | .527                             | .82                                              | 1.73                                                                | .77                                                                 |
| 10             | 63.1                            | 3.9                 | 60.0                | 7.0                          | .523                             | .79                                              | .51                                                                 | .79                                                                 |
| 11             | 62.5                            | 3.6                 | 59.6                | 6.5                          | .516                             | .72                                              | .38                                                                 | .81                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                               |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   |                                                                                          |
| 1     | 138.0                 | ...                             | N. & W. & N. W.                   | Clear, slightly foggy at midnight & 1 A. M. and from 8 to 11 P. M.                       |
| 2     | 134.0                 | ...                             | N. & W.                           | Clear, slightly foggy from 8 to 10 P. M.                                                 |
| 3     | 134.0                 | ...                             | S. W. & S.                        | Clear, slightly foggy at 1 A. M.                                                         |
| 4     | 138.4                 | ...                             | S.                                | Clear to 8 P. M. Scatd. \i afterwards.                                                   |
| 5     | 139.0                 | ...                             | S.                                | \i to 8 A. M. \i to 4 P. M. clear afterwards.                                            |
| 6     | 129.5                 | ...                             | S. & variable.                    | Clear to 9 A. M. Scatd. \i afterwards, slightly foggy at 5 A. M.                         |
| 7     | 139.0                 | ...                             | N. & N. W.                        | Various clouds to 7 A. M., clear afterwards.                                             |
| 8     | 129.0                 | ...                             | N. & N. W.                        | Clear.                                                                                   |
| 9     | 124.8                 | ...                             | N. & N. W.                        | Clear.                                                                                   |
| 10    | 131.0                 | ...                             | N. W. & N.                        | Clear, slightly foggy from 8 to 10 P. M.                                                 |
| 11    | 133.2                 | ...                             | W.                                | Clear, slightly foggy at 9 P. M.                                                         |
| 12    | 131.0                 | ...                             | N. W. & N. & N. E.                | Clear.                                                                                   |
| 13    | 129.0                 | ...                             | W. & N. E. & N.                   | Clear.                                                                                   |
| 14    | 133.4                 | ...                             | W. & variable.                    | Clear, foggy at 5 and 6 A. M.                                                            |
| 15    | 133.0                 | ...                             | N. & N. E.                        | Clear to 10 A. M. Scatd. \i to 5 P. M. clear afterwards, slightly foggy at 10 & 11 P. M. |
| 16    | 126.0                 | ..                              | N. & S.                           | Clear to 6 A. M. Scatd. \i to 11 A. M., clear afterwards.                                |
| 17    | 129.0                 | ...                             | N. & W. & N. W.                   | Clear to 9 A. M. Scatd. \i to 6 P. M. clear afterwards.                                  |
| 18    | 130.8                 | ...                             | W.                                | Clear, slightly foggy at 6 A. M.                                                         |
| 19    | 129.5                 | ...                             | S. & N.                           | Clear to 5 A. M. \i to 6 P. M. clear afterwards.                                         |
| 20    | 134.5                 | ...                             | E. & N. E.                        | Clear, slightly foggy from 5 to 9 A. M.                                                  |
| 21    | 130.0                 | ...                             | S. W. & W.                        | Clear to noon, Scatd. \i to 4 P. M. clear afterwards.                                    |
| 22    | 134.0                 | ...                             | N.                                | Clear, foggy from 2 to 4 A. M.                                                           |
| 23    | 127.2                 | ...                             | W. & N.                           | Clear to Noon, Scatd. \i to 5 P. M. clear afterwards, slightly foggy from 8 to 11 P. M.  |
| 24    | 130.8                 | ...                             | W.                                | Clear to 3 P. M. Scatd. \i to 8 P. M. clear afterwards, slightly foggy at 7 & 8 P. M.    |
| 25    | 135.2                 | ...                             | W. & S. W.                        | Clear to 10 A. M. Scatd. \i to 7 P. M. Scatd. \i afterwards.                             |

\i Cirri, —i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo-strati, \i Nimbi, \i Cirro-cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of Wind. | General Aspect of the Sky.                                                                                                                                        |
|-------|-----------------------|---------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                               |                                                                                                                                                                   |
| 26    | 139.5                 | ...                             | E. & S. & W.                  | Clear to 5 A. M. Scatd. $\curvearrowright$ afterwards.                                                                                                            |
| 27    | 129.5                 | ...                             | S.                            | Scatd. $\curvearrowright$ to 7 P. M. clear afterwards, slightly foggy at 7 A. M. and thin rain at 6 P. M.                                                         |
| 28    | ...                   | 0.45                            | E. & S. E.                    | Clear to 10 A. M. Overcast to 6 P. M. $\curvearrowright$ afterwards rain between 1 & 2 P. M. and from 4 to 6 P. M. Thunder at 3 & 5 P. M.                         |
| 29    | ...                   | 0.80                            | S. E. & S.                    | Overcast. Lightning towards N. at 8 & 9 P. M. rain after intervals.                                                                                               |
| 30    | ...                   | 0.20                            | N.                            | Scatd. $\curvearrowright$ to 5 A. M. overcast to 11 A. M. $\curvearrowright$ to 3 P. M. overcast afterwards. Light rains from 7 to 10 A. M. and from 5 to 9 P. M. |
| 31    | ...                   | 0.46                            | N. & N. E.                    | Overcast, rain at 4, 8, 9, 11 and Noon.                                                                                                                           |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.*

MONTHLY RESULTS.

|                                                                   | Inches |
|-------------------------------------------------------------------|--------|
| Mean height of the Barometer for the month, ...                   | 30.041 |
| Max. height of the Barometer occurred at 10 A. M. on the 8th, ... | 30.221 |
| Min. height of the Barometer occurred at 4 A. M. on the 6th, ...  | 29.848 |
| <i>Extreme Range</i> of the Barometer during the month, ...       | 0.373  |
| Mean of the daily Max. Pressures, ...                             | 30.123 |
| Ditto ditto Min. ditto ...                                        | 29.979 |
| <i>Mean daily range</i> of the Barometer during the month, ...    | 0.144  |

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|                                                                  | °    |
|------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month, ...                     | 69.0 |
| Max. Temperature occurred at 3 P. M. on the 27th, ...            | 84.7 |
| Min. Temperature occurred at 6 A. M. on the 8th, ...             | 55.8 |
| <i>Extreme range</i> of the Temperature during the month, ...    | 28.9 |
| Mean of the daily Max. Temperature, ...                          | 78.2 |
| Ditto ditto Min. ditto, ...                                      | 61.4 |
| <i>Mean daily range</i> of the Temperature during the month, ... | 16.8 |

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|                                                                |        |
|----------------------------------------------------------------|--------|
| Mean Wet Bulb Thermometer for the month, ...                   | 63.4   |
| Mean Dry Bulb Thermometer above mean Wet Bulb Thermometer, ... | 5.6    |
| Computed Mean Dew-point for the month, ...                     | 58.9   |
| Mean Dry Bulb Thermometer above computed mean Dew-point, ...   | 10.1   |
|                                                                | Inches |
| Mean Elastic force of Vapour for the month, ...                | 0.504  |

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|                                                                             | Troy grains |
|-----------------------------------------------------------------------------|-------------|
| Mean Weight of Vapour for the month, ...                                    | 5.56        |
| Additional Weight of Vapour required for complete saturation, ...           | 2.20        |
| Mean degree of humidity for the month, complete saturation being unity, ... | 0.72        |

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|                                                                                              | Inches       |
|----------------------------------------------------------------------------------------------|--------------|
| Rained 5 days, Max. fall of rain during 24 hours, ...                                        | 0.80         |
| Total amount of rain during the month, ...                                                   | 1.91         |
| Total amount of rain indicated by the Gauge attached to the Anemometer during the month, ... | 1.70         |
| Prevailing direction of the Wind, ...                                                        | N. & W. & S. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1866.*

## MONTHLY RESULTS.

Tables showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour,  
when any particular wind was blowing, it rained.

| Hour.     | N.           | Rain on.<br>N. E. | Rain on.<br>E. | Rain on.<br>S. E. | Rain on.<br>S. | Rain on.<br>S. W. | Rain on.<br>W. | Rain on.<br>N. W. | Rain on.<br>Calm. | Rain on. | Missed. |
|-----------|--------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|-------------------|----------|---------|
|           | No. of days. |                   |                |                   |                |                   |                |                   |                   |          |         |
| Midnight, | 7            | 4                 | 2              | 3                 | 6              |                   | 9              |                   |                   |          |         |
| 1         | 9            | 3                 | 3              | 2                 | 6              |                   | 8              |                   |                   |          |         |
| 2         | 9            | 4                 | 1              | 1                 | 9              |                   | 7              |                   |                   |          |         |
| 3         | 11           | 2                 | 4              | 1                 | 7              | 2                 | 4              |                   |                   |          |         |
| 4         | 11           | 3                 | 4              | 1                 | 7              | 1                 | 4              | 1                 | 1                 |          |         |
| 5         | 11           | 3                 | 3              |                   | 6              | 2                 | 4              | 1                 | 1                 |          | 1       |
| 6         | 11           | 6                 | 2              |                   | 6              | 2                 | 4              |                   |                   |          |         |
| 7         | 10           | 1                 | 3              |                   | 3              | 2                 | 4              | 2                 |                   |          |         |
| 8         | 11           | 2                 | 1              | 7                 | 2              | 2                 | 3              | 3                 | 2                 |          |         |
| 9         | 12           | 2                 | 4              | 3                 | 4              | 2                 | 3              | 1                 |                   |          |         |
| 10        | 10           | 1                 | 5              | 3                 | 4              | 2                 | 4              | 1                 |                   |          |         |
| 11        | 8            | 1                 | 4              | 2                 |                | 6                 | 1              | 2                 |                   |          |         |
| Noon.     | 13           | 1                 | 3              |                   | 1              | 1                 | 6              | 1                 |                   | 7        |         |
| 1         | 11           |                   | 2              | 1                 |                | 4                 | 1              | 3                 | 3                 | 7        |         |
| 2         | 1            |                   | 3              | 3                 | 1              | 3                 | 3              | 7                 | 11                |          |         |
| 3         | 3            |                   | 2              | 1                 |                | 4                 | 1              | 7                 | 13                |          |         |
| 4         | 5            |                   | 1              | 2                 | 1              | 3                 | 2              | 10                | 8                 |          |         |
| 5         | 7            | 2                 |                | 1                 |                | 4                 |                | 10                | 9                 |          |         |
| 6         | 8            | 2                 |                | 1                 | 1              | 5                 |                | 12                | 5                 |          |         |
| 7         | 9            |                   | 1              | 2                 |                | 3                 | 1              | 10                | 3                 |          |         |
| 8         | 9            | 1                 | 2              | 1                 | 2              | 2                 | 2              | 10                | 3                 |          |         |
| 9         | 9            | 1                 | 1              | 2                 | 1              | 3                 | 1              | 11                | 3                 |          |         |
| 10        | 7            |                   | 3              | 1                 | 2              | 4                 | 2              | 8                 | 3                 |          |         |
| 11        | 7            | 1                 | 3              | 2                 | 3              | 6                 | 1              | 8                 | 1                 |          |         |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.

Latitude 22° 23' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the Sea-level, 18 ft. 11 in.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.982                                          | 30.052                                    | 29.934  | 0.118   | 63.1                          | 66.9                                          | 60.0 | 6.9   |
| 2     | .994                                            | .067                                      | .946    | .121    | 64.3                          | 71.6                                          | 58.4 | 13.2  |
| 3     | .921                                            | .013                                      | .840    | .173    | 65.3                          | 73.8                                          | 57.2 | 16.6  |
| 4     | .833                                            | 29.898                                    | .787    | .111    | 63.6                          | 70.6                                          | 60.4 | 10.2  |
| 5     | .848                                            | .925                                      | .766    | .159    | 66.3                          | 75.8                                          | 58.6 | 17.2  |
| 6     | .983                                            | 30.062                                    | .915    | .147    | 69.2                          | 78.4                                          | 61.8 | 16.6  |
| 7     | 30.045                                          | .138                                      | .985    | .153    | 70.5                          | 80.2                                          | 61.4 | 18.8  |
| 8     | .024                                            | .101                                      | .967    | .134    | 70.8                          | 80.4                                          | 63.0 | 17.4  |
| 9     | .060                                            | .132                                      | .997    | .135    | 68.1                          | 75.2                                          | 64.6 | 10.6  |
| 10    | .051                                            | .122                                      | .982    | .140    | 71.5                          | 81.7                                          | 62.0 | 19.7  |
| 11    | 29.987                                          | .041                                      | .915    | .126    | 69.9                          | 80.0                                          | 65.4 | 14.6  |
| 12    | .943                                            | .013                                      | .850    | .163    | 66.8                          | 71.2                                          | 62.4 | 8.8   |
| 13    | 30.037                                          | .124                                      | .986    | .138    | 63.8                          | 71.1                                          | 56.4 | 14.7  |
| 14    | .006                                            | .075                                      | .937    | .138    | 64.7                          | 73.5                                          | 56.2 | 17.3  |
| 15    | 29.975                                          | .057                                      | .919    | .138    | 67.3                          | 76.4                                          | 58.6 | 17.8  |
| 16    | .952                                            | .040                                      | .888    | .152    | 69.3                          | 78.4                                          | 59.8 | 18.6  |
| 17    | .966                                            | .046                                      | .925    | .121    | 72.6                          | 82.0                                          | 63.2 | 18.8  |
| 18    | .981                                            | .073                                      | .930    | .143    | 72.8                          | 78.3                                          | 68.8 | 9.5   |
| 19    | .981                                            | .062                                      | .886    | .176    | 74.9                          | 86.0                                          | 67.4 | 18.6  |
| 20    | .953                                            | .039                                      | .896    | .143    | 71.9                          | 80.2                                          | 67.8 | 12.4  |
| 21    | .945                                            | .023                                      | .897    | .126    | 73.7                          | 81.8                                          | 67.8 | 14.0  |
| 22    | .923                                            | 29.992                                    | .856    | .136    | 72.0                          | 81.0                                          | 63.2 | 17.8  |
| 23    | .945                                            | 30.021                                    | .894    | .127    | 72.7                          | 82.6                                          | 62.2 | 20.4  |
| 24    | .967                                            | .056                                      | .916    | .140    | 73.0                          | 84.8                                          | 62.8 | 22.0  |
| 25    | .937                                            | .009                                      | .874    | .135    | 75.1                          | 87.2                                          | 64.8 | 22.4  |
| 26    | .887                                            | 29.959                                    | .824    | .135    | 77.0                          | 88.2                                          | 67.5 | 20.7  |
| 27    | .843                                            | .914                                      | .791    | .123    | 77.9                          | 89.2                                          | 68.4 | 20.8  |
| 28    | .815                                            | .900                                      | 736     | .164    | 79.6                          | 91.4                                          | 70.8 | 20.6  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Ther-  
mometer Means are derived from the hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—*Continued.*

| Date. | Mean Wet Bulb Thermometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew Point. | Mean Elastic force of vapour. | Mean Weight of Vapour in a Cubic foot of air. | Additional Weight of Vapour required for complete saturation. | Mean degree of Humidity, complete saturation being unity. |
|-------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|       | o                          | o                   | o                   | o                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| 1     | 61.4                       | 1.7                 | 59.9                | 3.2                       | 0.521                         | 5.81                                          | 0.66                                                          | 0.90                                                      |
| 2     | 59.3                       | 5.0                 | 54.8                | 9.5                       | .440                          | 4.88                                          | 1.84                                                          | .73                                                       |
| 3     | 59.9                       | 5.4                 | 55.6                | 9.7                       | .452                          | 5.02                                          | .91                                                           | .72                                                       |
| 4     | 59.9                       | 3.7                 | 56.6                | 7.0                       | .467                          | .21                                           | .36                                                           | .79                                                       |
| 5     | 61.7                       | 4.6                 | 58.0                | 8.3                       | .489                          | .42                                           | .73                                                           | .76                                                       |
| 6     | 63.5                       | 5.7                 | 58.9                | 10.3                      | .504                          | .56                                           | 2.25                                                          | .71                                                       |
| 7     | 62.6                       | 7.9                 | 56.3                | 14.2                      | .462                          | .08                                           | 3.05                                                          | .63                                                       |
| 8     | 64.0                       | 6.8                 | 58.6                | 12.2                      | .499                          | .49                                           | 2.71                                                          | .67                                                       |
| 9     | 63.9                       | 4.2                 | 60.5                | 7.6                       | .532                          | .87                                           | 1.68                                                          | .78                                                       |
| 10    | 65.9                       | 5.6                 | 61.4                | 10.1                      | .548                          | 6.02                                          | 2.36                                                          | .72                                                       |
| 11    | 65.6                       | 4.3                 | 62.2                | 7.7                       | .563                          | .19                                           | 1.79                                                          | .78                                                       |
| 12    | 62.8                       | 4.0                 | 59.6                | 7.2                       | .516                          | 5.72                                          | .54                                                           | .79                                                       |
| 13    | 56.2                       | 7.6                 | 49.4                | 14.4                      | .366                          | 4.08                                          | 2.53                                                          | .62                                                       |
| 14    | 58.8                       | 5.9                 | 54.1                | 10.6                      | .429                          | .77                                           | .03                                                           | .70                                                       |
| 15    | 60.8                       | 6.5                 | 55.6                | 11.7                      | .452                          | 5.00                                          | .37                                                           | .68                                                       |
| 16    | 62.9                       | 6.4                 | 57.8                | 11.5                      | .486                          | .35                                           | .48                                                           | .68                                                       |
| 17    | 67.8                       | 4.8                 | 64.0                | 8.6                       | .597                          | 6.53                                          | .13                                                           | .75                                                       |
| 18    | 70.2                       | 2.6                 | 68.1                | 4.7                       | .684                          | 7.47                                          | 1.24                                                          | .86                                                       |
| 19    | 68.4                       | 6.5                 | 63.8                | 11.1                      | .593                          | 6.46                                          | 2.82                                                          | .70                                                       |
| 20    | 67.5                       | 4.4                 | 64.0                | 7.9                       | .597                          | .54                                           | 1.94                                                          | .77                                                       |
| 21    | 66.3                       | 7.4                 | 61.1                | 12.6                      | .543                          | 5.92                                          | 3.04                                                          | .66                                                       |
| 22    | 62.9                       | 9.1                 | 55.6                | 16.4                      | .452                          | 4.96                                          | .54                                                           | .58                                                       |
| 23    | 62.7                       | 10.0                | 54.7                | 18.0                      | .438                          | .79                                           | .89                                                           | .55                                                       |
| 24    | 62.9                       | 10.1                | 54.8                | 18.2                      | .440                          | .80                                           | .96                                                           | .55                                                       |
| 25    | 64.9                       | 10.2                | 57.8                | 17.3                      | .486                          | 5.29                                          | 4.05                                                          | .57                                                       |
| 26    | 67.3                       | 9.7                 | 60.5                | 16.5                      | .532                          | .77                                           | .12                                                           | .58                                                       |
| 27    | 69.8                       | 8.1                 | 64.1                | 13.8                      | .599                          | 6.48                                          | 3.68                                                          | .64                                                       |
| 28    | 73.2                       | 6.4                 | 68.7                | 10.9                      | .697                          | 7.52                                          | .17                                                           | .70                                                       |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|-------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                 | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                         | Inches.                                                      | Inches. | Inches. | o                             | o                                                                | o    | o     |
| Mid-<br>night. | 29.964                                          | 30.079                                                       | 29.831  | 0.248   | 66.3                          | 74.2                                                             | 59.8 | 14.4  |
| 1              | .954                                            | .070                                                         | .821    | .249    | 65.8                          | 74.0                                                             | 59.0 | 15.0  |
| 2              | .943                                            | .051                                                         | .794    | .257    | 65.2                          | 74.0                                                             | 58.7 | 15.3  |
| 3              | .931                                            | .046                                                         | .778    | .268    | 64.6                          | 73.5                                                             | 58.0 | 15.5  |
| 4              | .925                                            | .039                                                         | .766    | .273    | 64.1                          | 72.4                                                             | 57.4 | 15.0  |
| 5              | .936                                            | .071                                                         | .797    | .274    | 63.7                          | 71.6                                                             | 56.8 | 14.8  |
| 6              | .954                                            | .079                                                         | .827    | .252    | 63.3                          | 71.2                                                             | 56.6 | 14.6  |
| 7              | .974                                            | .085                                                         | .845    | .240    | 63.3                          | 70.8                                                             | 56.2 | 14.6  |
| 8              | 30.000                                          | .106                                                         | .868    | .238    | 65.6                          | 71.0                                                             | 58.8 | 12.2  |
| 9              | .026                                            | .132                                                         | .898    | .234    | 68.9                          | 75.2                                                             | 60.6 | 14.6  |
| 10             | .031                                            | .138                                                         | .883    | .255    | 71.6                          | 78.6                                                             | 60.8 | 17.8  |
| 11             | .021                                            | .127                                                         | .884    | .243    | 74.0                          | 82.0                                                             | 62.0 | 20.0  |
| Noon.          | 29.994                                          | .099                                                         | .847    | .252    | 76.1                          | 86.4                                                             | 62.9 | 23.5  |
| 1              | .962                                            | .063                                                         | .813    | .250    | 77.4                          | 88.8                                                             | 65.0 | 23.8  |
| 2              | .931                                            | .028                                                         | .778    | .250    | 78.3                          | 90.6                                                             | 66.8 | 23.8  |
| 3              | .911                                            | .012                                                         | .748    | .264    | 78.6                          | 91.4                                                             | 64.4 | 27.0  |
| 4              | .905                                            | .022                                                         | .740    | .282    | 77.9                          | 91.2                                                             | 63.8 | 27.4  |
| 5              | .907                                            | .062                                                         | .736    | .326    | 77.0                          | 90.6                                                             | 62.8 | 27.8  |
| 6              | .915                                            | .070                                                         | .742    | .328    | 74.6                          | 87.6                                                             | 62.5 | 25.1  |
| 7              | .929                                            | .111                                                         | .760    | .351    | 72.6                          | 84.6                                                             | 62.2 | 22.4  |
| 8              | .948                                            | .122                                                         | .784    | .338    | 70.9                          | 80.6                                                             | 62.0 | 18.6  |
| 9              | .962                                            | .117                                                         | .798    | .319    | 69.7                          | 78.4                                                             | 62.1 | 16.3  |
| 10             | .969                                            | .080                                                         | .809    | .271    | 68.6                          | 77.2                                                             | 61.8 | 15.4  |
| 11             | .964                                            | .071                                                         | .804    | .267    | 67.6                          | 76.0                                                             | 61.4 | 14.6  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the Observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.*

Hourly means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 62.9                            | 3.4                 | 60.2                | 6.1                          | 0.527                            | 5.84                                             | 1.31                                                                | 0.82                                                                |
| 1              | 62.7                            | 3.1                 | 60.2                | 5.6                          | .527                             | .84                                              | .20                                                                 | .83                                                                 |
| 2              | 62.5                            | 2.7                 | 60.3                | 4.9                          | .528                             | .87                                              | .04                                                                 | .85                                                                 |
| 3              | 61.9                            | 2.7                 | 59.7                | 4.9                          | .518                             | .76                                              | .02                                                                 | .85                                                                 |
| 4              | 61.5                            | 2.6                 | 59.2                | 4.9                          | .509                             | .67                                              | .00                                                                 | .85                                                                 |
| 5              | 61.3                            | 2.4                 | 59.1                | 4.6                          | .508                             | .65                                              | 0.94                                                                | .86                                                                 |
| 6              | 60.9                            | 2.4                 | 58.7                | 4.6                          | .501                             | .58                                              | .93                                                                 | .86                                                                 |
| 7              | 61.0                            | 2.3                 | 58.9                | 4.4                          | .504                             | .62                                              | .89                                                                 | .86                                                                 |
| 8              | 62.2                            | 3.4                 | 59.5                | 6.1                          | .515                             | .71                                              | 1.29                                                                | .82                                                                 |
| 9              | 63.6                            | 5.3                 | 59.4                | 9.5                          | .513                             | .64                                              | 2.10                                                                | .73                                                                 |
| 10             | 64.4                            | 7.2                 | 58.6                | 13.0                         | .499                             | .47                                              | .93                                                                 | .65                                                                 |
| 11             | 65.0                            | 9.0                 | 58.7                | 15.3                         | .501                             | .47                                              | 3.57                                                                | .61                                                                 |
| Noon.          | 65.4                            | 10.7                | 57.9                | 18.2                         | .488                             | .29                                              | 4.34                                                                | .55                                                                 |
| 1              | 65.8                            | 11.6                | 57.7                | 19.7                         | .485                             | .24                                              | .77                                                                 | .52                                                                 |
| 2              | 66.1                            | 12.2                | 57.6                | 20.7                         | .483                             | .21                                              | 5.07                                                                | .51                                                                 |
| 3              | 66.1                            | 12.5                | 57.3                | 21.3                         | .478                             | .16                                              | .22                                                                 | .50                                                                 |
| 4              | 65.9                            | 12.0                | 57.5                | 20.4                         | .481                             | .21                                              | 4.95                                                                | .51                                                                 |
| 5              | 66.0                            | 11.0                | 58.3                | 18.7                         | .494                             | .35                                              | .54                                                                 | .54                                                                 |
| 6              | 66.4                            | 8.2                 | 60.7                | 13.9                         | .536                             | .83                                              | 3.37                                                                | .63                                                                 |
| 7              | 66.3                            | 6.3                 | 61.3                | 11.3                         | .546                             | .99                                              | 2.67                                                                | .69                                                                 |
| 8              | 65.4                            | 5.5                 | 61.0                | 9.9                          | .541                             | .94                                              | .29                                                                 | .72                                                                 |
| 9              | 64.6                            | 5.1                 | 60.5                | 9.2                          | .532                             | .86                                              | .07                                                                 | .74                                                                 |
| 10             | 64.3                            | 4.3                 | 60.9                | 7.7                          | .539                             | .94                                              | 1.73                                                                | .77                                                                 |
| 11             | 63.9                            | 3.7                 | 60.9                | 6.7                          | .539                             | .96                                              | .48                                                                 | .80                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                                                   |
|-------|-----------------------|---------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   |                                                                                                                                              |
| 1     | ...                   | 0.49                            | N. & N. E.                        | Overcast to 5 P. M. clear afterwards.<br>Rain from 5 to 10 A. M.                                                                             |
| 2     | 124.0                 | ...                             | N. W. & N.                        | Clear, slightly foggy at 3 A. M.                                                                                                             |
| 3     | 134.0                 | ...                             | W. & S. E.                        | Clear.                                                                                                                                       |
| 4     | ...                   | 0.33                            | E.                                | Clear to 2 A. M. $\curvearrowright$ to 10 A. M. Overcast afterwards. Rain at 11 A. M. and from 1 to 4 P. M.                                  |
| 5     | 128.0                 | ...                             | E. & N. E. & N.                   | Clear.                                                                                                                                       |
| 6     | 131.3                 | ...                             | E.                                | Clear to 9 A. M. $\curvearrowright$ to 2 P. M. $\curvearrowright$ to 7 P. M. clear afterwards.                                               |
| 7     | 133.0                 | ...                             | E.                                | Clear to 11 A. M. $\curvearrowright$ to 6 P. M., clear afterwards.                                                                           |
| 8     | 125.5                 | ...                             | E. & N. E.                        | Clouds of different kinds to 6 P. M., clear afterwards.                                                                                      |
| 9     | ...                   | 0.10                            | N. & E.                           | $\curvearrowright$ to 3 P. M. overcast afterwards. Thin rain at 11 A. M., 4 and from 7 to 9 P. M.                                            |
| 10    | 133.8                 | ...                             | E. & N.                           | Clear nearly the whole day.                                                                                                                  |
| 11    | 122.0                 | 1.56                            | E. & N.                           | Clear to 4 A. M. Scatd. $\curvearrowright$ to 1 P. M. Overcast afterwards. Thunder at 3 & 7 P. M. Rain from 4 to 7 & 10 & 11 P. M.           |
| 12    | ...                   | 1.26                            | N. & N. W.                        | Overcast to noon. $\curvearrowright$ to 5 P. M. clear afterwards. Lightning and Thunder at 2 A. M. Rain at midnight from 2 to 5 & at 7 A. M. |
| 13    | 128.0                 | ...                             | N. & N. W.                        | Clear.                                                                                                                                       |
| 14    | 136.5                 | ...                             | W. & N.                           | Clear.                                                                                                                                       |
| 15    | 128.5                 | ...                             | N. & E. & W.                      | Clear.                                                                                                                                       |
| 16    | 137.5                 | ...                             | W. & S.                           | Clear.                                                                                                                                       |
| 17    | 139.0                 | ...                             | W. & E.                           | Clear to 8 A. M. Scatd. $\curvearrowright$ to 4 P. M. clear afterwards.                                                                      |
| 18    | ...                   | ...                             | E. & S. & N.                      | Clear to 7 A. M. overcast to 5 P. M. clear afterwards foggy at 6 & 7 A. M.                                                                   |
| 19    | 145.0                 | ...                             | N. & E. & S.                      | $\curvearrowright$ and $\curvearrowright$ to noon. $\curvearrowright$ to 7 P. M. clear afterwards.                                           |
| 20    | ...                   | ...                             | S. & N.                           | Overcast to 3 P. M. clear afterwards. Thin rain at 9 A. M. & 2 P. M.                                                                         |
| 21    | 136.0                 | ...                             | N. & N. W.                        | Clear, slightly foggy from 9 to 11 P. M.                                                                                                     |
| 22    | 136.4                 | ...                             | N. W. & W. & N.                   | Clear to 9 A. M. Scatd. $\curvearrowright$ to 3 P. M. clear afterwards. Slightly foggy at 8 P. M.                                            |

$\curvearrowright$  Cirri, —i Strati,  $\curvearrowright$  Cumuli,  $\curvearrowright$  Cirro-strati,  $\curvearrowright$  Cumulo-strati,  $\curvearrowright$  Nimbi,  $\curvearrowright$  Cirro-cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                           |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------|
|       | °                     | Inches                          |                                   |                                                      |
| 23    | 140.0                 | ...                             | N. & N. W. & S.                   | Clear.                                               |
| 24    | 139.0                 | ...                             | N. & W.                           | Clear, slightly foggy at 10 & 11 P. M.               |
| 25    | 139.9                 | ...                             | N. W. & W. & N.                   | Clear, slightly foggy at midnight.                   |
| 26    | 142.2                 | ..                              | W.                                | Clear.                                               |
| 27    | 141.5                 | ...                             | W.                                | Clear, slightly foggy at 6 & 7 A. M.                 |
| 28    | 145.0                 | ...                             | S.                                | Clear, slightly foggy at midnight and at 6 & 7 A. M. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1866.*

MONTHLY RESULTS.

|                                                                   | Inches |
|-------------------------------------------------------------------|--------|
| Mean height of the Barometer for the month, ... ..                | 29.956 |
| Max. height of the Barometer occurred at 10 A. M. on the 7th,     | 30.138 |
| Min. height of the Barometer occurred at 5 P. M. on the 28th,     | 29.736 |
| <i>Extreme Range</i> of the Barometer during the month, ... ..    | 0.402  |
| Mean of the daily Max. Pressures, ... ..                          | 30.034 |
| Ditto ditto Min. ditto ... ..                                     | 29.894 |
| <i>Mean daily range</i> of the Barometer during the month, ... .. | 0.140  |

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|                                                                     | °    |
|---------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month, ... ..                     | 70.3 |
| Max. Temperature occurred at 3 P. M. on the 28th, ... ..            | 91.4 |
| Min. Temperature occurred at 7 A. M. on the 14th, ... ..            | 56.2 |
| <i>Extreme range</i> of the Temperature during the month, ... ..    | 35.2 |
| Mean of the daily Max. Temperature, ... ..                          | 79.2 |
| Ditto ditto Min. ditto, ... ..                                      | 62.9 |
| <i>Mean daily range</i> of the Temperature during the month, ... .. | 16.3 |

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|                                                                |      |
|----------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..                | 64.0 |
| Mean Dry Bulb Thermometer above mean Wet Bulb Thermometer, ... | 6.3  |
| Computed Mean Dew-point for the month, ... ..                  | 59.0 |
| Mean Dry Bulb Thermometer above computed mean Dew-point, ...   | 11.3 |

|                                                    | Inches |
|----------------------------------------------------|--------|
| Mean Elastic force of Vapour for the month, ... .. | 0.506  |

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|                                                                         | Troy grains |
|-------------------------------------------------------------------------|-------------|
| Mean Weight of Vapour for the month, ... ..                             | 5.56        |
| Additional Weight of Vapour required for complete saturation, ...       | 2.52        |
| Mean degree of humidity for the month, complete saturation being unity, | 0.69        |

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|                                                                                                      | Inches       |
|------------------------------------------------------------------------------------------------------|--------------|
| Rained 5 days, Max. fall of rain during 24 hours, ... ..                                             | 1.56         |
| Total amount of rain during the month, ... ..                                                        | 3.74         |
| Total amount of rain indicated by the Gauge attached to the Anemo-<br>meter during the month, ... .. | 3.34         |
| Prevailing direction of the Wind, ... ..                                                             | E. & N. & W. |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February, 1866.*

MONTHLY RESULTS.

Tables showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.           |   | N. E.    |   | E.       |   | S. E.    |  | S.       |   | S. W.    |  | W.       |   | N. W. |  | Calm. | Rain on. | Missed. |
|-----------|--------------|---|----------|---|----------|---|----------|--|----------|---|----------|--|----------|---|-------|--|-------|----------|---------|
|           | Rain on.     |   | Rain on. |   | Rain on. |   | Rain on. |  | Rain on. |   | Rain on. |  | Rain on. |   |       |  |       |          |         |
|           | No. of days. |   |          |   |          |   |          |  |          |   |          |  |          |   |       |  |       |          |         |
| Midnight. | 3            |   | 3        |   | 7        | 1 | 3        |  | 5        |   |          |  | 5        |   | 2     |  |       |          |         |
| 1         | 3            |   | 3        |   | 7        | 7 | 2        |  | 5        |   |          |  | 5        |   | 3     |  |       |          |         |
| 2         | 3            |   | 3        |   | 7        | 1 | 3        |  | 4        |   |          |  | 5        |   | 3     |  |       |          |         |
| 3         | 5            |   | 2        |   | 6        |   | 2        |  | 3        |   |          |  | 5        | 1 | 4     |  |       |          | 1       |
| 4         | 6            | 1 | 2        |   | 7        |   | 1        |  | 4        |   |          |  | 4        |   | 3     |  |       |          | 1       |
| 5         | 7            | 1 | 2        | 1 | 6        |   | 1        |  | 5        |   |          |  | 4        |   | 3     |  |       |          |         |
| 6         | 8            |   | 3        | 1 | 5        |   | 1        |  | 2        |   |          |  | 4        |   | 5     |  |       |          |         |
| 7         | 7            | 1 | 3        | 1 | 6        |   |          |  | 2        |   |          |  | 6        |   | 4     |  |       |          |         |
| 8         | 4            |   | 5        | 1 | 6        |   |          |  | 2        |   |          |  | 6        |   | 5     |  |       |          |         |
| 9         | 4            | 2 | 2        |   | 8        |   |          |  | 2        |   |          |  | 6        |   | 6     |  |       |          |         |
| 10        | 5            |   | 2        | 1 | 10       |   | 1        |  | 2        |   |          |  | 6        |   | 2     |  |       |          |         |
| 11        | 4            |   | 1        |   | 8        | 2 | 3        |  | 3        |   |          |  | 5        |   | 4     |  |       |          |         |
| Noon.     | 4            |   | 4        |   | 6        |   | 1        |  | 4        |   | 1        |  | 5        |   | 3     |  |       |          |         |
| 1         | 2            |   | 3        |   | 4        | 1 | 1        |  | 3        |   | 1        |  | 7        |   | 7     |  |       |          |         |
| 2         | 3            |   | 2        |   | 5        | 1 | 1        |  | 3        | 1 |          |  | 9        |   | 5     |  |       |          |         |
| 3         | 7            |   | 1        |   | 5        | 1 |          |  | 2        |   | 1        |  | 8        |   | 4     |  |       |          |         |
| 4         | 6            | 2 | 4        | 1 | 2        |   |          |  | 2        |   |          |  | 8        |   | 6     |  |       |          |         |
| 5         | 7            |   | 2        | 1 | 6        |   | 1        |  | 1        |   | 1        |  | 5        |   | 5     |  |       |          |         |
| 6         | 11           |   | 1        | 1 | 7        |   |          |  | 1        |   | 1        |  | 4        |   | 3     |  |       |          |         |
| 7         | 14           | 1 | 1        |   | 7        |   | 1        |  | 2        |   |          |  | 4        |   | 1     |  |       |          |         |
| 8         | 13           | 1 | 1        |   | 7        |   |          |  | 2        |   |          |  | 4        |   | 1     |  |       |          |         |
| 9         | 10           | 1 |          |   | 11       |   |          |  | 4        |   |          |  | 3        |   |       |  |       |          |         |
| 10        | 8            |   | 1        |   | 9        |   | 1        |  | 6        |   |          |  | 3        |   | 1     |  |       |          |         |
| 11        | 7            |   | 1        |   | 9        |   | 1        |  | 6        |   |          |  | 4        |   | 1     |  |       |          |         |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Latitude 22° 23' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.789                                          | 29.866                                    | 29.740  | 0.126   | 81.4                          | 93.6                                          | 72.8 | 20.8  |
| 2     | .821                                            | .898                                      | .748    | .150    | 82.3                          | 92.8                                          | 74.5 | 18.3  |
| 3     | .821                                            | .927                                      | .745    | .182    | 81.4                          | 91.7                                          | 72.4 | 19.3  |
| 4     | .756                                            | .818                                      | .678    | .140    | 81.8                          | 93.6                                          | 72.0 | 21.6  |
| 5     | .786                                            | .865                                      | .732    | .133    | 82.4                          | 94.8                                          | 72.4 | 22.4  |
| 6     | .816                                            | .892                                      | .757    | .135    | 81.8                          | 94.0                                          | 71.4 | 22.6  |
| 7     | .792                                            | .860                                      | .724    | .136    | 82.6                          | 94.0                                          | 75.4 | 18.6  |
| 8     | .793                                            | .876                                      | .719    | .157    | 83.4                          | 95.2                                          | 72.5 | 22.7  |
| 9     | .800                                            | .872                                      | .732    | .140    | 83.8                          | 95.0                                          | 75.4 | 19.6  |
| 10    | .784                                            | .859                                      | .719    | .140    | 83.4                          | 94.4                                          | 76.7 | 17.7  |
| 11    | .858                                            | .937                                      | .775    | .162    | 83.6                          | 92.4                                          | 76.8 | 15.6  |
| 12    | .977                                            | 30.060                                    | .900    | .160    | 83.4                          | 92.4                                          | 77.4 | 15.0  |
| 13    | .967                                            | .056                                      | .872    | .184    | 83.3                          | 92.2                                          | 77.8 | 14.4  |
| 14    | .845                                            | 29.945                                    | .764    | .181    | 86.4                          | 96.4                                          | 77.9 | 18.5  |
| 15    | .828                                            | .924                                      | .761    | .163    | 84.3                          | 94.0                                          | 76.6 | 17.4  |
| 16    | .871                                            | .952                                      | .812    | .140    | 84.5                          | 94.0                                          | 79.0 | 15.0  |
| 17    | .885                                            | .970                                      | .822    | .148    | 84.0                          | 94.4                                          | 77.0 | 17.4  |
| 18    | .820                                            | .899                                      | .750    | .149    | 83.4                          | 92.9                                          | 77.0 | 15.9  |
| 19    | .798                                            | .869                                      | .729    | .140    | 84.5                          | 95.0                                          | 77.6 | 17.4  |
| 20    | .842                                            | .921                                      | .779    | .142    | 84.3                          | 94.0                                          | 76.6 | 17.4  |
| 21    | .798                                            | .878                                      | .703    | .175    | 85.5                          | 96.5                                          | 76.8 | 19.7  |
| 22    | .717                                            | .803                                      | .619    | .184    | 86.7                          | 98.6                                          | 77.8 | 20.8  |
| 23    | .715                                            | .790                                      | .663    | .127    | 86.4                          | 98.4                                          | 77.8 | 20.6  |
| 24    | .751                                            | .838                                      | .684    | .154    | 84.9                          | 95.3                                          | 77.6 | 17.7  |
| 25    | .748                                            | .827                                      | .678    | .149    | 86.4                          | 96.2                                          | 81.0 | 15.2  |
| 26    | .700                                            | .769                                      | .626    | .143    | 87.4                          | 97.4                                          | 80.7 | 16.7  |
| 27    | .730                                            | .811                                      | .668    | .143    | 86.1                          | 95.1                                          | 79.5 | 15.6  |
| 28    | .812                                            | .914                                      | .743    | .171    | 84.9                          | 93.2                                          | 76.0 | 17.2  |
| 29    | .859                                            | .960                                      | .771    | .189    | 81.9                          | 91.6                                          | 73.8 | 17.8  |
| 30    | .855                                            | .927                                      | .775    | .152    | 81.0                          | 91.0                                          | 72.4 | 18.6  |
| 31    | .806                                            | .887                                      | .739    | .148    | 83.7                          | 93.0                                          | 77.0 | 16.0  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                    |
| 1     | 72.9                            | 8.5                 | 66.9                | 14.5                         | 0.657                            | 7.06                                             | 4.21                                                                | 0.63                                                               |
| 2     | 72.8                            | 9.5                 | 66.1                | 16.2                         | .640                             | 6.87                                             | .71                                                                 | .59                                                                |
| 3     | 70.3                            | 11.1                | 62.5                | 18.9                         | .568                             | .11                                              | 5.16                                                                | .54                                                                |
| 4     | 69.4                            | 12.4                | 60.7                | 21.1                         | .536                             | 5.75                                             | .65                                                                 | .50                                                                |
| 5     | 70.2                            | 12.2                | 61.7                | 20.7                         | .554                             | .93                                              | .68                                                                 | .51                                                                |
| 6     | 69.4                            | 12.4                | 60.7                | 21.1                         | .536                             | .75                                              | .65                                                                 | .50                                                                |
| 7     | 76.9                            | 5.7                 | 72.9                | 9.7                          | .797                             | 8.56                                             | 3.12                                                                | .73                                                                |
| 8     | 74.5                            | 8.9                 | 68.3                | 15.1                         | .688                             | 7.37                                             | 4.59                                                                | .62                                                                |
| 9     | 77.2                            | 6.6                 | 72.6                | 11.2                         | .790                             | 8.47                                             | 3.63                                                                | .70                                                                |
| 10    | 77.3                            | 6.1                 | 73.0                | 10.4                         | .801                             | .58                                              | .38                                                                 | .72                                                                |
| 11    | 72.8                            | 10.8                | 65.2                | 18.4                         | .621                             | 6.66                                             | 5.37                                                                | .55                                                                |
| 12    | 75.3                            | 8.1                 | 69.6                | 13.8                         | .717                             | 7.68                                             | 4.28                                                                | .64                                                                |
| 13    | 76.7                            | 6.6                 | 72.1                | 11.2                         | .778                             | 8.34                                             | 3.59                                                                | .70                                                                |
| 14    | 77.1                            | 9.3                 | 70.6                | 15.8                         | .741                             | 7.89                                             | 5.17                                                                | .60                                                                |
| 15    | 75.0                            | 9.3                 | 68.5                | 15.8                         | .692                             | .41                                              | 4.87                                                                | .60                                                                |
| 16    | 73.5                            | 11.0                | 65.8                | 18.7                         | .634                             | 6.77                                             | 5.58                                                                | .55                                                                |
| 17    | 74.2                            | 9.8                 | 67.3                | 16.7                         | .666                             | 7.12                                             | .05                                                                 | .59                                                                |
| 18    | 74.8                            | 8.6                 | 68.8                | 14.6                         | .699                             | .48                                              | 4.48                                                                | .63                                                                |
| 19    | 75.6                            | 8.9                 | 69.4                | 15.1                         | .713                             | .62                                              | .73                                                                 | .62                                                                |
| 20    | 73.6                            | 10.7                | 66.1                | 18.2                         | .640                             | 6.84                                             | 5.44                                                                | .56                                                                |
| 21    | 75.4                            | 10.1                | 68.3                | 17.2                         | .688                             | 7.34                                             | .38                                                                 | .58                                                                |
| 22    | 76.3                            | 10.4                | 70.1                | 16.6                         | .729                             | .76                                              | .42                                                                 | .59                                                                |
| 23    | 75.6                            | 10.8                | 68.0                | 18.4                         | .681                             | .26                                              | .80                                                                 | .56                                                                |
| 24    | 78.6                            | 6.3                 | 74.2                | 10.7                         | .832                             | 8.89                                             | 3.60                                                                | .71                                                                |
| 25    | 79.6                            | 6.8                 | 74.8                | 11.6                         | .849                             | 9.04                                             | 4.02                                                                | .69                                                                |
| 26    | 80.8                            | 6.6                 | 76.8                | 10.6                         | .905                             | .61                                              | 3.84                                                                | .71                                                                |
| 27    | 76.3                            | 9.8                 | 69.4                | 16.7                         | .713                             | 7.59                                             | 5.36                                                                | .59                                                                |
| 28    | 79.1                            | 5.8                 | 75.0                | 9.9                          | .854                             | 9.12                                             | 3.37                                                                | .73                                                                |
| 29    | 75.1                            | 6.8                 | 70.3                | 11.6                         | .734                             | 7.89                                             | .55                                                                 | .69                                                                |
| 30    | 75.1                            | 5.9                 | 71.0                | 10.0                         | .751                             | 8.09                                             | .05                                                                 | .73                                                                |
| 31    | 77.3                            | 6.4                 | 72.8                | 10.9                         | .795                             | .52                                              | .55                                                                 | .71                                                                |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer at<br>32° Fahrt. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|--------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                  | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                          | Inches.                                                      | Inches. | Inches. | o                             | o                                                                | o    | o     |
| Mid-<br>night. | 29.821                                           | 30.007                                                       | 29.706  | 0.301   | 79.1                          | 82.8                                                             | 72.5 | 10.3  |
| 1              | .807                                             | .001                                                         | .696    | .305    | 78.6                          | 82.0                                                             | 72.4 | 9.6   |
| 2              | .794                                             | 29.985                                                       | .682    | .303    | 78.1                          | 81.6                                                             | 72.8 | 8.8   |
| 3              | .784                                             | .978                                                         | .671    | .307    | 77.5                          | 81.5                                                             | 72.8 | 8.7   |
| 4              | .781                                             | .982                                                         | .668    | .314    | 77.2                          | 81.6                                                             | 72.8 | 8.8   |
| 5              | .796                                             | .995                                                         | .687    | .308    | 76.8                          | 81.4                                                             | 71.6 | 9.8   |
| 6              | .815                                             | 30.009                                                       | .707    | .302    | 76.4                          | 81.1                                                             | 71.5 | 9.6   |
| 7              | .839                                             | .025                                                         | .730    | .295    | 76.7                          | 81.4                                                             | 71.4 | 10.0  |
| 8              | .869                                             | .043                                                         | .748    | .295    | 78.8                          | 82.8                                                             | 73.8 | 9.0   |
| 9              | .885                                             | .055                                                         | .761    | .294    | 81.9                          | 86.6                                                             | 76.6 | 10.0  |
| 10             | .889                                             | .060                                                         | .751    | .309    | 85.1                          | 89.8                                                             | 80.0 | 9.8   |
| 11             | .878                                             | .056                                                         | .769    | .287    | 87.9                          | 92.4                                                             | 83.8 | 8.6   |
| Noon.          | .851                                             | .031                                                         | .740    | .291    | 90.3                          | 94.6                                                             | 87.6 | 7.0   |
| 1              | .818                                             | .003                                                         | .711    | .292    | 92.0                          | 96.0                                                             | 89.2 | 6.8   |
| 2              | .784                                             | 29.976                                                       | .666    | .310    | 93.4                          | 97.4                                                             | 91.0 | 6.4   |
| 3              | .761                                             | .957                                                         | .642    | .315    | 94.1                          | 98.4                                                             | 90.6 | 7.8   |
| 4              | .748                                             | .933                                                         | .625    | .308    | 94.0                          | 98.6                                                             | 89.8 | 8.8   |
| 5              | .745                                             | .939                                                         | .619    | .320    | 92.5                          | 97.4                                                             | 87.6 | 9.8   |
| 6              | .752                                             | .950                                                         | .624    | .326    | 88.9                          | 93.6                                                             | 84.6 | 9.0   |
| 7              | .769                                             | .964                                                         | .633    | .331    | 86.0                          | 90.6                                                             | 82.6 | 8.0   |
| 8              | .793                                             | .990                                                         | .666    | .324    | 84.0                          | 87.0                                                             | 81.6 | 5.4   |
| 9              | .819                                             | 30.009                                                       | .693    | .316    | 82.1                          | 84.8                                                             | 73.8 | 11.0  |
| 10             | .830                                             | .021                                                         | .707    | .314    | 80.9                          | 83.8                                                             | 76.2 | 7.6   |
| 11             | .831                                             | .019                                                         | .706    | .303    | 79.8                          | 83.0                                                             | 74.2 | 8.8   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 75.8                            | 3.3                 | 73.5                | 5.6                          | 0.814                            | 8.79                                             | 1.74                                                                | 0.84                                                                |
| 1              | 75.6                            | 3.0                 | 73.5                | 5.1                          | .814                             | .81                                              | .57                                                                 | .85                                                                 |
| 2              | 75.4                            | 2.7                 | 73.5                | 4.6                          | .814                             | .81                                              | .41                                                                 | .86                                                                 |
| 3              | 75.0                            | 2.5                 | 73.2                | 4.3                          | .806                             | .75                                              | .29                                                                 | .87                                                                 |
| 4              | 74.7                            | 2.5                 | 72.9                | 4.3                          | .797                             | .66                                              | .29                                                                 | .87                                                                 |
| 5              | 74.5                            | 2.3                 | 72.9                | 3.9                          | .797                             | .66                                              | .17                                                                 | .88                                                                 |
| 6              | 74.2                            | 2.2                 | 72.7                | 3.7                          | .792                             | .61                                              | .11                                                                 | .89                                                                 |
| 7              | 74.6                            | 2.1                 | 73.1                | 3.6                          | .803                             | .72                                              | .08                                                                 | .89                                                                 |
| 8              | 75.2                            | 3.6                 | 72.7                | 6.1                          | .792                             | .58                                              | .86                                                                 | .82                                                                 |
| 9              | 75.8                            | 6.1                 | 71.5                | 10.4                         | .763                             | .21                                              | 3.23                                                                | .72                                                                 |
| 10             | 75.7                            | 9.4                 | 69.1                | 16.0                         | .706                             | 7.53                                             | 5.04                                                                | .60                                                                 |
| 11             | 75.0                            | 12.9                | 67.3                | 20.6                         | .666                             | .06                                              | 6.58                                                                | .52                                                                 |
| Noon.          | 74.9                            | 15.4                | 65.7                | 24.6                         | .632                             | 6.68                                             | 7.95                                                                | .46                                                                 |
| 1              | 74.6                            | 17.4                | 64.2                | 27.8                         | .601                             | .32                                              | 9.04                                                                | .41                                                                 |
| 2              | 74.5                            | 18.9                | 63.2                | 30.2                         | .582                             | .11                                              | .88                                                                 | .38                                                                 |
| 3              | 74.3                            | 19.8                | 62.4                | 31.7                         | .567                             | 5.93                                             | 10.39                                                               | .36                                                                 |
| 4              | 74.9                            | 19.1                | 63.4                | 30.6                         | .586                             | 6.13                                             | .14                                                                 | .38                                                                 |
| 5              | 75.1                            | 17.4                | 64.7                | 27.8                         | .611                             | .43                                              | 9.16                                                                | .41                                                                 |
| 6              | 75.1                            | 13.8                | 66.8                | 22.1                         | .655                             | .94                                              | 7.10                                                                | .49                                                                 |
| 7              | 75.5                            | 10.5                | 68.1                | 17.9                         | .684                             | 7.28                                             | 5.63                                                                | .56                                                                 |
| 8              | 75.1                            | 8.9                 | 68.9                | 15.1                         | .701                             | .51                                              | 4.66                                                                | .62                                                                 |
| 9              | 75.3                            | 6.8                 | 70.5                | 11.6                         | .739                             | .93                                              | 3.58                                                                | .69                                                                 |
| 10             | 75.8                            | 5.1                 | 72.2                | 8.7                          | .781                             | 8.40                                             | 2.70                                                                | .76                                                                 |
| 11             | 75.9                            | 3.9                 | 73.2                | 6.6                          | .806                             | .70                                              | 2.05                                                                | .81                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                            |
|-------|-----------------------|---------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   |                                                                                                                       |
| 1     | 146.0                 | ...                             | N. W. & W. & S.                   | Clear.                                                                                                                |
| 2     | 142.0                 | ...                             | W.                                | Clear.                                                                                                                |
| 3     | 142.8                 | ...                             | W. & S. W.                        | Clear.                                                                                                                |
| 4     | 141.6                 | ...                             | W. & S. W & S.                    | Clear.                                                                                                                |
| 5     | 148.5                 | ...                             | W. & S.                           | Clear.                                                                                                                |
| 6     | 142.0                 | ...                             | W.                                | Clear.                                                                                                                |
| 7     | 141.5                 | ...                             | S. & S. W.<br>S. & W.             | Clear. Scuds from S. between 4 & 7 A. M.<br>Clear to 4 A. M., scatd. \i to 9 A. M.,<br>clear afterwards.              |
| 8     | 142.4                 | ...                             | S. W.                             | Clear, slightly foggy from 4 to 6 A. M.                                                                               |
| 9     | 136.4                 | ...                             | S. & N.                           | Clear, slightly foggy from 3 to 8 A. M.                                                                               |
| 10    | 137.2                 | ...                             | N. & W.                           | Clear, slightly foggy at 4 A. M.                                                                                      |
| 11    | 140.0                 | ...                             | S. & N.                           | Clear.                                                                                                                |
| 12    | 142.0                 | ...                             | S. & S. W.                        | Clear to 2 A. M., overcast to 6 A. M.,<br>clear afterwards.                                                           |
| 13    | 137.0                 | ...                             | S. & W.                           | Clear, slightly foggy at 1 A. M.                                                                                      |
| 14    | 141.0                 | ...                             | S. W. & W.                        | Clear, slightly foggy from 3 to 5 A. M.                                                                               |
| 15    | 150.0                 | ...                             | S. W. & W.                        | Scatd. clouds to 8 A. M., clear after-<br>wards.                                                                      |
| 16    | 137.0                 | ...                             | S. & N.                           | Clear to 7 A. M. \i to 7 P. M., clear<br>afterwards.                                                                  |
| 17    | 134.7                 | ...                             | S. & S. W.                        | \i to 8 P. M., clear afterwards.                                                                                      |
| 18    | 142.0                 | ...                             | W. & S. & S. W.                   | \i to 8 A. M., clear afterwards.                                                                                      |
| 19    | 149.0                 | ...                             | S. W. & W. & N. W.                | Clear, foggy from 4 to 7 A. M.                                                                                        |
| 20    | 142.0                 | ...                             | W. & S. W. & S.                   | Clear to 1 P. M., scatd. \i to 6 P. M.,<br>clear afterwards.                                                          |
| 21    | 142.0                 | ...                             | S. W. & W. & S.                   | Clear.                                                                                                                |
| 22    | 146.0                 | ...                             | S. & W.                           | Clear.                                                                                                                |
| 23    | 140.5                 | ...                             | S.                                | Clear.                                                                                                                |
| 24    | 141.0                 | ...                             | S. & S. W.                        | Scatd. \i to 9 A. M., clear afterwards.                                                                               |
| 25    | 146.0                 | ...                             | S.                                | Clouds of different kinds.                                                                                            |
| 26    | 142.5                 | ...                             | S.                                | Clear.                                                                                                                |
| 27    | 137.0                 | ...                             | S.                                | Clear to 6 A. M., scatd. \i to 5 P. M.,<br>overcast afterwards. Thin rain Light-<br>ning and Thunder at 10 & 11 P. M. |
| 28    | 132.0                 | ...                             | S.                                | Overcast to 6 A. M., scatd. \i to 8 P. M.<br>over east afterwards Thin rain at<br>11 P. M.                            |

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi,  
\i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                           |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------|
| 30    | 135.0                 | ...                             | S.                                | ☁i to 10 A. M. ☁i to 4 P. M., clear afterwards.      |
| 31    | 137.0                 | ...                             | E. & S. & S. W.                   | Clear to 4 A. M. ☁i to 1 P. M. Scatd. ☁i afterwards. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of March 1866.*

MONTHLY RESULTS.

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|                                                                       | Inches. |
|-----------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ... ..                    | 29.811  |
| Max. height of the Barometer occurred at 10 A. M. on the 12th, ... .. | 30.060  |
| Min. height of the Barometer occurred at 5 P. M. on the 22nd, ... ..  | 29.619  |
| <i>Extreme range</i> of the Barometer during the month, ... ..        | 0.441   |
| Mean of the daily Max. Pressures, ... ..                              | 29.893  |
| Ditto ditto Min. ditto ... ..                                         | 29.740  |
| <i>Mean daily range</i> of the Barometer during the month, ... ..     | 0.153   |

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|                                                                     | °    |
|---------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month, ... ..                     | 83.9 |
| Max. Temperature occurred at 4 P. M. on the 22nd, ... ..            | 98.6 |
| Min. Temperature occurred at 7 A. M. on the 6th, ... ..             | 71.4 |
| <i>Extreme range</i> of the Temperature during the month, ... ..    | 27.2 |
| Mean of the daily Max. Temperature ... ..                           | 94.3 |
| Ditto ditto Min. ditto, ... ..                                      | 76.1 |
| <i>Mean daily range</i> of the Temperature during the month, ... .. | 18.2 |

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|                                                                   |      |
|-------------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..                   | 75.1 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ... .. | 8.8  |
| Computed Mean Dew-point for the month, ... ..                     | 68.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ... ..   | 15.0 |

|                                                    | Inches. |
|----------------------------------------------------|---------|
| Mean Elastic force of Vapour for the month, ... .. | 0.701   |

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|                                                                        | Troy grains. |
|------------------------------------------------------------------------|--------------|
| Mean Weight of Vapour for the month ... ..                             | 7.51         |
| Additional Weight of Vapour required for complete saturation, ... ..   | 4.62         |
| Mean degree of humidity for the month, complete saturation being unity | 0.62         |

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|                                                           | Inches.         |
|-----------------------------------------------------------|-----------------|
| Drizzled 2 days,—Max. fall of rain during 24 hours ... .. | Nil             |
| Total amount of rain during the month, ... ..             | Nil             |
| Prevailing direction of the Wind, ... ..                  | S. & W. & S. W. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1866.*

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.          | Rain on.<br>N. E. | Rain on.<br>E. | Rain on.<br>S. E. | Rain on.<br>S. | Rain on.<br>S. W. | Rain on.<br>W. | Rain on.<br>N. W. | Rain on.<br>Calm. | Rain on. | Missed. |
|-----------|-------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|-------------------|----------|---------|
|           | No. of days |                   |                |                   |                |                   |                |                   |                   |          |         |
| Midnight. |             |                   | 1              | 2                 | 18             | 7                 | 3              |                   |                   |          |         |
| 1         |             |                   | 1              | 2                 | 18             | 8                 | 2              |                   |                   |          |         |
| 2         |             |                   | 1              |                   | 20             | 8                 | 2              |                   |                   |          |         |
| 3         |             |                   |                | 1                 | 17             | 8                 | 4              |                   |                   |          | 1       |
| 4         |             |                   |                | 1                 | 15             | 9                 | 5              |                   |                   |          | 1       |
| 5         |             |                   |                | 1                 | 13             | 10                | 6              |                   |                   |          | 1       |
| 6         | 1           | 1                 |                |                   | 14             | 9                 | 5              |                   |                   |          | 1       |
| 7         | 1           |                   | 1              |                   | 12             | 11                | 5              |                   |                   |          | 1       |
| 8         | 3           |                   |                |                   | 11             | 11                | 6              |                   |                   |          |         |
| 9         | 1           |                   |                |                   | 9              | 9                 | 10             | 2                 |                   |          |         |
| 10        | 2           |                   |                |                   | 5              | 10                | 10             | 4                 |                   |          |         |
| 11        | 5           | 1                 |                | 1                 | 3              | 6                 | 9              | 6                 |                   |          |         |
| Noon.     | 5           | 2                 | 1              | 1                 | 5              | 4                 | 7              | 6                 |                   |          |         |
| 1         | 2           | 2                 | 2              |                   | 3              | 6                 | 11             | 5                 |                   |          |         |
| 2         | 2           | 1                 | 2              | 1                 | 3              | 3                 | 15             | 4                 |                   |          |         |
| 3         | 4           |                   | 2              | 1                 | 2              | 6                 | 15             | 1                 |                   |          |         |
| 4         | 3           |                   | 2              | 1                 | 6              | 3                 | 15             | 1                 |                   |          |         |
| 5         | 3           | 1                 | 1              | 1                 | 8              | 2                 | 14             | 1                 |                   |          |         |
| 6         | 2           | 1                 | 2              |                   | 9              | 2                 | 13             | 2                 |                   |          |         |
| 7         | 2           | 1                 | 2              |                   | 14             | 1                 | 9              | 2                 |                   |          |         |
| 8         | 2           |                   | 1              |                   | 17             | 1                 | 9              | 1                 |                   |          |         |
| 9         | 1           |                   | 1              |                   | 21             | 3                 | 4              | 1                 |                   |          |         |
| 10        | 1           |                   |                | 1                 | 21             | 5                 | 3              |                   |                   |          |         |
| 11        |             |                   |                | 1                 | 19             | 6                 | 4              | 2                 | 1                 |          |         |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.842                                          | 29.976                                    | 29.781  | 0.195   | 82.5                          | 89.9                                          | 76.9 | 13.0  |
| 2     | .844                                            | .915                                      | .796    | .119    | 82.6                          | 91.8                                          | 76.4 | 15.4  |
| 3     | .853                                            | .955                                      | .801    | .154    | 77.4                          | 83.4                                          | 73.6 | 9.8   |
| 4     | .811                                            | .882                                      | .753    | .129    | 78.6                          | 89.0                                          | 71.4 | 17.6  |
| 5     | .806                                            | .879                                      | .725    | .154    | 82.1                          | 93.0                                          | 72.8 | 20.2  |
| 6     | .738                                            | .834                                      | .620    | .214    | 83.9                          | 95.0                                          | 78.2 | 16.8  |
| 7     | .695                                            | .772                                      | .617    | .155    | 85.6                          | 96.8                                          | 77.2 | 19.6  |
| 8     | .688                                            | .760                                      | .621    | .139    | 86.6                          | 97.6                                          | 78.0 | 19.6  |
| 9     | .707                                            | .794                                      | .629    | .165    | 88.2                          | 98.8                                          | 81.0 | 17.8  |
| 10    | .655                                            | .730                                      | .562    | .168    | 89.3                          | 102.6                                         | 81.8 | 20.8  |
| 11    | .615                                            | .685                                      | .545    | .140    | 89.1                          | 102.3                                         | 78.8 | 23.5  |
| 12    | .642                                            | .709                                      | .576    | .133    | 88.1                          | 100.2                                         | 77.4 | 22.8  |
| 13    | .730                                            | .810                                      | .671    | .139    | 87.7                          | 100.2                                         | 77.0 | 23.2  |
| 14    | .716                                            | .799                                      | .634    | .165    | 88.5                          | 101.8                                         | 79.2 | 22.6  |
| 15    | .674                                            | .747                                      | .581    | .166    | 88.8                          | 102.6                                         | 80.6 | 22.0  |
| 16    | .676                                            | .736                                      | .630    | .106    | 86.3                          | 93.8                                          | 80.7 | 13.1  |
| 17    | .700                                            | .766                                      | .642    | .124    | 85.3                          | 90.8                                          | 81.4 | 9.4   |
| 18    | .723                                            | .796                                      | .618    | .178    | 85.1                          | 92.1                                          | 80.8 | 11.3  |
| 19    | .734                                            | .812                                      | .679    | .133    | 86.4                          | 95.6                                          | 81.2 | 14.4  |
| 20    | .803                                            | .894                                      | .732    | .162    | 86.8                          | 94.0                                          | 81.4 | 12.6  |
| 21    | .914                                            | 30.062                                    | .806    | .256    | 82.4                          | 91.4                                          | 69.6 | 21.8  |
| 22    | .983                                            | .074                                      | .899    | .175    | 75.5                          | 84.4                                          | 68.4 | 16.0  |
| 23    | .951                                            | .039                                      | .845    | .194    | 79.3                          | 88.2                                          | 73.0 | 15.2  |
| 24    | .902                                            | 29.973                                    | .804    | .169    | 82.5                          | 91.2                                          | 75.0 | 16.2  |
| 25    | .835                                            | .917                                      | .721    | .196    | 83.6                          | 94.2                                          | 75.7 | 18.5  |
| 26    | .766                                            | .853                                      | .660    | .193    | 85.7                          | 96.4                                          | 77.4 | 19.0  |
| 27    | .796                                            | .858                                      | .731    | .127    | 86.1                          | 94.4                                          | 77.8 | 16.6  |
| 28    | .853                                            | .995                                      | .788    | .207    | 80.3                          | 89.8                                          | 72.2 | 17.6  |
| 29    | .874                                            | .959                                      | .792    | .167    | 78.2                          | 87.0                                          | 73.0 | 14.0  |
| 30    | .839                                            | .900                                      | .751    | .149    | 81.0                          | 90.6                                          | 72.0 | 18.6  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                    |
| 1     | 75.1                            | 7.4                 | 69.9                | 12.6                         | 0.725                            | 7.77                                             | 3.87                                                                | 0.67                                                               |
| 2     | 75.1                            | 7.5                 | 69.8                | 12.8                         | .722                             | .74                                              | .94                                                                 | .66                                                                |
| 3     | 71.1                            | 6.3                 | 66.7                | 10.7                         | .653                             | .07                                              | 2.94                                                                | .71                                                                |
| 4     | 69.9                            | 8.7                 | 63.8                | 14.8                         | .593                             | 6.41                                             | 3.97                                                                | .62                                                                |
| 5     | 73.2                            | 8.9                 | 67.0                | 15.1                         | .659                             | 7.08                                             | 4.43                                                                | .62                                                                |
| 6     | 77.3                            | 6.6                 | 72.7                | 11.2                         | .792                             | 8.49                                             | 3.64                                                                | .70                                                                |
| 7     | 75.2                            | 10.4                | 67.9                | 17.7                         | .679                             | 7.24                                             | 5.52                                                                | .57                                                                |
| 8     | 79.2                            | 7.4                 | 74.8                | 11.8                         | .849                             | 9.04                                             | 4.10                                                                | .69                                                                |
| 9     | 81.2                            | 7.0                 | 77.0                | 11.2                         | .910                             | .67                                              | .09                                                                 | .70                                                                |
| 10    | 80.4                            | 8.9                 | 75.1                | 14.2                         | .857                             | .08                                              | 5.13                                                                | .64                                                                |
| 11    | 76.7                            | 12.4                | 69.3                | 19.8                         | .711                             | 7.52                                             | 6.60                                                                | .53                                                                |
| 12    | 75.3                            | 12.8                | 67.6                | 20.5                         | .672                             | .13                                              | .59                                                                 | .52                                                                |
| 13    | 77.6                            | 10.1                | 71.5                | 16.2                         | .763                             | 8.11                                             | 5.45                                                                | .60                                                                |
| 14    | 78.2                            | 10.3                | 72.0                | 16.5                         | .776                             | .21                                              | .67                                                                 | .59                                                                |
| 15    | 79.8                            | 9.0                 | 74.4                | 14.4                         | .838                             | .89                                              | .11                                                                 | .64                                                                |
| 16    | 80.7                            | 5.6                 | 76.8                | 9.5                          | .905                             | 9.63                                             | 3.39                                                                | .74                                                                |
| 17    | 79.7                            | 5.6                 | 75.8                | 9.5                          | .876                             | .35                                              | .29                                                                 | .74                                                                |
| 18    | 79.7                            | 5.4                 | 75.9                | 9.2                          | .879                             | .40                                              | .17                                                                 | .75                                                                |
| 19    | 80.1                            | 6.3                 | 75.7                | 10.7                         | .873                             | .30                                              | .76                                                                 | .71                                                                |
| 20    | 80.4                            | 6.4                 | 76.6                | 10.2                         | .899                             | .57                                              | .64                                                                 | .72                                                                |
| 21    | 76.2                            | 6.2                 | 71.9                | 10.5                         | .773                             | 8.29                                             | .32                                                                 | .71                                                                |
| 22    | 70.7                            | 4.8                 | 67.3                | 8.2                          | .666                             | 7.25                                             | 2.21                                                                | .77                                                                |
| 23    | 74.6                            | 4.7                 | 71.3                | 8.0                          | .758                             | 8.20                                             | .39                                                                 | .77                                                                |
| 24    | 76.1                            | 6.4                 | 71.6                | 10.9                         | .766                             | .22                                              | 3.42                                                                | .71                                                                |
| 25    | 78.0                            | 5.6                 | 74.1                | 9.5                          | .830                             | .89                                              | .14                                                                 | .74                                                                |
| 26    | 78.7                            | 7.0                 | 73.8                | 11.9                         | .822                             | .76                                              | 4.04                                                                | .68                                                                |
| 27    | 80.6                            | 5.5                 | 76.7                | 9.4                          | .902                             | 9.62                                             | 3.33                                                                | .74                                                                |
| 28    | 76.3                            | 4.0                 | 73.5                | 6.8                          | .814                             | 8.78                                             | 2.13                                                                | .81                                                                |
| 29    | 74.0                            | 4.2                 | 71.1                | 7.1                          | .753                             | .16                                              | .09                                                                 | .80                                                                |
| 30    | 74.1                            | 6.9                 | 69.3                | 11.7                         | .711                             | 7.64                                             | 3.50                                                                | .69                                                                |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer at<br>32° Fahr. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|-------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                 | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                         | Inches.                                                      | Inches. | Inches. | o                             | o                                                                | o    | o     |
| Mid-<br>night. | 29.783                                          | 30.042                                                       | 29.623  | 0.419   | 79.5                          | 83.4                                                             | 68.8 | 14.6  |
| 1              | .771                                            | 29.963                                                       | .608    | .355    | 79.0                          | 83.0                                                             | 68.4 | 14.6  |
| 2              | .761                                            | .982                                                         | .593    | .389    | 78.8                          | 82.6                                                             | 68.8 | 13.8  |
| 3              | .752                                            | .959                                                         | .580    | .379    | 78.5                          | 82.2                                                             | 68.4 | 13.8  |
| 4              | .755                                            | .960                                                         | .587    | .373    | 78.2                          | 82.0                                                             | 69.0 | 13.0  |
| 5              | .770                                            | .982                                                         | .600    | .382    | 78.0                          | 82.2                                                             | 69.0 | 13.2  |
| 6              | .790                                            | 30.005                                                       | .620    | .385    | 77.8                          | 82.2                                                             | 68.6 | 13.6  |
| 7              | .811                                            | .038                                                         | .640    | .398    | 78.8                          | 83.4                                                             | 70.4 | 13.0  |
| 8              | .833                                            | .068                                                         | .665    | .403    | 81.2                          | 85.8                                                             | 70.7 | 15.1  |
| 9              | .849                                            | .074                                                         | .684    | .390    | 84.3                          | 88.8                                                             | 73.3 | 15.5  |
| 10             | .851                                            | .070                                                         | .685    | .385    | 86.9                          | 92.2                                                             | 75.0 | 17.2  |
| 11             | .841                                            | .014                                                         | .683    | .331    | 89.1                          | 95.6                                                             | 76.3 | 19.3  |
| Noon.          | .822                                            | .007                                                         | .662    | .345    | 90.6                          | 98.9                                                             | 77.6 | 21.3  |
| 1              | .791                                            | 29.971                                                       | .627    | .344    | 91.9                          | 100.2                                                            | 78.0 | 22.2  |
| 2              | .757                                            | .947                                                         | .585    | .362    | 92.7                          | 101.8                                                            | 82.0 | 19.8  |
| 3              | .729                                            | .918                                                         | .565    | .353    | 93.0                          | 102.3                                                            | 82.8 | 19.5  |
| 4              | .709                                            | .899                                                         | .555    | .344    | 92.4                          | 102.6                                                            | 81.0 | 21.6  |
| 5              | .705                                            | .905                                                         | .545    | .360    | 90.6                          | 100.8                                                            | 79.0 | 21.8  |
| 6              | .727                                            | .917                                                         | .557    | .360    | 87.7                          | 96.4                                                             | 77.2 | 19.2  |
| 7              | .741                                            | .948                                                         | .577    | .371    | 84.7                          | 91.6                                                             | 72.8 | 18.8  |
| 8              | .768                                            | .963                                                         | .605    | .358    | 82.6                          | 89.8                                                             | 73.6 | 16.2  |
| 9              | .783                                            | .989                                                         | .632    | .357    | 81.6                          | 87.0                                                             | 73.4 | 13.6  |
| 10             | .796                                            | 30.016                                                       | .641    | .375    | 80.6                          | 85.0                                                             | 72.2 | 12.8  |
| 11             | .795                                            | .062                                                         | .639    | .423    | 80.0                          | 84.4                                                             | 73.3 | 11.1  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | °                               | °                   | °                   | °                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 76.1                            | 3.4                 | 73.7                | 5.8                          | 0.819                            | 8.85                                             | 1.81                                                                | 0.83                                                                |
| 1              | 76.0                            | 3.0                 | 73.9                | 5.1                          | .824                             | .92                                              | .58                                                                 | .85                                                                 |
| 2              | 76.1                            | 2.7                 | 74.2                | 4.6                          | .832                             | 9.00                                             | .44                                                                 | .86                                                                 |
| 3              | 76.1                            | 2.4                 | 74.4                | 4.1                          | .838                             | .08                                              | .27                                                                 | .88                                                                 |
| 4              | 76.0                            | 2.2                 | 74.5                | 3.7                          | .840                             | .11                                              | .14                                                                 | .89                                                                 |
| 5              | 75.8                            | 2.2                 | 74.3                | 3.7                          | .835                             | .05                                              | .14                                                                 | .89                                                                 |
| 6              | 75.8                            | 2.0                 | 74.4                | 3.4                          | .838                             | .10                                              | .03                                                                 | .90                                                                 |
| 7              | 76.3                            | 2.5                 | 74.5                | 4.3                          | .840                             | .11                                              | .33                                                                 | .87                                                                 |
| 8              | 77.2                            | 4.0                 | 74.4                | 6.8                          | .838                             | .02                                              | 2.19                                                                | .81                                                                 |
| 9              | 77.8                            | 6.5                 | 73.2                | 11.1                         | .806                             | 8.63                                             | 3.65                                                                | .70                                                                 |
| 10             | 78.1                            | 8.8                 | 72.8                | 14.1                         | .795                             | .47                                              | 4.78                                                                | .64                                                                 |
| 11             | 78.1                            | 11.0                | 71.5                | 17.6                         | .763                             | .08                                              | 6.04                                                                | .57                                                                 |
| Noon.          | 77.7                            | 12.9                | 70.0                | 20.6                         | .727                             | 7.66                                             | 7.10                                                                | .52                                                                 |
| 1              | 77.9                            | 14.0                | 69.5                | 22.4                         | .715                             | .53                                              | .79                                                                 | .49                                                                 |
| 2              | 77.7                            | 15.0                | 68.7                | 24.0                         | .697                             | .32                                              | 8.36                                                                | .47                                                                 |
| 3              | 77.6                            | 15.4                | 68.4                | 24.6                         | .690                             | .25                                              | .56                                                                 | .46                                                                 |
| 4              | 77.4                            | 15.0                | 68.4                | 24.0                         | .690                             | .25                                              | .29                                                                 | .47                                                                 |
| 5              | 77.3                            | 13.3                | 69.3                | 21.3                         | .711                             | .50                                              | 7.26                                                                | .51                                                                 |
| 6              | 77.5                            | 10.2                | 71.4                | 16.3                         | .761                             | 8.08                                             | 5.48                                                                | .60                                                                 |
| 7              | 76.9                            | 7.8                 | 71.4                | 13.3                         | .761                             | .13                                              | 4.29                                                                | .66                                                                 |
| 8              | 76.7                            | 5.9                 | 72.6                | 10.0                         | .790                             | .49                                              | 3.19                                                                | .73                                                                 |
| 9              | 76.5                            | 5.1                 | 72.9                | 8.7                          | .797                             | .57                                              | 2.77                                                                | .76                                                                 |
| 10             | 76.3                            | 4.3                 | 73.3                | 7.3                          | .809                             | .72                                              | .29                                                                 | .79                                                                 |
| 11             | 76.1                            | 3.9                 | 73.4                | 6.6                          | .811                             | .75                                              | 3.06                                                                | .81                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind | General Aspect of the Sky.                                                                                                                              |
|-------|-----------------------|---------------------------------|-----------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   | lb                    |                                                                                                                                                         |
| 1     | 132.0                 | ...                             | W. S. W. & E. S. E.               | 2.75                  | Overcast to Noon, \i to 5 P. M., clear afterwards.                                                                                                      |
| 2     | 141.0                 | ...                             | S. S. E. & W. S. W.               | 1.25                  | \i to 7 A. M., scatd. \i to 4 P. M., overcast to 8 P. M. \i afterwards.                                                                                 |
| 3     | 121.5                 | ...                             | N. & N. N. W.                     | 2.25                  | \i to 3 P. M., overcast afterwards. Thin rain between 6 & 7 A. M. & at 8 & 10 P. M.                                                                     |
| 4     | 128.0                 | ...                             | W. S. W.                          | 0.25                  | \i to 5 A. M., \i to Noon, clear afterwards.                                                                                                            |
| 5     | 135.0                 | ...                             | W. S. W. & S. S. W.               | ...                   | Clear to 11 A. M., scatd. \i to 5 P. M., clear afterwards.                                                                                              |
| 6     | 132.0                 | ...                             | S. S. W. & S. W.                  | 2.25                  | Clear to 7 A. M., scatd. \i to 7 P. M. clear afterwards, lightning to the S. E. at 10 & 11 P. M.                                                        |
| 7     | 141.0                 | ...                             | S. W. & W. N. W.                  | 0.50                  | Clear scuds, from S. W. from 4 to 7 A. M. Foggy at 6 A. M.                                                                                              |
| 8     | 145.6                 | ...                             | S. & W. S. W.                     | 0.25                  | Clear to 10 A. M. Scatd. \i to 5 P. M., clear afterwards.                                                                                               |
| 9     | 140.0                 | ...                             | S. by E. & S.                     | ...                   | Scuds from S. to N. to 9 A. M. clear afterwards.                                                                                                        |
| 10    | 143.0                 | ...                             | S. & S. S. W.                     | ...                   | Scuds from S. W. to N. E. to 8 A. M. clear afterwards.                                                                                                  |
| 11    | 144.6                 | ...                             | S. & N. W.                        | ...                   | Clear.                                                                                                                                                  |
| 12    | 140.5                 | ...                             | S. & variable                     | 0.50                  | Clear. Foggy at 6 & 7 A. M.                                                                                                                             |
| 13    | 145.5                 | ...                             | S. & variable                     | 0.50                  | Clear. Foggy from 5 to 7 A. M.                                                                                                                          |
| 14    | 140.5                 | ...                             | S. & W.                           | 0.75                  | Clear.                                                                                                                                                  |
| 15    | 148.4                 | ...                             | S. S. W. & S. by E.               | ...                   | Clear to 3 A. M. Scatd. clouds to 8 A. M., clear afterwards.                                                                                            |
| 16    | 132.4                 | ...                             | S. & S, S. W. (high)              | 2.00                  | Clear to 9 A. M. Scuds from S. to N. to 3 P. M. clear afterwards.                                                                                       |
| 17    | 122.0                 | ...                             | S. (high)                         | 4.50                  | Clear to 4 A. M. Scuds from S. to N. to 3 P. M. Overcast to 7 P. M. clear afterwards, lightning to the S. at 7 & 8 A. M., thin rain between 4 & 5 A. M. |
| 18    | 128.7                 | ...                             | S. S. W. & S.                     | 3.25                  | Clouds of different kinds.                                                                                                                              |
| 19    | 130.2                 | ...                             | S. & S. S. W. & S. by W.          | 2.00                  | Clouds of different kinds to 6 P. M., clear afterwards. Lightning to the S. E. at 4 A. M.                                                               |
| 20    | 138.0                 | ...                             | S. & S. S. W.                     | 1.80                  | Clouds of different kinds. Lightning to the E.                                                                                                          |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1866.

## Solar Radiation, Weather, &amp;c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General Aspect of the Sky.                                                                                                                               |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   | lb                     |                                                                                                                                                          |
| 21    | .....                 | } * 0.51                        | S. & S. S. E.                     | 10.50                  | Overcast Lightning Thunder & rain at 10 & 11 P. M. Hails at 10 P. M.                                                                                     |
| 22    | 123.2                 |                                 | S. E. & variable                  | 2.00                   | Overcast to Noon \i & \i afterwards, Lightning & Thunder at Midnight light rain at Midnight, 1 & from 4 to 6 A. M.                                       |
| 23    | 128.0                 | 0.14                            | S. W. & N. N. W.                  | 2.80                   | \i & \i to 6 P. M. clear afterwards. Lightning to S. at 9 P. M. Rain at 4 & 5 P. M.                                                                      |
| 24    | 135.8                 | ...                             | E. S. E. & variable.              | 1.00                   | Overcast to 3 A. M. clear to 9 A. M. Scatd. \i to 6 P. M. clear afterwards, Lightning to S. W. at 1 A. M.                                                |
| 25    | 132.0                 | ...                             | E. & S. S. W.                     | 1.00                   | Clear to 6 A. M. Scatd. \i to 4 P. M. clear afterwards.                                                                                                  |
| 26    | 128.5                 | ...                             | S. S. W. & S.                     | 1.25                   | Clear to 1 P. M. \i afterwards Lightning to the W. & S. at 7 & 8 P. M. Thunder at 7 P. M. Light rain between 7 & 8 P. M.                                 |
| 27    | 131.6                 | ...                             | S. S. E. & S.                     | 1.00                   | \i to A. M. Scuds from S. to 10 A. M. \i to 4 P. M. clear afterwards.                                                                                    |
| 28    | .....                 | 1.16                            | S. E. & E.                        | 2.75                   | Clear to 7 A. M. Scuds from S. to 10 A. M. Overcast afterwards Lightning to the E. from 6 to 9 P. M. Thunder at 5 & 6 P. M. rain at Noon, 5, 6 & 8 P. M. |
| 29    | 128.0                 | ...                             | W. & variable.                    | 2.00                   | Scatd. \i to 5 A. M. \i & \i to 1 P. M. overcast afterwards Lightning to the E. at 8 & 9 P. M. Thin rain at 6 P. M.                                      |
| 30    | 131.0                 | ...                             | S. W. & N. N. E.                  | 5.00                   | Scatd. \i & \i to 1 P. M. Scatd \i to 5 P. M. overcast afterwards Lightning to the S. W. at 9 P. M. Thin rain at 10 & 11 P. M.                           |

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi, \i Cirro cumuli.

\* Fell from 10 P. M. of the 21st to 6 A. M. of the 22nd.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of April 1866.*

MONTHLY RESULTS.

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|                                                                   | Inches. |
|-------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ... ..                | 29.779  |
| Max. height of the Barometer occurred at 9 A. M. on the 22nd, ... | 30.074  |
| Min. height of the Barometer occurred at 5 P. M. on the 11th, ... | 29.545  |
| <i>Extreme range</i> of the Barometer during the month, ... ..    | 0.529   |
| Mean of the daily Max. Pressures, ... ..                          | 29.863  |
| Ditto ditto Min. ditto ... ..                                     | 29.700  |
| <i>Mean daily range</i> of the Barometer during the month, ... .. | 0.163   |

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|                                                                     | o     |
|---------------------------------------------------------------------|-------|
| Mean Dry Bulb Thermometer for the month, ... ..                     | 84.1  |
| Max. Temperature occurred at 4 P. M. on the 10th & 15th ... ..      | 102.6 |
| Min. Temperature occurred at 1 & 3 A. M. on the 22nd ... ..         | 68.4  |
| <i>Extreme range</i> of the Temperature during the month, ... ..    | 34.2  |
| Mean of the daily Max. Temperature ... ..                           | 94.0  |
| Ditto ditto Min. ditto, ... ..                                      | 76.7  |
| <i>Mean daily range</i> of the Temperature during the month, ... .. | 17.3  |

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|                                                                |      |
|----------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..                | 76.9 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ... | 7.2  |
| Computed Mean Dew-point for the month, ... ..                  | 71.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ...   | 12.2 |

Inches.

|                                                    |       |
|----------------------------------------------------|-------|
| Mean Elastic force of Vapour for the month, ... .. | 0.773 |
|----------------------------------------------------|-------|

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Troy grains.

|                                                                        |      |
|------------------------------------------------------------------------|------|
| Mean Weight of Vapour for the month ... ..                             | 8.28 |
| Additional Weight of Vapour required for complete saturation, ...      | 3.93 |
| Mean degree of humidity for the month, complete saturation being unity | 0.68 |

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Inches.

|                                                                                                      |      |
|------------------------------------------------------------------------------------------------------|------|
| Rained 9 days,—Max. fall of rain during 24 hours ... ..                                              | 1.16 |
| Total amount of rain during the month, ... ..                                                        | 1.81 |
| Total amount of rain indicated by the Gauge attached to the anemo-<br>meter during the month. ... .. | 1.37 |
| Prevailing direction of the Wind, ... .. S. & S. S. W. & W. S. W.                                    |      |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.827                                          | 29.900                                    | 29.736  | 0.164   | 81.4                          | 91.0                                          | 72.4 | 18.6  |
| 2     | .838                                            | .890                                      | .807    | .083    | 78.8                          | 87.4                                          | 73.6 | 13.8  |
| 3     | .769                                            | .855                                      | .686    | .169    | 78.9                          | 88.9                                          | 71.7 | 17.2  |
| 4     | .705                                            | .758                                      | .628    | .130    | 79.5                          | 89.8                                          | 74.6 | 15.2  |
| 5     | .659                                            | .726                                      | .569    | .157    | 82.2                          | 91.2                                          | 72.7 | 18.5  |
| 6     | .579                                            | .630                                      | .482    | .148    | 84.2                          | 93.2                                          | 76.6 | 16.6  |
| 7     | .563                                            | .607                                      | .514    | .093    | 84.4                          | 93.0                                          | 76.0 | 17.0  |
| 8     | .583                                            | .634                                      | .542    | .092    | 87.2                          | 94.9                                          | 82.0 | 12.9  |
| 9     | .611                                            | .701                                      | .552    | .149    | 88.3                          | 98.6                                          | 82.4 | 16.2  |
| 10    | .674                                            | .733                                      | .606    | .127    | 88.8                          | 99.2                                          | 81.8 | 17.4  |
| 11    | .672                                            | .739                                      | .564    | .175    | 86.9                          | 97.8                                          | 78.4 | 19.4  |
| 12    | .622                                            | .675                                      | .543    | .132    | 87.7                          | 96.7                                          | 80.8 | 15.9  |
| 13    | .643                                            | .694                                      | .588    | .106    | 88.5                          | 96.6                                          | 82.0 | 14.6  |
| 14    | .681                                            | .740                                      | .612    | .128    | 87.4                          | 96.4                                          | 76.0 | 20.4  |
| 15    | .680                                            | .751                                      | .595    | .156    | 84.8                          | 95.0                                          | 76.4 | 18.6  |
| 16    | .652                                            | .693                                      | .561    | .132    | 85.8                          | 96.3                                          | 74.2 | 22.1  |
| 17    | .666                                            | .735                                      | .600    | .135    | 85.9                          | 94.3                                          | 78.2 | 16.1  |
| 18    | .665                                            | .720                                      | .586    | .134    | 87.0                          | 95.8                                          | 77.0 | 18.8  |
| 19    | .661                                            | .720                                      | .604    | .116    | 87.9                          | 97.3                                          | 79.2 | 18.1  |
| 20    | .681                                            | .740                                      | .624    | .116    | 89.3                          | 97.8                                          | 83.0 | 14.8  |
| 21    | .670                                            | .734                                      | .576    | .158    | 89.3                          | 97.2                                          | 83.8 | 13.4  |
| 22    | .621                                            | .672                                      | .532    | .140    | 89.2                          | 95.8                                          | 83.8 | 12.0  |
| 23    | .577                                            | .642                                      | .495    | .147    | 89.3                          | 96.4                                          | 83.8 | 12.6  |
| 24    | .599                                            | .647                                      | .497    | .150    | 88.3                          | 96.8                                          | 80.4 | 16.4  |
| 25    | .595                                            | .657                                      | .523    | .134    | 90.0                          | 97.8                                          | 84.0 | 13.8  |
| 26    | .614                                            | .680                                      | .553    | .127    | 90.7                          | 102.6                                         | 83.0 | 19.6  |
| 27    | .585                                            | .660                                      | .505    | .155    | 92.0                          | 105.8                                         | 83.0 | 22.8  |
| 28    | .553                                            | .617                                      | .479    | .138    | 91.2                          | 101.0                                         | 84.4 | 16.6  |
| 29    | .547                                            | .623                                      | .476    | .147    | 90.3                          | 98.2                                          | 84.6 | 13.6  |
| 30    | .610                                            | .677                                      | .542    | .135    | 90.2                          | 98.4                                          | 83.0 | 15.4  |
| 31    | .633                                            | .690                                      | .537    | .153    | 90.6                          | 98.0                                          | 85.0 | 13.0  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                    |
| 1     | 72.7                            | 8.7                 | 66.6                | 14.8                         | 0.651                            | 6.99                                             | 4.28                                                                | 0.62                                                               |
| 2     | 74.4                            | 4.4                 | 71.3                | 7.5                          | .758                             | 8.20                                             | 2.24                                                                | .79                                                                |
| 3     | 72.6                            | 6.3                 | 68.2                | 10.7                         | .686                             | 7.41                                             | 3.06                                                                | .71                                                                |
| 4     | 74.1                            | 5.4                 | 70.3                | 9.2                          | .734                             | .93                                              | 2.73                                                                | .74                                                                |
| 5     | 76.2                            | 6.0                 | 72.0                | 10.2                         | .776                             | 8.33                                             | 3.21                                                                | .72                                                                |
| 6     | 79.3                            | 4.9                 | 75.9                | 8.3                          | .879                             | 9.42                                             | 2.82                                                                | .77                                                                |
| 7     | 80.7                            | 3.7                 | 78.1                | 6.3                          | .943                             | 10.10                                            | .21                                                                 | .82                                                                |
| 8     | 82.4                            | 4.8                 | 79.5                | 7.7                          | .986                             | .49                                              | .88                                                                 | .79                                                                |
| 9     | 82.0                            | 6.3                 | 78.2                | 10.1                         | .946                             | .05                                              | 3.75                                                                | .73                                                                |
| 10    | 81.7                            | 7.1                 | 77.4                | 11.4                         | .922                             | 9.79                                             | 4.21                                                                | .70                                                                |
| 11    | 80.2                            | 6.7                 | 76.2                | 10.7                         | .887                             | .45                                              | 3.80                                                                | .71                                                                |
| 12    | 81.5                            | 6.2                 | 77.8                | 9.9                          | .934                             | .93                                              | .63                                                                 | .73                                                                |
| 13    | 81.7                            | 6.8                 | 77.6                | 10.9                         | .928                             | .85                                              | 4.03                                                                | .71                                                                |
| 14    | 79.6                            | 7.8                 | 74.9                | 12.5                         | .851                             | .04                                              | .41                                                                 | .67                                                                |
| 15    | 78.5                            | 6.3                 | 74.1                | 10.7                         | .830                             | 8.87                                             | 3.59                                                                | .71                                                                |
| 16    | 80.5                            | 5.3                 | 76.8                | 9.0                          | .905                             | 9.65                                             | .18                                                                 | .75                                                                |
| 17    | 80.9                            | 5.0                 | 77.4                | 8.5                          | .922                             | .83                                              | .04                                                                 | .76                                                                |
| 18    | 81.5                            | 5.5                 | 78.2                | 8.8                          | .946                             | 10.07                                            | .22                                                                 | .76                                                                |
| 19    | 82.3                            | 5.6                 | 78.9                | 9.0                          | .967                             | .28                                              | .36                                                                 | .75                                                                |
| 20    | 83.3                            | 6.0                 | 79.7                | 9.6                          | .992                             | .51                                              | .70                                                                 | .74                                                                |
| 21    | 82.7                            | 6.6                 | 78.7                | 10.6                         | .961                             | .18                                              | 4.03                                                                | .72                                                                |
| 22    | 83.1                            | 6.1                 | 79.4                | 9.8                          | .983                             | .41                                              | 3.75                                                                | .74                                                                |
| 23    | 83.2                            | 6.1                 | 79.5                | 9.8                          | .986                             | .45                                              | .76                                                                 | .74                                                                |
| 24    | 80.4                            | 7.9                 | 75.7                | 12.6                         | .873                             | 9.26                                             | 4.54                                                                | .67                                                                |
| 25    | 83.2                            | 6.8                 | 79.1                | 10.9                         | .973                             | 10.30                                            | .20                                                                 | .71                                                                |
| 26    | 83.6                            | 7.1                 | 79.3                | 11.4                         | .979                             | .36                                              | .44                                                                 | .70                                                                |
| 27    | 83.8                            | 8.2                 | 78.9                | 13.1                         | .967                             | .20                                              | 5.16                                                                | .66                                                                |
| 28    | 85.0                            | 6.2                 | 81.3                | 9.9                          | 1.043                            | 11.02                                            | 4.00                                                                | .73                                                                |
| 29    | 84.2                            | 6.1                 | 80.5                | 9.8                          | .017                             | 10.76                                            | 3.87                                                                | .74                                                                |
| 30    | 82.7                            | 7.5                 | 78.2                | 12.0                         | 0.946                            | .00                                              | 4.59                                                                | .69                                                                |
| 31    | 83.3                            | 7.3                 | 78.9                | 11.7                         | .967                             | .22                                              | .54                                                                 | .69                                                                |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer at<br>32° Fahr. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|-------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                 | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                         | Inches.                                                      | Inches. | Inches. | o                             | o                                                                | o    | o     |
| Mid-<br>night. | 29.660                                          | 29.868                                                       | 29.545  | 0.323   | 82.2                          | 86.8                                                             | 73.2 | 13.6  |
| 1              | .650                                            | .858                                                         | .534    | .324    | 81.9                          | 86.2                                                             | 73.2 | 13.0  |
| 2              | .639                                            | .839                                                         | .525    | .314    | 81.7                          | 85.6                                                             | 72.9 | 12.7  |
| 3              | .630                                            | .826                                                         | .511    | .315    | 81.4                          | 85.8                                                             | 72.6 | 13.2  |
| 4              | .635                                            | .823                                                         | .531    | .292    | 81.1                          | 85.8                                                             | 72.2 | 13.6  |
| 5              | .646                                            | .830                                                         | .540    | .290    | 81.0                          | 85.6                                                             | 71.7 | 13.9  |
| 6              | .660                                            | .846                                                         | .571    | .275    | 81.1                          | 86.6                                                             | 72.0 | 14.6  |
| 7              | .677                                            | .868                                                         | .573    | .295    | 82.5                          | 88.2                                                             | 73.4 | 14.8  |
| 8              | .693                                            | .895                                                         | .582    | .313    | 85.2                          | 89.8                                                             | 77.0 | 12.8  |
| 9              | .700                                            | .900                                                         | .582    | .318    | 88.1                          | 93.6                                                             | 80.7 | 12.9  |
| 10             | .701                                            | .896                                                         | .582    | .314    | 90.5                          | 96.5                                                             | 83.6 | 12.9  |
| 11             | .690                                            | .874                                                         | .568    | .306    | 92.6                          | 97.4                                                             | 85.2 | 12.2  |
| Noon.          | .673                                            | .851                                                         | .548    | .303    | 94.1                          | 101.4                                                            | 85.6 | 15.8  |
| 1              | .650                                            | .827                                                         | .535    | .292    | 95.1                          | 103.0                                                            | 86.8 | 16.2  |
| 2              | .626                                            | .820                                                         | .521    | .299    | 95.3                          | 104.4                                                            | 74.3 | 30.1  |
| 3              | .604                                            | .818                                                         | .512    | .306    | 95.4                          | 105.8                                                            | 76.7 | 29.1  |
| 4              | .585                                            | .811                                                         | .481    | .330    | 94.3                          | 105.0                                                            | 75.6 | 29.4  |
| 5              | .576                                            | .812                                                         | .476    | .336    | 92.7                          | 101.5                                                            | 75.7 | 25.8  |
| 6              | .589                                            | .813                                                         | .488    | .325    | 89.8                          | 96.5                                                             | 74.8 | 21.7  |
| 7              | .613                                            | .822                                                         | .496    | .326    | 86.8                          | 91.6                                                             | 74.2 | 17.4  |
| 8              | .635                                            | .838                                                         | .516    | .322    | 84.6                          | 90.0                                                             | 74.2 | 15.8  |
| 9              | .653                                            | .843                                                         | .549    | .294    | 83.7                          | 88.2                                                             | 73.6 | 14.6  |
| 10             | .661                                            | .842                                                         | .561    | .281    | 83.3                          | 88.0                                                             | 74.2 | 13.8  |
| 11             | .663                                            | .856                                                         | .573    | .283    | 82.7                          | 87.6                                                             | 73.8 | 13.8  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 78.6                            | 3.6                 | 76.1                | 6.1                          | 0.885                            | 9.51                                             | 2.03                                                                | 0.82                                                                |
| 1              | 78.7                            | 3.2                 | 76.5                | 5.4                          | .896                             | .65                                              | 1.79                                                                | .84                                                                 |
| 2              | 78.7                            | 3.0                 | 76.6                | 5.1                          | .899                             | .67                                              | .70                                                                 | .85                                                                 |
| 3              | 78.7                            | 2.7                 | 76.8                | 4.6                          | .905                             | .73                                              | .54                                                                 | .86                                                                 |
| 4              | 78.7                            | 2.4                 | 77.0                | 4.1                          | .910                             | .81                                              | .36                                                                 | .88                                                                 |
| 5              | 78.7                            | 2.3                 | 77.1                | 3.9                          | .913                             | .84                                              | .30                                                                 | .88                                                                 |
| 6              | 79.0                            | 2.1                 | 77.5                | 3.6                          | .925                             | .96                                              | .21                                                                 | .89                                                                 |
| 7              | 79.9                            | 2.6                 | 78.1                | 4.4                          | .943                             | 10.14                                            | .50                                                                 | .87                                                                 |
| 8              | 81.0                            | 4.2                 | 78.1                | 7.1                          | .943                             | .08                                              | 2.53                                                                | .80                                                                 |
| 9              | 81.8                            | 6.3                 | 78.0                | 10.1                         | .940                             | 9.99                                             | 3.73                                                                | .73                                                                 |
| 10             | 82.3                            | 8.2                 | 77.4                | 13.1                         | .922                             | .75                                              | 4.97                                                                | .66                                                                 |
| 11             | 83.0                            | 9.6                 | 77.2                | 15.4                         | .916                             | .65                                              | 5.98                                                                | .62                                                                 |
| Noon.          | 83.2                            | 10.9                | 76.7                | 17.4                         | .902                             | .47                                              | 6.85                                                                | .58                                                                 |
| 1              | 83.6                            | 11.5                | 76.7                | 18.4                         | .902                             | .45                                              | 7.34                                                                | .56                                                                 |
| 2              | 83.2                            | 12.1                | 75.9                | 19.4                         | .879                             | .21                                              | .68                                                                 | .55                                                                 |
| 3              | 83.1                            | 12.3                | 75.7                | 19.7                         | .875                             | .13                                              | .81                                                                 | .54                                                                 |
| 4              | 82.9                            | 11.4                | 76.1                | 18.2                         | .885                             | .28                                              | .13                                                                 | .57                                                                 |
| 5              | 82.5                            | 10.2                | 76.4                | 16.3                         | .893                             | .41                                              | 6.27                                                                | .60                                                                 |
| 6              | 81.8                            | 8.0                 | 77.0                | 12.8                         | .910                             | .63                                              | 4.79                                                                | .67                                                                 |
| 7              | 80.5                            | 6.3                 | 76.7                | 10.1                         | .902                             | .60                                              | 3.61                                                                | .73                                                                 |
| 8              | 79.4                            | 5.2                 | 75.8                | 8.8                          | .876                             | .37                                              | .02                                                                 | .76                                                                 |
| 9              | 79.1                            | 4.6                 | 75.9                | 7.8                          | .879                             | .42                                              | 2.65                                                                | .78                                                                 |
| 10             | 78.9                            | 4.4                 | 75.8                | 7.5                          | .876                             | .39                                              | .54                                                                 | .79                                                                 |
| 11             | 78.8                            | 3.9                 | 76.1                | 6.6                          | .885                             | .50                                              | .22                                                                 | .81                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General Aspect of the Sky.                                                                                                                                       |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   | lb                     |                                                                                                                                                                  |
| 1     | 130.5                 | ...                             | S. & variable.                    | 3.50                   | Overcast to 2 A. M., scatd. \i to 3 P. M., scatd. \i & \i afterwards. Thin rain at Midnight.                                                                     |
| 2     | 126.0                 | ...                             | S. by W. & N. E.                  | 3.00                   | Scatd. \i to 6 A. M. \i to Noon \i & \i afterwards. Lightning to S. E. at 1 P. M. Thunder at 2 P. M. Thin rain at 2 & 8 P. M.                                    |
| 3     | 126.0                 | ...                             | N. W. & S. by E.                  | 1.75                   | \i to 5 A. M. scatd. \i to 11 A. M. \i & \i afterwards. Lightning to W. at 8 & 9 P. M.                                                                           |
| 4     | 129.6                 | 0.88                            | S. by E. & E.                     | 2.20                   | \i to 3 A. M. Scatd. \i to 1 P. M. \i afterwards. Thunder at 3 & 4 P. M. Lightning at 4 & 8 P. M. Hail at 4 P. M. Rain from 3 to 5 P. M.                         |
| 5     | 130.2                 | ...                             | E. & S.                           | 0.50                   | Scatd. \i to 7 P. M., clear afterwards.                                                                                                                          |
| 6     | 127.0                 | 0.31                            | S. S. E. & S.                     | 2.70                   | Clear to 1 A. M. Scuds from S. to 11 A. M., scatd. \i to 3 P. M. Overcast afterwards. Thunder at 7 & 8 P. M. Lightning from 7 to 11 P. M. Rain from 6 to 8 P. M. |
| 7     | 129.0                 | ...                             | S. & S. S. E. & E.                | 1.00                   | Scatd. \i to 4 P. M., clear afterwards.                                                                                                                          |
| 8     | 135.0                 | ...                             | S. by E. & S.                     | 1.00                   | Clear to 4 A. M. Scuds from S to A. M., scatd. \i to 4 P. M., clear afterwards.                                                                                  |
| 9     | 135.0                 | ...                             | S. & variable                     | 1.50                   | Clear to 3 A. M. Scuds from S. to 10 A. M., clear afterwards.                                                                                                    |
| 10    | 140.0                 | ...                             | S.                                | 0.50                   | Clear to 2 P. M. Scatd. \i to 7 P. M., clear afterwards. Lightning to N. at 8 P. M.                                                                              |
| 11    | 137.0                 | 0.12                            | S. & variable.                    | 3.60                   | Clear to 5 A. M. Scatd. \i to 8 P. M., clear afterwards. Lightning to N. E. at 7 & 8 P. M. Rain at 7 P. M.                                                       |
| 12    | 136.0                 | ...                             | S.                                | 0.60                   | Clear.                                                                                                                                                           |
| 13    | 128.2                 | ...                             | S. & S. S. E.                     | 0.50                   | Scatd. \i to 6 A. M. Scuds from S. to 10 A. M. Scatd. \i afterwards. Lightning to N. W. at 8, 9 & 11 P. M.                                                       |
| 14    | 130.0                 | 0.55                            | S. E. & S. by E.                  | 19.50                  | Clear to 6 A. M. \i to 7 P. M. Overcast afterwards. Lightning from 7 to 11 P. M. Thunder from 8 to 10 P. M. Rain at 8 P. M.                                      |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                                                                                                |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15    | 129.2                 | ...                             | Variable.                         | 2.00                   | Overcast to 4 A. M. Clear to Noon. Scatd $\curvearrowright$ to 6 P. M. Scatd $\searrow$ afterwards.                                                                                                                       |
| 16    | 134.9                 | 0.58                            | S. & S. by E.                     | 12.00                  | Scatd. $\searrow$ to 5 A. M., scatd. $\curvearrowright$ to 6 P. M. Overcast afterwards. Lightning from 7 to 10 P. M. Thunder at 7 & 8 P. M. Rain between 6 & 7 P. M.                                                      |
| 17    | 130.2                 | ...                             | S. by E. & S. by W.               | 0.25                   | Clear to 7 A. M., scatd. $\curvearrowright$ to 6 P. M., clear afterwards.                                                                                                                                                 |
| 18    | 128.0                 | 0.12                            | S. & S. S. W.                     | 3.00                   | Clear to 6 A. M., scatd $\curvearrowright$ to 6 P. M. Overcast afterwards. Rain between 7 & 8 P. M.                                                                                                                       |
| 19    | 132.0                 | ...                             | S. S. W. & S. W. & S.             | 0.70                   | Clear to 11 A. M., scatd $\curvearrowright$ to 2 P. M., clear afterwards.                                                                                                                                                 |
| 20    | 130.0                 | ...                             | S. S. W. & S.                     | 0.50                   | Clear.                                                                                                                                                                                                                    |
| 21    | 130.2                 | ...                             | S. & S. S. W.                     | 0.30                   | Scatd. $\searrow$ to 4 A. M., clear afterwards.                                                                                                                                                                           |
| 22    | 134.0                 | ...                             | S. & S. S. W.                     | 0.70                   | Clear.                                                                                                                                                                                                                    |
| 23    | 129.0                 | ...                             | S. & S. S. W.                     | 3.50                   | Clear to 5 A. M., scuds from S. to 11 A. M., clear afterwards. Shock of an earthquake, felt at 3-41 from N. W. to S. E., the shock, or shocks, lasted several minutes and there was apparently a cross wave from N. to S. |
| 24    | 132.0                 | ...                             | S. & S. S. E.                     | 1.25                   | Scatd. $\curvearrowright$ to 11 A. M., clear afterwards. Lighting to N. W. at 8 & 9 P. M.                                                                                                                                 |
| 25    | 130.0                 | ...                             | S. & S. S. W.                     | 1.00                   | Clear.                                                                                                                                                                                                                    |
| 26    | 141.6                 | ...                             | S. & S. S. W.                     | 1.00                   | Clear.                                                                                                                                                                                                                    |
| 27    | 143.0                 | ...                             | S. & S. W.                        | 0.60                   | Clear.                                                                                                                                                                                                                    |
| 28    | 132.0                 | ...                             | S.                                | 0.25                   | Clear to 3 A. M., scuds from S. to 7 A. M., clear to 6 P. M., scuds from S. afterwards.                                                                                                                                   |
| 29    | 128.0                 | ...                             | S. & S. S. W.                     | 1.50                   | Scuds from S. to 9 A. M. Clouds of different kinds afterwards.                                                                                                                                                            |
| 30    | 133.0                 | ...                             | S. & S. S. W.                     | 1.30                   | Clear to 4 A. M., scatd. $\curvearrowright$ to 6 P. M. Overcast afterwards. Lightning to N. W. at 8 & 9 P. M. Thin rain between 1 & 9 P. M.                                                                               |
| 31    | 130.0                 | ...                             | S. & S. S. W.                     | 0.80                   | Scatd. $\curvearrowright$ .                                                                                                                                                                                               |

$\searrow$  i Cirri, — i Strati,  $\curvearrowright$  i Cumuli,  $\searrow$  i Cirro-strati,  $\sim$  i Cumulo strati,  $\sim$  i Nimbi,  $\searrow$  i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of May 1866.*

MONTHLY RESULTS.

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|                                                                   | Inches. |
|-------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ...                   | 29.646  |
| Max. height of the Barometer occurred at 9 A. M. on the 1st, ...  | 29.900  |
| Min. height of the Barometer occurred at 5 P. M. on the 29th, ... | 29.476  |
| <i>Extreme range</i> of the Barometer during the month, ...       | 0.424   |
| Mean of the daily Max. Pressures, ...                             | 29.708  |
| Ditto ditto Min. ditto ...                                        | 29.571  |
| <i>Mean daily range</i> of the Barometer during the month, ...    | 0.137   |

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|                                                                  | °     |
|------------------------------------------------------------------|-------|
| Mean Dry Bulb Thermometer for the month, ...                     | 87.0  |
| Max. Temperature occurred at 3 P. M. on the 27th ...             | 105.8 |
| Min. Temperature occurred at 5 A. M. on the 3rd ...              | 71.7  |
| <i>Extreme range</i> of the Temperature during the month, ...    | 34.1  |
| Mean of the daily Max. Temperature ...                           | 96.1  |
| Ditto ditto Min. ditto, ...                                      | 79.6  |
| <i>Mean daily range</i> of the Temperature during the month, ... | 16.5  |

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|                                                                |      |
|----------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ...                   | 80.7 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ... | 6.3  |
| Computed Mean Dew-point for the month, ...                     | 76.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ...   | 10.1 |

|                                                 | Inches. |
|-------------------------------------------------|---------|
| Mean Elastic force of Vapour for the month, ... | 0.908   |

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|                                                                             | Troy grains. |
|-----------------------------------------------------------------------------|--------------|
| Mean Weight of Vapour for the month ...                                     | 9.66         |
| Additional Weight of Vapour required for complete saturation, ...           | 3.63         |
| Mean degree of humidity for the month, complete saturation being unity 0.73 |              |

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|                                                                                              | Inches. |
|----------------------------------------------------------------------------------------------|---------|
| Rained 9 days,—Max. fall of rain during 24 hours ...                                         | 0.88    |
| Total amount of rain during the month, ...                                                   | 2.56    |
| Total amount of rain indicated by the Gauge attached to the anemometer during the month. ... | 1.85    |
| Prevailing direction of the Wind, ... S. & S. S. W. & S. S. E.                               |         |

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N. | Rain on. | N. E. | Rain on. | N. N. E. | Rain on. | N. by E. | Rain on. | E. by S. | Rain on. | E. S. E. | Rain on. | S. E. | Rain on. | S. by E. | Rain on. | S. S. E. | Rain on. | S. S. W. | Rain on. | S. W. | Rain on. | W. S. W. | Rain on. | W. by N. | Rain on. | W. N. W. | Rain on. | N. W. | Rain on. | N. N. W. | Rain on. | N. by W. | Rain on. |  |  |  |  |  |
|-----------|----|----------|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|----------|----------|----------|----------|----------|----------|----------|-------|----------|----------|----------|----------|----------|----------|----------|-------|----------|----------|----------|----------|----------|--|--|--|--|--|
| Mid night |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 1         |    |          | 1     |          |          |          |          |          |          |          | 1        |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 2         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 3         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 4         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 5         |    |          | 1     |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 6         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 7         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 8         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 9         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 10        |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 11        |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| Noon.     |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 1         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 2         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 3         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 4         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 5         | 2  |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 6         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 7         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 8         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 9         |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 10        |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |
| 11        |    |          |       |          |          |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |          |          |       |          |          |          |          |          |  |  |  |  |  |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18-11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.610                                          | 29.662                                    | 29.548  | 0.114   | 89.9                          | 99.2                                          | 83.0 | 16.2  |
| 2     | .629                                            | .682                                      | .557    | .125    | 87.4                          | 98.0                                          | 79.6 | 18.4  |
| 3     | .625                                            | .678                                      | .555    | .123    | 87.8                          | 98.4                                          | 79.2 | 19.2  |
| 4     | .593                                            | .647                                      | .480    | .167    | 88.9                          | 98.2                                          | 81.4 | 16.8  |
| 5     | .571                                            | .628                                      | .499    | .129    | 90.2                          | 98.4                                          | 83.4 | 15.0  |
| 6     | .509                                            | .557                                      | .404    | .153    | 90.4                          | 98.6                                          | 84.0 | 14.6  |
| 7     | .494                                            | .551                                      | .431    | .120    | 91.1                          | 99.8                                          | 84.2 | 15.6  |
| 8     | .551                                            | .612                                      | .479    | .133    | 91.4                          | 101.6                                         | 83.6 | 18.0  |
| 9     | .570                                            | .622                                      | .497    | .125    | 90.5                          | 97.8                                          | 82.0 | 15.8  |
| 10    | .546                                            | .621                                      | .447    | .174    | 89.5                          | 98.6                                          | 76.2 | 22.4  |
| 11    | .503                                            | .573                                      | .423    | .150    | 88.3                          | 96.8                                          | 80.2 | 16.6  |
| 12    | .499                                            | .550                                      | .425    | .125    | 89.1                          | 95.6                                          | 85.4 | 10.2  |
| 13    | .532                                            | .604                                      | .462    | .142    | 89.4                          | 98.4                                          | 83.0 | 15.4  |
| 14    | .538                                            | .596                                      | .450    | .146    | 89.9                          | 98.2                                          | 84.6 | 13.6  |
| 15    | .492                                            | .544                                      | .440    | .104    | 83.4                          | 86.5                                          | 80.8 | 5.7   |
| 16    | .494                                            | .533                                      | .443    | .090    | 83.3                          | 87.3                                          | 79.6 | 7.7   |
| 17    | .515                                            | .571                                      | .451    | .120    | 82.2                          | 85.0                                          | 79.6 | 5.4   |
| 18    | .531                                            | .575                                      | .476    | .099    | 82.9                          | 87.2                                          | 78.4 | 8.8   |
| 19    | .503                                            | .563                                      | .436    | .127    | 82.7                          | 86.8                                          | 80.0 | 6.8   |
| 20    | .425                                            | .485                                      | .350    | .135    | 84.3                          | 89.0                                          | 81.8 | 7.2   |
| 21    | .375                                            | .416                                      | .319    | .097    | 80.9                          | 82.4                                          | 79.0 | 3.4   |
| 22    | .429                                            | .519                                      | .365    | .154    | 82.1                          | 89.2                                          | 79.0 | 10.2  |
| 23    | .502                                            | .557                                      | .446    | .111    | 83.3                          | 90.8                                          | 79.4 | 11.4  |
| 24    | .483                                            | .545                                      | .408    | .137    | 82.9                          | 87.3                                          | 79.6 | 8.2   |
| 25    | .441                                            | .489                                      | .380    | .109    | 85.7                          | 91.2                                          | 81.8 | 9.4   |
| 26    | .431                                            | .477                                      | .376    | .101    | 85.3                          | 89.5                                          | 81.2 | 8.3   |
| 27    | .465                                            | .520                                      | .415    | .105    | 83.3                          | 85.1                                          | 80.6 | 4.5   |
| 28    | .514                                            | .579                                      | .452    | .127    | 84.1                          | 88.6                                          | 82.0 | 6.6   |
| 29    | .573                                            | .637                                      | .503    | .134    | 87.2                          | 93.4                                          | 83.4 | 10.0  |
| 30    | .607                                            | .667                                      | .560    | .107    | 83.9                          | 87.4                                          | 81.8 | 5.6   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                    |
| 1     | 82.2                            | 7.7                 | 77.6                | 12.3                         | 0.928                            | 9.83                                             | 4.63                                                                | 0.63                                                               |
| 2     | 80.7                            | 6.7                 | 76.7                | 10.7                         | .902                             | .58                                              | 3.87                                                                | .71                                                                |
| 3     | 81.0                            | 6.8                 | 76.9                | 10.9                         | .908                             | .64                                              | 4.04                                                                | .71                                                                |
| 4     | 82.7                            | 6.2                 | 79.0                | 9.9                          | .970                             | 10.29                                            | 3.75                                                                | .73                                                                |
| 5     | 83.7                            | 6.5                 | 79.8                | 10.4                         | .995                             | .54                                              | 4.05                                                                | .72                                                                |
| 6     | 83.1                            | 7.3                 | 78.7                | 11.7                         | .961                             | .16                                              | .51                                                                 | .69                                                                |
| 7     | 84.1                            | 7.0                 | 79.9                | 11.2                         | .998                             | .54                                              | .43                                                                 | .70                                                                |
| 8     | 83.6                            | 7.8                 | 78.9                | 12.5                         | .967                             | .20                                              | .90                                                                 | .68                                                                |
| 9     | 82.8                            | 7.7                 | 78.2                | 12.3                         | .946                             | .00                                              | .72                                                                 | .68                                                                |
| 10    | 82.4                            | 7.1                 | 78.1                | 11.4                         | .943                             | .00                                              | .29                                                                 | .70                                                                |
| 11    | 81.6                            | 6.7                 | 77.6                | 10.7                         | .928                             | 9.85                                             | 3.95                                                                | .71                                                                |
| 12    | 83.2                            | 5.9                 | 79.7                | 9.4                          | .992                             | 10.53                                            | .79                                                                 | .75                                                                |
| 13    | 83.0                            | 6.4                 | 79.2                | 10.2                         | .976                             | .35                                              | .90                                                                 | .73                                                                |
| 14    | 82.3                            | 7.6                 | 77.7                | 12.2                         | .931                             | 9.86                                             | 4.60                                                                | .68                                                                |
| 15    | 80.6                            | 2.8                 | 78.6                | 4.8                          | .958                             | 10.28                                            | 1.68                                                                | .86                                                                |
| 16    | 80.1                            | 3.2                 | 77.9                | 5.4                          | .937                             | .06                                              | .87                                                                 | .84                                                                |
| 17    | 79.7                            | 2.5                 | 77.9                | 4.3                          | .937                             | .08                                              | .46                                                                 | .87                                                                |
| 18    | 79.5                            | 3.4                 | 77.1                | 5.8                          | .913                             | 9.80                                             | .99                                                                 | .83                                                                |
| 19    | 80.5                            | 2.2                 | 79.0                | 3.7                          | .970                             | 10.42                                            | .30                                                                 | .89                                                                |
| 20    | 80.6                            | 3.7                 | 78.0                | 6.3                          | .940                             | .07                                              | 2.21                                                                | .82                                                                |
| 21    | 78.8                            | 2.1                 | 77.3                | 3.6                          | .919                             | 9.90                                             | 1.20                                                                | .89                                                                |
| 22    | 79.9                            | 2.2                 | 78.4                | 3.7                          | .952                             | 10.23                                            | .28                                                                 | .89                                                                |
| 23    | 80.4                            | 2.9                 | 78.4                | 4.9                          | .952                             | .21                                              | .72                                                                 | .86                                                                |
| 24    | 79.9                            | 3.0                 | 77.8                | 5.1                          | .934                             | .03                                              | .76                                                                 | .85                                                                |
| 25    | 80.3                            | 5.4                 | 76.5                | 9.2                          | .896                             | 9.57                                             | 3.23                                                                | .75                                                                |
| 26    | 80.4                            | 4.9                 | 77.0                | 8.3                          | .910                             | .73                                              | 2.91                                                                | .77                                                                |
| 27    | 81.2                            | 2.1                 | 79.7                | 3.6                          | .992                             | 10.63                                            | 1.30                                                                | .89                                                                |
| 28    | 81.7                            | 2.4                 | 80.0                | 4.1                          | 1.001                            | .72                                              | .49                                                                 | .88                                                                |
| 29    | 81.0                            | 6.2                 | 77.3                | 9.9                          | 0.919                            | 9.78                                             | 3.59                                                                | .73                                                                |
| 30    | 79.8                            | 4.1                 | 76.9                | 7.0                          | .908                             | .72                                              | 2.41                                                                | .80                                                                |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations.  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | °                          | °                                                        | °    | °     |
| Mid-night. | 29.532                                    | 29.642                                                 | 29.497  | 0.239   | 83.4                       | 87.2                                                     | 79.2 | 8.0   |
| 1          | .518                                      | .630                                                   | .397    | .233    | 83.2                       | 87.0                                                     | 79.2 | 7.8   |
| 2          | .507                                      | .621                                                   | .383    | .238    | 83.0                       | 87.0                                                     | 79.2 | 7.8   |
| 3          | .500                                      | .633                                                   | .367    | .266    | 82.8                       | 86.8                                                     | 78.8 | 8.0   |
| 4          | .497                                      | .641                                                   | .365    | .276    | 82.7                       | 86.8                                                     | 78.4 | 8.4   |
| 5          | .597                                      | .644                                                   | .365    | .279    | 82.7                       | 86.4                                                     | 78.8 | 7.6   |
| 6          | .524                                      | .651                                                   | .379    | .272    | 82.7                       | 86.6                                                     | 79.0 | 7.6   |
| 7          | .539                                      | .664                                                   | .397    | .267    | 83.7                       | 88.0                                                     | 80.0 | 8.0   |
| 8          | .553                                      | .678                                                   | .397    | .281    | 85.2                       | 90.8                                                     | 80.6 | 10.2  |
| 9          | .561                                      | .676                                                   | .396    | .280    | 86.9                       | 95.0                                                     | 81.0 | 14.0  |
| 10         | .561                                      | .682                                                   | .394    | .283    | 88.5                       | 97.2                                                     | 80.4 | 16.8  |
| 11         | .552                                      | .676                                                   | .379    | .297    | 89.8                       | 98.6                                                     | 80.6 | 18.0  |
| Noon.      | .539                                      | .651                                                   | .362    | .289    | 90.9                       | 100.6                                                    | 81.3 | 19.3  |
| 1          | .520                                      | .632                                                   | .352    | .280    | 91.6                       | 101.6                                                    | 82.4 | 19.2  |
| 2          | .499                                      | .618                                                   | .339    | .279    | 91.9                       | 101.2                                                    | 81.6 | 19.6  |
| 3          | .481                                      | .579                                                   | .329    | .250    | 91.9                       | 101.0                                                    | 80.8 | 20.2  |
| 4          | .463                                      | .565                                                   | .319    | .246    | 91.0                       | 100.2                                                    | 80.4 | 19.8  |
| 5          | .459                                      | .652                                                   | .323    | .329    | 90.0                       | 98.2                                                     | 81.0 | 17.2  |
| 6          | .475                                      | .578                                                   | .343    | .235    | 88.2                       | 95.2                                                     | 81.4 | 13.8  |
| 7          | .500                                      | .601                                                   | .362    | .239    | 85.9                       | 92.7                                                     | 76.2 | 16.5  |
| 8          | .520                                      | .614                                                   | .382    | .232    | 85.1                       | 90.8                                                     | 79.4 | 11.4  |
| 9          | .538                                      | .656                                                   | .401    | .255    | 84.4                       | 89.8                                                     | 79.0 | 10.8  |
| 10         | .549                                      | .651                                                   | .411    | .240    | 83.9                       | 88.4                                                     | 79.2 | 9.2   |
| 11         | .547                                      | .656                                                   | .416    | .240    | 83.5                       | 87.8                                                     | 79.4 | 8.4   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.      | Mean Wet Bulb Thermometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew Point. | Mean Elastic force of Vapour. | Mean Weight of Vapour in a Cubic foot of air. | Additional Weight of Vapour required for complete saturation. | Mean degree of Humidity, complete saturation being unity. |
|------------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|            | o                          | o                   | o                   | o                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| Mid-night. | 80.3                       | 3.1                 | 78.1                | 5.3                       | 0.943                         | 10.12                                         | 1.84                                                          | 0.85                                                      |
| 1          | 80.3                       | 2.9                 | 78.3                | 4.9                       | .949                          | .18                                           | .71                                                           | .86                                                       |
| 2          | 80.5                       | 2.5                 | 78.7                | 4.3                       | .961                          | .33                                           | .49                                                           | .87                                                       |
| 3          | 80.5                       | 2.3                 | 78.9                | 3.9                       | .967                          | .39                                           | .36                                                           | .88                                                       |
| 4          | 80.5                       | 2.2                 | 79.0                | 3.7                       | .970                          | .42                                           | .30                                                           | .89                                                       |
| 5          | 80.6                       | 2.1                 | 79.1                | 3.6                       | .973                          | .45                                           | .27                                                           | .89                                                       |
| 6          | 80.6                       | 2.1                 | 79.1                | 3.6                       | .973                          | .45                                           | .27                                                           | .89                                                       |
| 7          | 81.1                       | 2.6                 | 79.3                | 4.4                       | .979                          | .51                                           | .56                                                           | .87                                                       |
| 8          | 81.4                       | 3.8                 | 78.7                | 6.5                       | .961                          | .26                                           | 2.35                                                          | .81                                                       |
| 9          | 81.8                       | 5.1                 | 78.7                | 8.2                       | .961                          | .24                                           | 3.01                                                          | .77                                                       |
| 10         | 82.0                       | 6.5                 | 78.1                | 10.4                      | .943                          | .02                                           | .86                                                           | .72                                                       |
| 11         | 82.3                       | 7.5                 | 77.8                | 12.0                      | .934                          | 9.89                                          | 4.53                                                          | .69                                                       |
| Noon.      | 82.8                       | 8.1                 | 77.9                | 13.0                      | .937                          | .90                                           | .99                                                           | .67                                                       |
| 1          | 82.9                       | 8.7                 | 77.7                | 13.9                      | .931                          | .82                                           | 5.37                                                          | .65                                                       |
| 2          | 83.1                       | 8.8                 | 77.8                | 14.1                      | .934                          | .85                                           | .47                                                           | .64                                                       |
| 3          | 82.9                       | 9.0                 | 77.5                | 14.4                      | .925                          | .76                                           | .56                                                           | .64                                                       |
| 4          | 82.9                       | 8.1                 | 78.0                | 13.0                      | .940                          | .93                                           | .00                                                           | .67                                                       |
| 5          | 82.5                       | 7.5                 | 78.0                | 12.0                      | .940                          | .95                                           | 4.55                                                          | .69                                                       |
| 6          | 82.2                       | 6.0                 | 78.6                | 9.6                       | .958                          | 10.17                                         | 3.59                                                          | .74                                                       |
| 7          | 80.9                       | 5.0                 | 77.4                | 8.5                       | .922                          | 9.83                                          | .04                                                           | .76                                                       |
| 8          | 80.4                       | 4.7                 | 77.1                | 8.0                       | .913                          | .76                                           | 2.81                                                          | .78                                                       |
| 9          | 80.0                       | 4.4                 | 76.9                | 7.5                       | .908                          | .70                                           | .61                                                           | .79                                                       |
| 10         | 80.1                       | 3.8                 | 77.4                | 6.5                       | .922                          | .87                                           | .26                                                           | .81                                                       |
| 11         | 80.2                       | 3.3                 | 77.9                | 5.6                       | .937                          | 10.04                                         | 1.96                                                          | .84                                                       |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                                   |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | °                     | Inches                          |                                   | lb                     |                                                                                                                                                              |
| 1     | 136.0                 | ...                             | S. & S. S. E.                     | 0.80                   | Clear to 5 A. M. Scatd. \i to 9 A. M. Scatd. \i to 4 P. M. Clear afterwards.                                                                                 |
| 2     | 132.0                 | 0.32                            | S. S. E. & S.                     | 2.00                   | Clear to 5 A. M. Scatd. \i to 4 P. M. Overcast afterwards. Thunder & Lightning at 6, 7 & 9 P. M. Rain from 5 to 9 P. M.                                      |
| 3     | 137.0                 | ...                             | S. & S. E.                        | 1.25                   | Overcast to 5 A. M. \i to 6 P. M. Clear afterwards.                                                                                                          |
| 4     | 135.0                 | ...                             | S. by E. & S.                     | 5.00                   | \i to 10 A. M. clear to 3 P. M. Overcast afterwards. Lightning to the E. at 9 P. M.                                                                          |
| 5     | 130.0                 | ...                             | S. & S. S. W.                     | 1.25                   | Scatd. \i to 11 A. M. Scatd. \i to 5 P. M. Overcast afterwards. Lightning to the N at 7 & 8 P. M.                                                            |
| 6     | ...                   | ...                             | S. S. W. & S.                     | 4.25                   | Clouds of various kinds. Thin rain at 9. P. M.                                                                                                               |
| 7     | 130.0                 | ...                             | S. S. E. & S.                     | 2.00                   | Clear to 3 A. M. Scatd. \i to 5 P. M. \i & \i afterwards.                                                                                                    |
| 8     | 132.0                 | ...                             | S. by E. & variable               | 3.00                   | \i to 6 A. M. Thin clouds to 10 A. M. Clear to 5 P. M. Overcast afterwards. Lightning to N. E. at 8 & 9 P. M. Thunder at 8 P. M. Light rain at 10 & 11 P. M. |
| 9     | 135.0                 | 0.15                            | S. W. & S.                        | 3.00                   | Overcast to 3 A. M. Scatd. \i & \i to 5 P. M. Overcast afterwards. Lightning at 8 & 10 P. M. Thunder at 10 P. M. Rain at 9 P. M.                             |
| 10    | 128.0                 | 0.24                            | S. & S. S. E.                     | 23.00                  | Overcast to 4 A. M. Scatd. \i & \i to 5 P. M. Overcast afterwards. Rain from 7 to 9 P. M.                                                                    |
| 11    | 126.0                 | ...                             | E. & S. S. E.                     | 0.25                   | Scatd. \i to \i to 10 A. M. \i to 7 P. M. Overcast afterwards. Lightning to the N. at 8 P. M.                                                                |
| 12    | 128.0                 | ...                             | E. S. E. & variable.              | 0.30                   | Overcast to 8 A. M. \i to 7 P. M. Clear afterwards. Thunder at 3 P. M. Thin rain from 7 to 9 A. M. & at 3 P. M.                                              |
| 13    | 136.0                 | ...                             | E. N. E. & S. & E.                | 0.50                   | Clear to 4 A. M. \i to 8 A. M. Scatd. \i afterwards. Lightning to the N. E. at 9 & 10 P. M.                                                                  |
| 14    | 131.0                 | ...                             | E. S. E. & S. E.                  | 0.50                   | Overcast to 3 A. M. Scatd. \i to 7 P. M. Clear afterwards. Lightning to the N. at 1 A. M.                                                                    |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                                  |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | inches                          |                                   | lb                     |                                                                                                                                                             |
| 15    | ...                   | 0.38                            | E. S. E. & E.                     | 0.80                   | Clear to 4 A. M. $\searrow$ i to 11 A. M. Overcast afterwards. Thunder at 1 P. M. Rain at 6 & 9 A. M. & from 1 to 5 P. M.                                   |
| 16    | ...                   | 0.18                            | S. E. & E. by S.                  | 0.80                   | Clear to 3 A. M. Overcast afterwards. Thunder at 7 A. M. Rain at 5, 6 & 7 A. M. & at 2 P. M.                                                                |
| 17    | ...                   | 0.53                            | SE & SSE & S by E                 | 0.90                   | Overcast. Light rain from 2 to 9 A. M. & at 1 and 2 P. M. Lightning at 2, 3, & 4 A. M. Thunder at 2 & 11 A. M.                                              |
| 18    | ...                   | ...                             | S.S.E. & S.S.W. & W.              | 0.50                   | $\searrow$ i & $\swarrow$ i to 7 P. M. Overcast afterwards. Light rain at 11 A. M.                                                                          |
| 19    | ...                   | 0.23                            | W. & S. W.                        | 0.40                   | Overcast. Light rain after intervals.                                                                                                                       |
| 20    | ...                   | *<br>0.96                       | W. S. W.                          | 0.40                   | Overcast. Thin rain at 3 A. M. & from 7 to 11 P. M.                                                                                                         |
| 21    | ...                   |                                 | W. by S. & W.N.W.                 | 0.60                   | Overcast. Light rain after intervals.                                                                                                                       |
| 22    | ...                   | 0.58                            | W. N. W. & S.                     | 0.80                   | Overcast to 5 A. M. $\searrow$ i & $\swarrow$ i to 1 P. M. Overcast to 7 P. M. Clear afterwards. Rain at 3, 4 & 7 P. M.                                     |
| 23    | 121.0                 | 2.41                            | S. S. W. & W.                     | 0.80                   | $\swarrow$ i to 3 A. M. Overcast to 11 A. M. $\swarrow$ i to 4 P. M. Overcast afterwards. Rain at 5 & from 8 to 11 P. M. Thunder & Lightning at 8 & 9 P. M. |
| 24    | ...                   | 0.23                            | W. by S. & W.S.W.                 | 0.80                   | Overcast nearly the whole day. Light rain from 6 to 11 A. M.                                                                                                |
| 25    | 117.0                 | ...                             | W. S. W. & W. by S.               | 0.40                   | Clear to 5 A. M. $\searrow$ i to 9 A. M. $\swarrow$ i to 3 P. M. Overcast afterwards. Slight rain between 2 & 3 P. M.                                       |
| 26    | 117.8                 | ...                             | S. W. & W. N. W.                  | 0.40                   | $\swarrow$ i & $\searrow$ i to 6 P. M. Overcast afterwards. Slight rain at 3, 10, & 11 P. M.                                                                |
| 27    | ...                   | 0.64                            | W. S.W. & N.N.W.                  | 1.25                   | Overcast rain at 1, 4, 5 & from 7 to 9 A. M. & at 8 P. M.                                                                                                   |
| 28    | ...                   | ...                             | W. S. W. & S. W.                  | 0.50                   | Overcast. Slight rain at 6, 10 & 11 A. M.                                                                                                                   |
| 29    | 123.0                 | ...                             | W. by S. & N. N.W.                | 0.50                   | $\swarrow$ i to 3 A. M. Overcast to 7 A. M. $\searrow$ i & $\swarrow$ i to 5 P. M. Overcast afterwards.                                                     |
| 30    | ...                   | 0.12                            | W. by N. & variable               | 0.50                   | Overcast to Noon. $\searrow$ i, to 5 P. M. Thin clouds afterwards. Rain at 6 & 7 A. M.                                                                      |

$\searrow$  i Cirri, — i S rati,  $\swarrow$  i Cumuli,  $\swarrow$  i Cirro-strati,  $\sim$  i Cumulo strati,  $\sim$  i Nimbi,  $\swarrow$  i Cirro cumuli.

\*Fell from 7 P. M. of the 20th to 10 P. M. of the 21st.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of June 1866.*

MONTHLY RESULTS.

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|                                                                      | Inches. |
|----------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ... ..                   | 29.518  |
| Max. height of the Barometer occurred at 10 A. M. on the 2nd, ... .. | 29.682  |
| Min. height of the Barometer occurred at 4 P. M. on the 21st, ... .. | 29.3.9  |
| <i>Extreme range</i> of the Barometer during the month, ... ..       | 0.363   |
| Mean of the daily Max. Pressures, ... ..                             | 29.575  |
| Ditto ditto Min. ditto ... ..                                        | 29.449  |
| <i>Mean daily range</i> of the Barometer during the month, ... ..    | 0.126   |

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|                                                                     | °     |
|---------------------------------------------------------------------|-------|
| Mean Dry Bulb Thermometer for the month, ... ..                     | 86.4  |
| Max. Temperature occurred at 1 P. M. on the 8th ... ..              | 101.6 |
| Min. Temperature occurred at 7 P. M. on the 10th ... ..             | 76.2  |
| <i>Extreme range</i> of the Temperature during the month, ... ..    | 25.4  |
| Mean of the daily Max. Temperature ... ..                           | 92.8  |
| Ditto ditto Min. ditto, ... ..                                      | 81.3  |
| <i>Mean daily range</i> of the Temperature during the month, ... .. | 11.5  |

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|                                                                   |      |
|-------------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..                   | 81.4 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ... .. | 5.0  |
| Computed Mean Dew-point for the month, ... ..                     | 77.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point, ... ..   | 8.5  |

Inches.

|                                                    |       |
|----------------------------------------------------|-------|
| Mean Elastic force of Vapour for the month, ... .. | 0.937 |
|----------------------------------------------------|-------|

---

Troy grains.

|                                                                        |      |
|------------------------------------------------------------------------|------|
| Mean Weight of Vapour for the month ... ..                             | 9.98 |
| Additional Weight of Vapour required for complete saturation, ... ..   | 3.08 |
| Mean degree of humidity for the month, complete saturation being unity | 0.76 |

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Inches.

|                                                                                                 |      |
|-------------------------------------------------------------------------------------------------|------|
| Rained 21 days,—Max. fall of rain during 24 hours ... ..                                        | 2.41 |
| Total amount of rain during the month, ... ..                                                   | 7.02 |
| Total amount of rain indicated by the Gauge attached to the anemometer during the month, ... .. | 6.25 |
| Prevailing direction of the Wind, ... S. S. E. & S. & W. S. W.                                  |      |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.602                                          | 29.642                                    | 29.551  | 0.091   | 77.7                          | 81.0                                          | 75.6 | 5.4   |
| 2     | .597                                            | .646                                      | .537    | .109    | 76.2                          | 77.8                                          | 75.2 | 2.6   |
| 3     | .569                                            | .63                                       | .517    | .096    | 79.1                          | 85.6                                          | 74.4 | 11.2  |
| 4     | .538                                            | .576                                      | .476    | .100    | 81.2                          | 85.4                                          | 78.0 | 7.4   |
| 5     | .529                                            | .580                                      | .484    | .096    | 81.3                          | 86.6                                          | 77.4 | 9.2   |
| 6     | .604                                            | .665                                      | .564    | .101    | 81.6                          | 87.6                                          | 78.4 | 9.2   |
| 7     | .635                                            | .698                                      | .570    | .123    | 83.2                          | 89.0                                          | 79.8 | 9.2   |
| 8     | .572                                            | .634                                      | .482    | .152    | 85.1                          | 93.0                                          | 80.0 | 13.0  |
| 9     | .520                                            | .575                                      | .433    | .142    | 85.8                          | 93.2                                          | 80.6 | 12.6  |
| 10    | .494                                            | .547                                      | .436    | .111    | 86.2                          | 91.6                                          | 83.2 | 8.4   |
| 11    | .505                                            | .558                                      | .441    | .117    | 85.1                          | 90.5                                          | 81.0 | 9.5   |
| 12    | .555                                            | .616                                      | .506    | .110    | 84.5                          | 90.0                                          | 81.0 | 9.0   |
| 13    | .646                                            | .697                                      | .593    | .104    | 84.6                          | 89.8                                          | 81.2 | 8.6   |
| 14    | .660                                            | .714                                      | .602    | .112    | 85.0                          | 90.4                                          | 80.2 | 10.2  |
| 15    | .575                                            | .651                                      | .489    | .162    | 83.4                          | 86.0                                          | 81.2 | 4.8   |
| 16    | .521                                            | .560                                      | .469    | .091    | 84.2                          | 86.7                                          | 82.0 | 4.7   |
| 17    | .555                                            | .597                                      | .522    | .075    | 83.2                          | 91.0                                          | 78.6 | 12.4  |
| 18    | .563                                            | .600                                      | .516    | .084    | 82.9                          | 86.2                                          | 80.4 | 5.8   |
| 19    | .580                                            | .631                                      | .509    | .122    | 83.3                          | 88.6                                          | 79.0 | 9.6   |
| 20    | .604                                            | .654                                      | .547    | .107    | 82.3                          | 86.0                                          | 80.2 | 5.8   |
| 21    | .615                                            | .662                                      | .555    | .107    | 82.7                          | 86.8                                          | 79.2 | 7.6   |
| 22    | .587                                            | .634                                      | .534    | .100    | 83.4                          | 87.0                                          | 79.8 | 7.2   |
| 23    | .614                                            | .664                                      | .545    | .119    | 84.5                          | 89.4                                          | 80.0 | 9.4   |
| 24    | .638                                            | .681                                      | .584    | .097    | 84.6                          | 87.8                                          | 81.8 | 6.0   |
| 25    | .634                                            | .670                                      | .573    | .097    | 84.0                          | 90.4                                          | 81.6 | 8.8   |
| 26    | .597                                            | .645                                      | .517    | .128    | 82.2                          | 85.0                                          | 81.2 | 3.8   |
| 27    | .597                                            | .639                                      | .533    | .106    | 83.7                          | 88.6                                          | 79.2 | 9.4   |
| 28    | .611                                            | .668                                      | .555    | .113    | 83.2                          | 87.5                                          | 80.4 | 7.1   |
| 29    | .631                                            | .691                                      | .560    | .131    | 84.3                          | 90.2                                          | 79.8 | 10.4  |
| 30    | .629                                            | .673                                      | .573    | .100    | 84.8                          | 90.8                                          | 80.3 | 10.5  |
| 31    | .631                                            | .668                                      | .575    | .093    | 83.0                          | 87.8                                          | 80.6 | 7.2   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

Meteorological Observations.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| 1     | 75.3                            | 2.4                 | 73.6                | 4.1                          | 0.817                            | 8.86                                             | 1.24                                                                | 0.88                                                                |
| 2     | 75.0                            | 1.2                 | 74.2                | 2.0                          | .832                             | 9.05                                             | 0.61                                                                | .94                                                                 |
| 3     | 77.0                            | 2.1                 | 75.5                | 3.6                          | .868                             | .38                                              | 1.15                                                                | .89                                                                 |
| 4     | 78.9                            | 2.3                 | 77.3                | 3.9                          | .919                             | .90                                              | .31                                                                 | .88                                                                 |
| 5     | 78.1                            | 3.2                 | 75.9                | 5.4                          | .879                             | .47                                              | .77                                                                 | .84                                                                 |
| 6     | 79.3                            | 2.3                 | 77.7                | 3.9                          | .931                             | 10.02                                            | .32                                                                 | .88                                                                 |
| 7     | 80.4                            | 2.8                 | 78.4                | 4.8                          | .952                             | .21                                              | .68                                                                 | .86                                                                 |
| 8     | 81.0                            | 4.1                 | 78.1                | 7.0                          | .943                             | .08                                              | 2.49                                                                | .80                                                                 |
| 9     | 81.6                            | 4.2                 | 78.7                | 7.1                          | .961                             | .26                                              | .57                                                                 | .80                                                                 |
| 10    | 82.1                            | 4.1                 | 79.2                | 7.0                          | .976                             | .41                                              | .58                                                                 | .80                                                                 |
| 11    | 80.8                            | 4.3                 | 77.8                | 7.3                          | .934                             | 9.99                                             | .58                                                                 | .80                                                                 |
| 12    | 80.1                            | 4.4                 | 77.0                | 7.5                          | .910                             | .73                                              | .62                                                                 | .79                                                                 |
| 13    | 80.6                            | 4.0                 | 77.8                | 6.8                          | .934                             | .99                                              | .40                                                                 | .81                                                                 |
| 14    | 80.7                            | 4.3                 | 77.7                | 7.3                          | .931                             | .96                                              | .57                                                                 | .80                                                                 |
| 15    | 81.2                            | 2.2                 | 79.7                | 3.7                          | .992                             | 10.63                                            | 1.33                                                                | .89                                                                 |
| 16    | 81.4                            | 2.8                 | 79.4                | 4.8                          | .983                             | .51                                              | .73                                                                 | .86                                                                 |
| 17    | 80.4                            | 2.8                 | 78.4                | 4.8                          | .952                             | .21                                              | .68                                                                 | .86                                                                 |
| 18    | 80.1                            | 2.8                 | 78.1                | 4.8                          | .943                             | .12                                              | .67                                                                 | .86                                                                 |
| 19    | 80.8                            | 2.5                 | 79.0                | 4.3                          | .970                             | .42                                              | .51                                                                 | .87                                                                 |
| 20    | 80.6                            | 1.7                 | 79.4                | 2.9                          | .983                             | .56                                              | .02                                                                 | .91                                                                 |
| 21    | 80.4                            | 2.3                 | 78.8                | 3.9                          | .964                             | .36                                              | .36                                                                 | .88                                                                 |
| 22    | 80.2                            | 3.2                 | 78.0                | 5.4                          | .940                             | .09                                              | .87                                                                 | .84                                                                 |
| 23    | 81.4                            | 3.1                 | 79.2                | 5.3                          | .976                             | .45                                              | .90                                                                 | .85                                                                 |
| 24    | 81.5                            | 3.1                 | 79.3                | 5.3                          | .979                             | .48                                              | .91                                                                 | .85                                                                 |
| 25    | 81.1                            | 2.9                 | 79.1                | 4.9                          | .973                             | .42                                              | .75                                                                 | .86                                                                 |
| 26    | 80.3                            | 1.9                 | 79.0                | 3.2                          | .970                             | .44                                              | .10                                                                 | .91                                                                 |
| 27    | 80.3                            | 3.4                 | 77.9                | 5.8                          | .937                             | .04                                              | 2.03                                                                | .83                                                                 |
| 28    | 80.0                            | 3.2                 | 77.8                | 5.4                          | .934                             | .03                                              | 1.86                                                                | .81                                                                 |
| 29    | 80.7                            | 3.6                 | 78.2                | 6.1                          | .946                             | .13                                              | 2.15                                                                | .85                                                                 |
| 30    | 80.5                            | 4.3                 | 77.5                | 7.3                          | .925                             | 9.90                                             | .56                                                                 | .85                                                                 |
| 31    | 79.9                            | 3.1                 | 77.7                | 5.3                          | .931                             | 10.00                                            | 1.82                                                                | .85                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer at<br>32° Fahit. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|--------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                  | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                          | Inches.                                                      | Inches. | Inches. | °                             | °                                                                | °    | °     |
| Mid-<br>night. | 29.605                                           | 29.674                                                       | 29.515  | 0.159   | 81.2                          | 84.5                                                             | 76.0 | 8.5   |
| 1              | .593                                             | .663                                                         | .491    | .172    | 81.0                          | 83.8                                                             | 75.8 | 8.0   |
| 2              | .583                                             | .656                                                         | .466    | .190    | 80.7                          | 83.5                                                             | 75.4 | 8.1   |
| 3              | .573                                             | .650                                                         | .456    | .194    | 80.4                          | 83.3                                                             | 74.8 | 8.5   |
| 4              | .570                                             | .659                                                         | .476    | .183    | 80.2                          | 83.2                                                             | 74.6 | 8.6   |
| 5              | .577                                             | .664                                                         | .480    | .184    | 80.4                          | 83.4                                                             | 74.4 | 9.0   |
| 6              | .591                                             | .680                                                         | .493    | .187    | 80.6                          | 83.4                                                             | 74.5 | 8.9   |
| 7              | .606                                             | .700                                                         | .504    | .196    | 81.2                          | 84.0                                                             | 74.6 | 9.4   |
| 8              | .618                                             | .705                                                         | .516    | .189    | 82.5                          | 85.3                                                             | 75.8 | 9.5   |
| 9              | .626                                             | .712                                                         | .530    | .182    | 84.1                          | 87.4                                                             | 76.6 | 10.8  |
| 10             | .629                                             | .714                                                         | .535    | .179    | 84.9                          | 88.8                                                             | 77.0 | 11.8  |
| 11             | .620                                             | .702                                                         | .529    | .173    | 85.7                          | 90.2                                                             | 76.8 | 13.4  |
| Noon.          | .608                                             | .686                                                         | .509    | .177    | 86.1                          | 91.2                                                             | 77.2 | 14.0  |
| 1              | .591                                             | .675                                                         | .491    | .184    | 86.5                          | 92.2                                                             | 76.4 | 15.8  |
| 2              | .569                                             | .657                                                         | .460    | .197    | 86.3                          | 93.0                                                             | 76.6 | 16.4  |
| 3              | .548                                             | .632                                                         | .433    | .199    | 85.9                          | 93.2                                                             | 75.2 | 18.0  |
| 4              | .536                                             | .616                                                         | .439    | .177    | 85.6                          | 91.0                                                             | 75.6 | 15.4  |
| 5              | .534                                             | .608                                                         | .443    | .165    | 85.3                          | 89.6                                                             | 75.5 | 14.1  |
| 6              | .542                                             | .616                                                         | .456    | .160    | 84.5                          | 88.0                                                             | 75.5 | 12.5  |
| 7              | .560                                             | .637                                                         | .480    | .157    | 83.3                          | 86.0                                                             | 75.4 | 10.6  |
| 8              | .581                                             | .660                                                         | .505    | .155    | 82.7                          | 85.2                                                             | 75.6 | 9.6   |
| 9              | .602                                             | .684                                                         | .527    | .157    | 82.3                          | 84.7                                                             | 75.6 | 9.1   |
| 10             | .616                                             | .697                                                         | .540    | .157    | 81.8                          | 85.2                                                             | 75.6 | 9.6   |
| 11             | .616                                             | .689                                                         | .542    | .147    | 81.4                          | 85.0                                                             | 75.6 | 9.4   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—(Continued.)

| Hour.      | Mean Wet Bulb Thermometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew Point. | Mean Elastic force of Vapour. | Mean Weight of Vapour in a Cubic foot of air. | Additional Weight of Vapour required for complete saturation. | Mean degree of Humidity, complete saturation being unity. |
|------------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|            | o                          | o                   | o                   | o                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| Mid-night. | 79.4                       | 1.8                 | 78.1                | 3.1                       | 0.943                         | 10.16                                         | 1.05                                                          | 0.91                                                      |
| 1          | 79.3                       | 1.7                 | 78.1                | 2.9                       | .943                          | .16                                           | 0.98                                                          | .91                                                       |
| 2          | 79.1                       | 1.6                 | 78.0                | 2.7                       | .940                          | .13                                           | .91                                                           | .92                                                       |
| 3          | 79.1                       | 1.3                 | 78.2                | 2.2                       | .946                          | .21                                           | .73                                                           | .93                                                       |
| 4          | 78.9                       | 1.3                 | 78.0                | 2.2                       | .940                          | .15                                           | .73                                                           | .93                                                       |
| 5          | 79.0                       | 1.4                 | 78.0                | 2.4                       | .940                          | .15                                           | .79                                                           | .93                                                       |
| 6          | 79.2                       | 1.4                 | 78.2                | 2.4                       | .946                          | .21                                           | .80                                                           | .93                                                       |
| 7          | 79.5                       | 1.7                 | 78.3                | 2.9                       | .949                          | .22                                           | .99                                                           | .91                                                       |
| 8          | 80.2                       | 2.3                 | 78.6                | 3.9                       | .958                          | .30                                           | 1.34                                                          | .89                                                       |
| 9          | 80.7                       | 3.4                 | 78.3                | 5.8                       | .949                          | .16                                           | 2.05                                                          | .83                                                       |
| 10         | 80.8                       | 4.1                 | 77.9                | 7.0                       | .937                          | .02                                           | .47                                                           | .80                                                       |
| 11         | 81.2                       | 4.5                 | 78.0                | 7.7                       | .940                          | .03                                           | .77                                                           | .78                                                       |
| Noon.      | 81.2                       | 4.9                 | 77.8                | 8.3                       | .934                          | 9.97                                          | .98                                                           | .77                                                       |
| 1          | 81.2                       | 5.3                 | 78.0                | 8.5                       | .940                          | 10.01                                         | 3.09                                                          | .76                                                       |
| 2          | 81.1                       | 5.2                 | 77.5                | 8.8                       | .925                          | 9.86                                          | .16                                                           | .76                                                       |
| 3          | 81.1                       | 4.8                 | 77.7                | 8.2                       | .931                          | .94                                           | 2.93                                                          | .77                                                       |
| 4          | 80.8                       | 4.8                 | 77.4                | 8.2                       | .922                          | .85                                           | .91                                                           | .77                                                       |
| 5          | 80.8                       | 4.5                 | 77.6                | 7.7                       | .928                          | .91                                           | .73                                                           | .78                                                       |
| 6          | 80.3                       | 4.2                 | 77.4                | 7.1                       | .922                          | .87                                           | .48                                                           | .80                                                       |
| 7          | 79.8                       | 3.5                 | 77.3                | 6.0                       | .919                          | .86                                           | .07                                                           | .83                                                       |
| 8          | 79.8                       | 2.9                 | 77.8                | 4.9                       | .934                          | 10.03                                         | 1.69                                                          | .86                                                       |
| 9          | 79.7                       | 2.6                 | 77.9                | 4.4                       | .937                          | .08                                           | .50                                                           | .87                                                       |
| 10         | 79.6                       | 2.2                 | 78.1                | 3.7                       | .943                          | .14                                           | .26                                                           | .89                                                       |
| 11         | 79.6                       | 1.8                 | 78.3                | 3.1                       | .949                          | .22                                           | .95                                                           | .91                                                       |

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                      |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | o                     | Inches<br>0.80                  | W. & S. W.                        | lb<br>4.20             | Overcast. Rain day & night.                                                                                                                     |
| 2     |                       | * 4.20                          | S. W. & W. N. W.                  | 2.60                   | Overcast. Rain day & night.                                                                                                                     |
| 3     |                       | † 1.32                          | W. S. W. & S. S. E.               | 2.25                   | Overcast to 11 A. M. Scatd. $\searrow$ & $\swarrow$ afterwards. Rain from 5 to 10 A. M.                                                         |
| 4     |                       |                                 | S. E. & E. S. E.                  | 2.00                   | Scatd. $\searrow$ to 4 A. M. Overcast to 5 P. M. clear afterwards. Light rain at 6 & 10 A. M. & at 1 & 3 P. M.                                  |
| 5     | 118.4                 | 0.13                            | S. S. E. & S. by E.               | 1.50                   | Overcast to 8 A. M. $\searrow$ afterwards. Light rain at 2, 7 & 10 A. M. and at 4 & 10 P. M.                                                    |
| 6     | ...                   | 0.87                            | S. by E. & S. by W.               | 1.00                   | Overcast to 2 P. M. Scatd. $\searrow$ to 6 P. M. clear afterwards. Rain at 2, 5, 8 & 11 A. M. & at 2 & 5 P. M.                                  |
| 7     | ...                   | 0.61                            | S. S. E. & S. & S. by W.          | 0.25                   | Clear to 4 A. M. $\searrow$ to 7 P. M. clear afterwards. Rain between 10 & 11 A. M. & at 2 P. M.                                                |
| 8     | 119.0                 | ...                             | S. by W. & S.                     | 0.30                   | Overcast to 5 A. M. $\searrow$ to 11 A. M. $\searrow$ afterwards. Light rain at 4 A. M.                                                         |
| 9     | 134.0                 | ...                             | S. S. W. & S.                     | 0.50                   | $\searrow$ to 4 P. M. overcast afterwards Thunder at 6 P. M. Lightning to the N. W. at 8 P. M.                                                  |
| 10    | 125.4                 |                                 | S. S. E. & S. E.                  | 0.50                   | Scatd. $\searrow$ to 7 P. M. clear afterwards.                                                                                                  |
| 11    | 128.0                 | 0.10                            | S. E. & E. by S.                  | 1.20                   | Clear to 3 A. M. Scatd. $\searrow$ to 8 P. M. clear afterwards. Rain between 10 & 11 A. M. & between 2 & 3 P. M.                                |
| 12    | 112.0                 | 0.09                            | S. E. & E. S. E.                  | 2.10                   | Clear to 3 A. M. $\searrow$ to 11 A. M. Scatd. $\searrow$ & $\searrow$ to 5 P. M. $\searrow$ afterwards. Rain at 5 A. M. & between 9 & 10 A. M. |
| 13    | 129.8                 | ...                             | S. E. & S. S. E.                  | 0.70                   | Scatd. $\searrow$ & $\searrow$ to 7 P. M. clear afterwards. Light rain at 6½ & 11½ A. M.                                                        |
| 14    | 121.0                 | ...                             | S. & S. S. E.                     | 0.50                   | Clear to 4 A. M. Scatd. $\searrow$ & $\searrow$ to 7 P. M. clear afterwards. Light rain at 6 P. M.                                              |
| 15    |                       | 0.16                            | S. by E. & S.                     | 0.50                   | Scatd. $\searrow$ to 4 A. M. $\searrow$ & $\searrow$ to 8 P. M. clear afterwards. Light rain from 9 to 11 A. M.                                 |

\* Fell from 1 P. M. of the 1st to 4 P. M. of the 2nd.

† Do. 5 P. M. of the 2nd. to 10 A. M. of the 3rd.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   | lb                     |                                                                                                           |
| 16    | ...                   | 0.18                            | S.                                | 1.00                   | ∩i to 3 A. M. ∩i to 10 A. M. overcast to 7 P. M. clear afterwards. Rain from 9 A. M. to Noon.             |
| 17    | 118.0                 | 0.78                            | S. S. W. & S. by W                | 4.30                   | Clear to 3 A. M. ∩i to 2 P. M. overcast afterwards. Rain from 3 to 5 P. M.                                |
| 18    | ...                   | ...                             | S. W.                             | 1.00                   | Overcast, slight rain at 6½, 7½ & 10 A. M.                                                                |
| 19    | ...                   | 0.88                            | S. & S. W. & W.                   | 1.00                   | Overcast nearly the whole day. Rain from 2 to 6 A. M. & at 8 A. M.                                        |
| 20    | ...                   | 0.85                            | S. by E. & S. & S. S. E.          | 0.20                   | Overcast to 4 P. M. ∩i afterwards. Rain at 10 & 11, A. M. & at 1, 3, 4 & 7 P. M.                          |
| 21    | ...                   | ...                             | S. & S. S. E.                     | 0.50                   | ∩i & ∩i nearly the whole day. Slight rain at 7 A. M. & at 3 P. M.                                         |
| 22    | ...                   | 0.18                            | S. & S. S. E.                     | 0.50                   | ∩i & ∩i. Rain at 6 & 10½ A. M. & between Noon & 1 P. M.                                                   |
| 23    | 113.7                 | ...                             | S. & S. S. W.                     | 0.50                   | ∩i & ∩i.                                                                                                  |
| 24    | ...                   | ...                             | S. S. W. & S.                     | 0.50                   | Scatd. ∩i to 5 A. M. overcast afterwards.                                                                 |
| 25    | ...                   | 0.50                            | S. by W. & S.                     | 0.60                   | Overcast nearly the whole day. Rain at 3, 10 & 11 A. M. & from 2 to 4 P. M.                               |
| 26    | ...                   | 1.94                            | S. & S. S. E.                     | 0.40                   | Overcast nearly the whole day. Rain at 6 & from 8 to 11½ A. M.                                            |
| 27    | 120.0                 | ...                             | S. by W. & E. S. E.               | 0.40                   | Scatd. ∩i to 10 A. M. ∩i to 5 P. M. Scatd. ∩i & ∩i afterwards.                                            |
| 28    | 114.0                 | ...                             | S. S. E. & S.                     | 0.70                   | ∩i to 4 P. M. Scatd. ∩i & ∩i afterwards. Light rain at 5 & 7 A. M. & at 3 P. M.                           |
| 29    | 134.0                 | ...                             | S. E. & S. S. E.                  | 0.70                   | Scatd. ∩i to 4 P. M. Scatd. ∩i afterwards. Rain between midnight & 1 A. M. & at 4 P. M.                   |
| 30    | 127.0                 | 0.10                            | E. S. E. & S. E.                  | 0.40                   | Scatd. ∩i to 8 A. M. ∩i to 4 P. M. Scatd. ∩i afterwards. Rain at 11 A. M. & at 1 P. M.                    |
| 31    | ...                   | ...                             | E. N. E. & N. E.                  | 0.25                   | Clear to 5 A. M. ∩i & ∩i to 10 A. M. Overcast afterwards. Thunder at 2 P. M. Light rain from 1 to 3 P. M. |

∩i Cirri, — i Strati, ∩i Cumuli, ∩i Cirro-strati, ~i Cumulo strati, ∩i Nimbi, ∩i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of July 1866.*

MONTHLY RESULTS.

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|                                                                       | Inches. |
|-----------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ... ..                    | 29.587  |
| Max. height of the Barometer occurred at 10 A. M. on the 14th, ... .. | 29.714  |
| Min. height of the Barometer occurred at 3 P. M. on the 9th, ... ..   | 29.433  |
| <i>Extreme range</i> of the Barometer during the month, ... ..        | 0.281   |
| Mean of the daily Max. Pressures, ... ..                              | 29.637  |
| Ditto ditto Min. ditto ... ..                                         | 29.527  |
| <i>Mean daily range</i> of the Barometer during the month, ... ..     | 0.110   |

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|                                                                     | °    |
|---------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month, ... ..                     | 83.1 |
| Max. Temperature occurred at 3 P. M. on the 9th ... ..              | 93.2 |
| Min. Temperature occurred at 5 A. M. on the 3rd ... ..              | 74.4 |
| <i>Extreme range</i> of the Temperature during the month, ... ..    | 18.8 |
| Mean of the daily Max. Temperature ... ..                           | 88.0 |
| Ditto ditto Min. ditto, ... ..                                      | 79.7 |
| <i>Mean daily range</i> of the Temperature during the month, ... .. | 8.3  |

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|                                                                   |      |
|-------------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..                   | 80.1 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ... .. | 3.0  |
| Computed Mean Dew-point for the month, ... ..                     | 78.0 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ... ..   | 5.1  |

Inches.

|                                                    |       |
|----------------------------------------------------|-------|
| Mean Elastic force of Vapour for the month, ... .. | 0.940 |
|----------------------------------------------------|-------|

---

Troy grain.

|                                                                               |       |
|-------------------------------------------------------------------------------|-------|
| Mean Weight of Vapour for the month ... ..                                    | 10.09 |
| Additional Weight of Vapour required for complete saturation, ... ..          | 1.77  |
| Mean degree of humidity for the month, complete saturation being unity ... .. | 0.85  |

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Inches.

|                                                                                                 |       |
|-------------------------------------------------------------------------------------------------|-------|
| Fained 26 days,—Max. fall of rain during 24 hours ... ..                                        | 3.43  |
| Total amount of rain during the month, ... ..                                                   | 13.42 |
| Total amount of rain indicated by the Gauge attached to the anemometer during the month. ... .. | 12.06 |
| Prevailing direction of the Wind, ... S. & S. S. E. & S. E.                                     |       |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                      | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                         | o    | o     |
| 1     | 29.586                                          | 29.625                                    | 29.520  | 0.105   | 83.2                          | 89.6                                      | 80.4 | 9.2   |
| 2     | .614                                            | .695                                      | .544    | .151    | 80.7                          | 83.2                                      | 78.2 | 5.0   |
| 3     | .730                                            | .809                                      | .683    | .126    | 80.4                          | 83.6                                      | 79.2 | 4.4   |
| 4     | .739                                            | .777                                      | .677    | .100    | 80.0                          | 82.7                                      | 79.0 | 3.7   |
| 5     | .680                                            | .742                                      | .616    | .126    | 81.5                          | 84.8                                      | 79.4 | 5.4   |
| 6     | .540                                            | .655                                      | .442    | .213    | 82.2                          | 86.0                                      | 79.8 | 6.2   |
| 7     | .390                                            | .449                                      | .332    | .117    | 81.2                          | 85.4                                      | 79.2 | 6.2   |
| 8     | .414                                            | .499                                      | .369    | .130    | 80.9                          | 85.2                                      | 78.2 | 7.0   |
| 9     | .544                                            | .630                                      | .475    | .155    | 83.6                          | 89.7                                      | 78.8 | 10.9  |
| 10    | .593                                            | .631                                      | .524    | .107    | 84.3                          | 90.8                                      | 80.7 | 10.1  |
| 11    | .557                                            | .613                                      | .474    | .139    | 84.6                          | 89.2                                      | 81.8 | 7.4   |
| 12    | .501                                            | .551                                      | .426    | .125    | 83.6                          | 89.4                                      | 80.4 | 9.0   |
| 13    | .542                                            | .595                                      | .489    | .106    | 83.0                          | 87.6                                      | 79.8 | 7.8   |
| 14    | .597                                            | .639                                      | .541    | .098    | 83.3                          | 87.4                                      | 80.0 | 7.4   |
| 15    | .617                                            | .651                                      | .560    | .091    | 83.4                          | 89.6                                      | 80.2 | 9.4   |
| 16    | .589                                            | .631                                      | .531    | .100    | 82.4                          | 86.0                                      | 78.8 | 7.2   |
| 17    | .563                                            | .623                                      | .484    | .139    | 83.5                          | 87.8                                      | 80.2 | 7.6   |
| 18    | .525                                            | .572                                      | .452    | .120    | 82.6                          | 86.7                                      | 80.5 | 6.2   |
| 19    | .505                                            | .547                                      | .442    | .105    | 83.8                          | 88.3                                      | 80.2 | 8.1   |
| 20    | .509                                            | .561                                      | .465    | .096    | 83.2                          | 85.6                                      | 81.5 | 4.1   |
| 21    | .548                                            | .607                                      | .495    | .112    | 82.0                          | 85.2                                      | 79.6 | 5.6   |
| 22    | .578                                            | .634                                      | .515    | .119    | 83.7                          | 89.4                                      | 79.4 | 10.0  |
| 23    | .562                                            | .615                                      | .475    | .140    | 84.6                          | 90.4                                      | 80.4 | 10.0  |
| 24    | .558                                            | .613                                      | .485    | .128    | 85.0                          | 90.8                                      | 81.4 | 9.4   |
| 25    | .585                                            | .645                                      | .515    | .130    | 84.3                          | 89.8                                      | 81.8 | 8.0   |
| 26    | .606                                            | .657                                      | .547    | .110    | 83.6                          | 88.4                                      | 80.6 | 7.8   |
| 27    | .607                                            | .649                                      | .550    | .099    | 82.3                          | 88.4                                      | 80.3 | 8.1   |
| 28    | .582                                            | .636                                      | .511    | .125    | 82.0                          | 86.0                                      | 77.4 | 8.6   |
| 29    | .670                                            | .739                                      | .615    | .124    | 81.9                          | 85.8                                      | 78.6 | 7.2   |
| 30    | .754                                            | .822                                      | .691    | .131    | 84.1                          | 90.0                                      | 79.0 | 11.0  |
| 31    | .723                                            | .787                                      | .639    | .148    | 86.2                          | 91.8                                      | 81.4 | 10.4  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| 1     | 79.8                            | 3.4                 | 77.4                | 5.8                          | 0.922                            | 9.89                                             | 2.00                                                                | 0.83                                                                |
| 2     | 79.1                            | 1.6                 | 78.0                | 2.7                          | .940                             | 10.13                                            | 0.91                                                                | .92                                                                 |
| 3     | 79.0                            | 1.4                 | 78.0                | 2.4                          | .940                             | .15                                              | .79                                                                 | .93                                                                 |
| 4     | 78.5                            | 1.5                 | 77.4                | 2.6                          | .922                             | 9.95                                             | .86                                                                 | .92                                                                 |
| 5     | 79.8                            | 1.7                 | 78.6                | 2.9                          | .958                             | 10.32                                            | .99                                                                 | .91                                                                 |
| 6     | 80.0                            | 2.2                 | 78.5                | 3.7                          | .955                             | .27                                              | 1.27                                                                | .89                                                                 |
| 7     | 79.2                            | 2.0                 | 77.8                | 3.4                          | .934                             | .07                                              | .14                                                                 | .90                                                                 |
| 8     | 79.0                            | 1.9                 | 77.7                | 3.2                          | .931                             | .04                                              | .06                                                                 | .91                                                                 |
| 9     | 80.1                            | 3.5                 | 77.6                | 6.0                          | .928                             | 9.95                                             | 2.08                                                                | .83                                                                 |
| 10    | 80.9                            | 3.4                 | 78.5                | 5.8                          | .955                             | 10.23                                            | .05                                                                 | .83                                                                 |
| 11    | 81.3                            | 3.3                 | 79.0                | 5.6                          | .970                             | .37                                              | .02                                                                 | .84                                                                 |
| 12    | 80.0                            | 3.6                 | 77.5                | 6.1                          | .925                             | 9.92                                             | .11                                                                 | .83                                                                 |
| 13    | 79.9                            | 3.1                 | 77.7                | 5.3                          | .931                             | 10.00                                            | 1.82                                                                | .85                                                                 |
| 14    | 80.3                            | 3.0                 | 78.2                | 5.1                          | .946                             | .15                                              | .78                                                                 | .85                                                                 |
| 15    | 80.4                            | 3.0                 | 78.3                | 5.1                          | .949                             | .18                                              | .78                                                                 | .85                                                                 |
| 16    | 79.8                            | 2.6                 | 78.0                | 4.4                          | .940                             | .11                                              | .50                                                                 | .87                                                                 |
| 17    | 80.3                            | 3.2                 | 78.1                | 5.4                          | .943                             | .12                                              | .88                                                                 | .84                                                                 |
| 18    | 79.7                            | 2.9                 | 77.7                | 4.9                          | .931                             | .00                                              | .68                                                                 | .86                                                                 |
| 19    | 81.0                            | 2.8                 | 79.0                | 4.8                          | .970                             | .40                                              | .70                                                                 | .86                                                                 |
| 20    | 81.5                            | 1.7                 | 80.3                | 2.9                          | 1.011                            | .84                                              | .05                                                                 | .91                                                                 |
| 21    | 80.2                            | 1.8                 | 78.9                | 3.1                          | 0.967                            | .41                                              | .06                                                                 | .91                                                                 |
| 22    | 80.8                            | 2.9                 | 78.8                | 4.9                          | .964                             | .34                                              | .73                                                                 | .86                                                                 |
| 23    | 81.2                            | 3.4                 | 78.8                | 5.8                          | .964                             | .31                                              | 2.08                                                                | .83                                                                 |
| 24    | 81.3                            | 3.7                 | 78.7                | 6.3                          | .961                             | .29                                              | .24                                                                 | .82                                                                 |
| 25    | 80.7                            | 3.6                 | 78.2                | 6.1                          | .946                             | .13                                              | .15                                                                 | .83                                                                 |
| 26    | 80.4                            | 3.2                 | 78.2                | 5.4                          | .946                             | .15                                              | 1.88                                                                | .84                                                                 |
| 27    | 79.9                            | 2.4                 | 78.2                | 4.1                          | .946                             | .17                                              | .41                                                                 | .88                                                                 |
| 28    | 79.4                            | 2.6                 | 77.6                | 4.4                          | .928                             | 9.99                                             | .48                                                                 | .87                                                                 |
| 29    | 79.8                            | 2.1                 | 78.3                | 3.6                          | .949                             | 10.20                                            | .24                                                                 | .89                                                                 |
| 30    | 80.6                            | 3.5                 | 78.1                | 6.0                          | .943                             | .10                                              | 2.11                                                                | .83                                                                 |
| 31    | 82.1                            | 4.1                 | 79.2                | 7.0                          | .976                             | .41                                              | .58                                                                 | .80                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahrt. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|--------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                            | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                    | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.601                                     | 29.760                                                 | 29.399  | 0.361   | 81.3                       | 83.7                                                     | 79.0 | 4.7   |
| 1          | .589                                       | .751                                                   | .389    | .362    | 80.9                       | 83.8                                                     | 79.2 | 4.6   |
| 2          | .580                                       | .744                                                   | .379    | .365    | 80.7                       | 83.0                                                     | 79.2 | 3.8   |
| 3          | .570                                       | .738                                                   | .372    | .366    | 80.5                       | 82.6                                                     | 78.9 | 3.7   |
| 4          | .566                                       | .741                                                   | .368    | .373    | 80.2                       | 82.2                                                     | 78.2 | 4.0   |
| 5          | .574                                       | .750                                                   | .378    | .372    | 80.1                       | 81.8                                                     | 77.4 | 4.4   |
| 6          | .588                                       | .771                                                   | .378    | .393    | 80.3                       | 82.4                                                     | 77.8 | 4.6   |
| 7          | .603                                       | .801                                                   | .393    | .408    | 81.0                       | 83.2                                                     | 78.8 | 4.4   |
| 8          | .616                                       | .809                                                   | .411    | .398    | 82.0                       | 84.8                                                     | 79.0 | 5.8   |
| 9          | .626                                       | .816                                                   | .424    | .392    | 83.6                       | 87.0                                                     | 79.6 | 7.4   |
| 10         | .629                                       | .822                                                   | .432    | .390    | 84.7                       | 88.4                                                     | 79.2 | 9.2   |
| 11         | .618                                       | .812                                                   | .408    | .404    | 86.1                       | 89.6                                                     | 80.5 | 9.1   |
| Noon.      | .603                                       | .796                                                   | .384    | .412    | 85.7                       | 90.4                                                     | 81.4 | 9.0   |
| 1          | .583                                       | .766                                                   | .378    | .388    | 86.1                       | 91.0                                                     | 81.2 | 9.8   |
| 2          | .560                                       | .733                                                   | .353    | .380    | 85.8                       | 91.2                                                     | 79.2 | 12.0  |
| 3          | .540                                       | .713                                                   | .339    | .374    | 85.8                       | 90.8                                                     | 79.4 | 11.4  |
| 4          | .525                                       | .694                                                   | .332    | .362    | 85.7                       | 91.0                                                     | 79.6 | 11.4  |
| 5          | .527                                       | .693                                                   | .343    | .350    | 85.0                       | 91.8                                                     | 80.0 | 11.8  |
| 6          | .540                                       | .713                                                   | .355    | .358    | 83.8                       | 89.7                                                     | 79.6 | 10.1  |
| 7          | .558                                       | .723                                                   | .367    | .356    | 83.1                       | 87.7                                                     | 79.2 | 8.5   |
| 8          | .583                                       | .748                                                   | .388    | .360    | 82.6                       | 86.4                                                     | 79.6 | 6.8   |
| 9          | .604                                       | .758                                                   | .400    | .358    | 82.2                       | 85.6                                                     | 79.6 | 6.0   |
| 10         | .617                                       | .809                                                   | .411    | .398    | 81.9                       | 84.8                                                     | 79.6 | 5.2   |
| 11         | .613                                       | .767                                                   | .415    | .352    | 81.6                       | 84.4                                                     | 79.2 | 5.2   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.      | Mean Wet Bulb Thermometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew Point. | Mean Elastic force of Vapour. | Mean Weight of Vapour in a Cubic foot of air. | Additional Weight of Vapour required for complete saturation. | Mean degree of Humidity, complete saturation being unity. |
|------------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|            | o                          | o                   | o                   | o                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| Mid-night. | 79.7                       | 1.6                 | 78.6                | 2.7                       | 0.958                         | 10.32                                         | 0.92                                                          | 0.92                                                      |
| 1          | 79.5                       | 1.4                 | 78.5                | 2.4                       | .955                          | .31                                           | .79                                                           | .93                                                       |
| 2          | 79.4                       | 1.3                 | 78.5                | 2.2                       | .955                          | .31                                           | .73                                                           | .93                                                       |
| 3          | 79.2                       | 1.3                 | 78.3                | 2.2                       | .949                          | .24                                           | .74                                                           | .93                                                       |
| 4          | 79.0                       | 1.2                 | 78.2                | 2.0                       | .946                          | .21                                           | .67                                                           | .94                                                       |
| 5          | 78.9                       | 1.2                 | 78.1                | 2.0                       | .943                          | .18                                           | .66                                                           | .94                                                       |
| 6          | 79.0                       | 1.3                 | 78.1                | 2.2                       | .943                          | .18                                           | .73                                                           | .93                                                       |
| 7          | 79.5                       | 1.5                 | 78.4                | 2.6                       | .952                          | .25                                           | .89                                                           | .92                                                       |
| 8          | 80.0                       | 2.0                 | 78.6                | 3.4                       | .958                          | .32                                           | 1.15                                                          | .90                                                       |
| 9          | 80.5                       | 3.1                 | 78.3                | 5.3                       | .949                          | .18                                           | .85                                                           | .85                                                       |
| 10         | 80.8                       | 3.9                 | 78.1                | 6.6                       | .943                          | .08                                           | 2.34                                                          | .81                                                       |
| 11         | 81.5                       | 4.6                 | 78.3                | 7.8                       | .949                          | .12                                           | .83                                                           | .78                                                       |
| Noon.      | 81.3                       | 4.4                 | 78.2                | 7.5                       | .946                          | .09                                           | .71                                                           | .79                                                       |
| 1          | 81.6                       | 4.5                 | 78.4                | 7.7                       | .952                          | .15                                           | .80                                                           | .78                                                       |
| 2          | 81.2                       | 4.6                 | 78.0                | 7.8                       | .940                          | .03                                           | .80                                                           | .78                                                       |
| 3          | 81.2                       | 4.6                 | 78.0                | 7.8                       | .940                          | .03                                           | .80                                                           | .78                                                       |
| 4          | 81.2                       | 4.5                 | 78.0                | 7.7                       | .940                          | .03                                           | .77                                                           | .78                                                       |
| 5          | 80.7                       | 4.3                 | 77.7                | 7.3                       | .931                          | 9.96                                          | .57                                                           | .80                                                       |
| 6          | 80.4                       | 3.4                 | 78.0                | 5.8                       | .940                          | 10.07                                         | .03                                                           | .83                                                       |
| 7          | 80.2                       | 2.9                 | 78.2                | 4.9                       | .946                          | .15                                           | 1.71                                                          | .86                                                       |
| 8          | 80.1                       | 2.5                 | 78.3                | 4.3                       | .949                          | .20                                           | .48                                                           | .87                                                       |
| 9          | 79.9                       | 2.3                 | 78.3                | 3.9                       | .949                          | .20                                           | .34                                                           | .88                                                       |
| 10         | 80.0                       | 1.9                 | 78.7                | 3.2                       | .961                          | .35                                           | .09                                                           | .91                                                       |
| 11         | 79.9                       | 1.7                 | 78.7                | 2.9                       | .961                          | .35                                           | 0.99                                                          | .91                                                       |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                          |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches                          |                                   | lb                     |                                                                                                                                                     |
| 1     | 126.0                 | 0.34                            | E. N. E. & E.                     | 0.50                   | Vi nearly the whole day. Rain between 11 & Noon & between 5 & 6 P. M.                                                                               |
| 2     | ...                   | 0.43                            | E. S. E. & E.                     | 0.80                   | Overcast. Rain constantly.                                                                                                                          |
| 3     | ...                   | 0.67                            | E. S. E. & S. by E.               | 0.75                   | Overcast. Rain at 2, 5, 7, 9, & 10 A. M. & from 1 to 3 P. M. Thunder at 8 A. M.                                                                     |
| 4     | ...                   | 1.56                            | S. S. E. & S. by E.               | 0.75                   | Overcast. Rain from 4 A. M. to 5 P. M. Thunder & Lightning at 4 A. M.                                                                               |
| 5     | ...                   | 0.21                            | W.N.W. & S. S. E.                 | 0.40                   | Clear to 2 A. M. Overcast to 10 A. M. Vi to 8 P. M. Overcast afterwards. Rain at 10 A. M. at 2 & 3 P.M. Thunder at 2 & 3 P. M. Lightning at 9 P. M. |
| 6     | ...                   | 0.44                            | N. N. E.                          | 0.50                   | Overcast to 11 A. M. Vi to 8 P. M. Overcast afterwards. Rain at 8 & 11 A. M. & at 2, 6 & 9 P. M. Lightning at midnight.                             |
| 7     | ...                   | 0.58                            | N. N. E. & E. S.E.                | 2.12                   | Overcast. Rain constantly.                                                                                                                          |
| 8     | ...                   | 0.18                            | E. S. E. & S. S. E.               |                        | Overcast to 3 P. M. Ci to 6 P. M., clear afterwards. Rain from midnight to 4 A. M. at 8 A. M. & at 3 P. M.                                          |
| 9     | 130.0                 | 0.12                            | S. S. E. & S. E.                  |                        | Scatd. Ci to 5 P. M. clear afterwards. Rain at 4, 6 & 11 A. M. & between 4 & 5 P. M.                                                                |
| 10    | 125.0                 | ...                             | S.S.E.&S.E.&SSW.                  |                        | Clear to 7 A. M. Scatd. Ci to 8 P. M. clear afterwards. Light rain at 5 P. M.                                                                       |
| 11    | 126.0                 | ...                             | S. S. W. & variable & S. by E.    |                        | Clear to 2 A. M. Vi to 7 P. M. clear afterwards. Light rain between Noon & 1 P. M. & at 6 P. M.                                                     |
| 12    | 124.0                 | 0.25                            | S. E. & E.                        |                        | Clear to 4 A. M. Scuds from E to 11 A. M. Scatd. Ci to 8 P. M. clear afterwards. Rain at 7, 11 & Noon.                                              |
| 13    | 130.0                 | 0.17                            | S. S. E. & E. by S.               |                        | Scatd. Vi & Ci to 6 A. M. clouds of different kinds afterwards. Rain at 9 & between 11 & Noon & between 10 & 11 P.M.                                |
| 14    | ...                   | ...                             | S. E. & S. by E.                  |                        | Overcast to 10 A. M. Vi & Ci to 6 P. M. clear afterwards. Slight rain at 3 & 4 A. M.                                                                |
| 15    | 131.0                 | 0.14                            | S. S. E. & S. E.                  |                        | Clear to 3 A. M. Vi afterwards. Rain between 5 & 6 AM & at 2 PM.                                                                                    |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind.                                  | General aspect of the Sky.                                                                                                                                     |
|-------|-----------------------|---------------------------------|-----------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16    | o                     | Inches                          | S. S. W.                          | lb                                                      | Overcast to 3 P. M. \i to 7 P. M. \i afterwards. Light rain at 2 & 9½ A. M. & at 1½ P. M.                                                                      |
| 17    | ...                   | ...                             | S. S. W. & S. S. E.               | ...                                                     | \i nearly the whole day.                                                                                                                                       |
| 18    | ...                   | 1.36                            | S. S. W. & S. W.                  |                                                         | \i to 3 A. M. \i to 10 A. M. Overcast afterwards, Rain at 11 A. M. 12½ P. M. & from 5 to 11 P. M.                                                              |
| 19    | ...                   | ...                             | S. S. W. & variable               | Instruments out of order                                | Overcast nearly the whole day. Lightning & Thunder at midnight. Slight rain from midnight to 2 A. M. & at 6 P. M.                                              |
| 20    | ...                   | 0.44                            | W. & variable                     |                                                         | Overcast to 4 P. M. \i & \i afterwards. Rain at 2 & 3 A. M. & at Noon.                                                                                         |
| 21    | ...                   | 0.63                            | S. & S. by W.                     |                                                         | Overcast nearly the whole day. Rain from midnight to 2 & at 5 & from 7 to 9 A. M.                                                                              |
| 22    | ...                   | ...                             | S. by E. & S. S. E.               |                                                         | Scatd. \i to 8 A. M. \i to 1 P. M. Overcast to 6 P. M. Thin clouds afterwards.                                                                                 |
| 23    | 133.0                 | ...                             | S. S. E. & S. by E.               |                                                         | \i to 9 A. M. \i afterwards.                                                                                                                                   |
| 24    | ...                   | ...                             | E. & E. S. E.                     |                                                         | \i & \i nearly the whole day. Light, rain at 3 P. M.                                                                                                           |
| 25    | ...                   | 0.12                            | E. N. E. & E. S. E.               |                                                         | \i & \i nearly the whole day. Rain at 3 & 4 P. M.                                                                                                              |
| 26    | ...                   | 0.10                            | S. E. & E. N. E.                  |                                                         | Scatd. clouds to 7 A. M. \i to Noon. Overcast at 5 P. M. Scatd. clouds afterwards, Rain at 1 & 4½ P. M.                                                        |
| 27    | ...                   | 0.30                            | E. & S. S. E.                     |                                                         | Scatd. clouds to 11 A. M. Overcast to 3 P. M. Thin clouds afterwards, Rain at 11½ A. M.                                                                        |
| 28    | ...                   | 0.30                            | S. E. & S. S. E.                  |                                                         | Overcast to 6 A. M. \i & Scuds from E to 11 A. M. Thin clouds to 4 P. M. Scatd. \i afterwards. Rain from 2 to 5 A. M. at 10 A. M. Noon 3½ P. M. & at 10½ P. M. |
| 29    | ...                   | 3.14                            | S. by W. & variable.              |                                                         | Overcast to 1 P. M. \i to 6 P. M. clear afterwards, rain from 3 to 5 A. M. at 8 A. M. & at 3½ P. M.                                                            |
| 30    | 133.0                 | ...                             | S. & S. S. W.                     | \i to 7 P. M. clear afterwards. Light rain at Noon.     |                                                                                                                                                                |
| 31    | 134.6                 | ...                             | S. S. W. & S. by W.               | Clear to 2 A. M. Scatd. \i to 6 P. M. clear afterwards. |                                                                                                                                                                |

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, ~ i Cumulo strati, ~ i Nimbi, \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of August 1866.*

MONTHLY RESULTS.

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|                                                                    | Inches. |
|--------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month, ... ..                 | 29.584  |
| Max. height of the Barometer occurred at 10 A. M. on the 30th, ... | 29.822  |
| Min. height of the Barometer occurred at 4 P. M. on the 7th, ...   | 29.332  |
| <i>Extreme range</i> of the Barometer during the month, ... ..     | 0.490   |
| Mean of the daily Max. Pressures, ... ..                           | 29.642  |
| Ditto ditto Min. ditto ... ..                                      | 29.519  |
| <i>Mean daily range</i> of the Barometer during the month, ... ..  | 0.123   |

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|                                                                     | °    |
|---------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month, ... ..                     | 82.9 |
| Max. Temperature occurred at 5 P. M. on the 31st, ... ..            | 91.8 |
| Min. Temperature occurred at 5 A. M. on the 28th, ... ..            | 77.4 |
| <i>Extreme range</i> of the Temperature during the month, ... ..    | 14.4 |
| Mean of the daily Max. Temperature ... ..                           | 87.6 |
| Ditto ditto Min. ditto, ... ..                                      | 79.9 |
| <i>Mean daily range</i> of the Temperature during the month, ... .. | 7.7  |

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|                                                                |      |
|----------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month, ... ..                | 80.2 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ... | 2.7  |
| Computed Mean Dew-point for the month, ... ..                  | 78.3 |
| Mean Dry Bulb Thermometer above computed mean Dew-point. ...   | 4.6  |

|                                                    |       |
|----------------------------------------------------|-------|
| Mean Elastic force of Vapour for the month, ... .. | 0.949 |
|----------------------------------------------------|-------|

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|                                                                        | Troy grain. |
|------------------------------------------------------------------------|-------------|
| Mean Weight of Vapour for the month ... ..                             | 10.18       |
| Additional Weight of Vapour required for complete saturation, ...      | 1.61        |
| Mean degree of humidity for the month, complete saturation being unity | 0.86        |

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|                                                                                                 | Inches. |
|-------------------------------------------------------------------------------------------------|---------|
| Rained 27 days,—Max. fall of rain during 24 hours ... ..                                        | 3.14    |
| Total amount of rain during the month, ... ..                                                   | 11.48   |
| Total amount of rain indicated by the Gauge attached to the anemometer during the month. ... .. | 10.67   |
| Prevailing direction of the Wind, ... S. S. E. E. S. E. & S. by E.                              |         |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                      | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                         | o    | o     |
| 1     | 29.669                                          | 29.730                                    | 29.582  | 0.148   | 87.0                          | 93.2                                      | 82.2 | 11.0  |
| 2     | .646                                            | .715                                      | .576    | .139    | 86.8                          | 93.0                                      | 82.2 | 10.8  |
| 3     | .598                                            | .669                                      | .517    | .152    | 86.5                          | 92.0                                      | 82.0 | 10.0  |
| 4     | .570                                            | .627                                      | .494    | .133    | 83.1                          | 87.2                                      | 80.0 | 7.2   |
| 5     | .612                                            | .683                                      | .550    | .133    | 83.3                          | 89.4                                      | 79.9 | 9.5   |
| 6     | .666                                            | .726                                      | .615    | .111    | 83.9                          | 88.4                                      | 80.6 | 7.8   |
| 7     | .667                                            | .726                                      | .584    | .142    | 85.7                          | 90.2                                      | 81.6 | 8.6   |
| 8     | .571                                            | .652                                      | .473    | .179    | 83.5                          | 89.0                                      | 79.6 | 9.4   |
| 9     | .498                                            | .555                                      | .444    | .111    | 80.8                          | 82.8                                      | 79.0 | 3.8   |
| 10    | .548                                            | .607                                      | .504    | .103    | 83.3                          | 87.3                                      | 80.2 | 7.1   |
| 11    | .626                                            | .687                                      | .569    | .118    | 83.2                          | 87.0                                      | 80.6 | 6.4   |
| 12    | .615                                            | .672                                      | .534    | .138    | 84.2                          | 90.1                                      | 80.5 | 9.6   |
| 13    | .638                                            | .691                                      | .586    | .105    | 84.9                          | 91.8                                      | 81.8 | 10.0  |
| 14    | .642                                            | .694                                      | .575    | .119    | 84.8                          | 88.0                                      | 81.8 | 6.2   |
| 15    | .579                                            | .618                                      | .515    | .103    | 85.8                          | 91.6                                      | 81.8 | 9.8   |
| 16    | .579                                            | .622                                      | .511    | .111    | 84.5                          | 92.8                                      | 80.2 | 12.6  |
| 17    | .599                                            | .645                                      | .523    | .122    | 82.9                          | 86.2                                      | 80.2 | 6.0   |
| 18    | .643                                            | .724                                      | .576    | .148    | 82.9                          | 86.8                                      | 79.8 | 7.0   |
| 19    | .730                                            | .786                                      | .674    | .112    | 83.2                          | 89.0                                      | 80.6 | 8.4   |
| 20    | .741                                            | .797                                      | .681    | .116    | 82.5                          | 87.6                                      | 80.4 | 7.2   |
| 21    | .712                                            | .762                                      | .645    | .117    | 82.6                          | 87.5                                      | 79.0 | 8.5   |
| 22    | .763                                            | .812                                      | .713    | .099    | 84.1                          | 89.8                                      | 79.6 | 10.2  |
| 23    | .802                                            | .855                                      | .746    | .109    | 85.1                          | 90.8                                      | 80.2 | 10.6  |
| 24    | .773                                            | .834                                      | .698    | .136    | 84.1                          | 89.0                                      | 79.0 | 10.0  |
| 25    | .729                                            | .776                                      | .657    | .119    | 82.2                          | 84.0                                      | 79.2 | 4.8   |
| 26    | .731                                            | .782                                      | .652    | .130    | 83.9                          | 90.0                                      | 78.0 | 12.0  |
| 27    | .767                                            | .842                                      | .688    | .154    | 85.4                          | 91.2                                      | 80.8 | 10.4  |
| 28    | .752                                            | .811                                      | .676    | .135    | 86.2                          | 91.4                                      | 82.2 | 9.2   |
| 29    | .751                                            | .803                                      | .676    | .127    | 86.5                          | 93.2                                      | 81.4 | 11.8  |
| 30    | .760                                            | .831                                      | .677    | .154    | 86.5                          | 93.6                                      | 81.8 | 11.8  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| 1     | 82.9                            | 4.1                 | 80.4                | 6.6                          | 1.014                            | 10.79                                            | 2.50                                                                | 0.81                                                                |
| 2     | 82.7                            | 4.1                 | 80.2                | 6.6                          | .008                             | .73                                              | .48                                                                 | .81                                                                 |
| 3     | 82.5                            | 4.0                 | 80.1                | 6.4                          | .005                             | .71                                              | .39                                                                 | .82                                                                 |
| 4     | 80.6                            | 2.5                 | 78.8                | 4.3                          | 0.964                            | .36                                              | 1.50                                                                | .87                                                                 |
| 5     | 80.5                            | 2.8                 | 78.5                | 4.8                          | .955                             | .25                                              | .68                                                                 | .86                                                                 |
| 6     | 81.4                            | 2.5                 | 79.6                | 4.3                          | .989                             | .60                                              | .53                                                                 | .87                                                                 |
| 7     | 82.4                            | 3.3                 | 80.1                | 5.6                          | 1.005                            | .71                                              | 2.09                                                                | .84                                                                 |
| 8     | 80.6                            | 2.9                 | 78.6                | 4.9                          | 0.958                            | .28                                              | 1.72                                                                | .86                                                                 |
| 9     | 79.3                            | 1.5                 | 78.2                | 2.6                          | .946                             | .19                                              | 0.88                                                                | .92                                                                 |
| 10    | 80.7                            | 2.6                 | 78.9                | 4.4                          | .967                             | .39                                              | 1.54                                                                | .87                                                                 |
| 11    | 79.1                            | 4.1                 | 76.2                | 7.0                          | .887                             | 9.52                                             | 2.37                                                                | .80                                                                 |
| 12    | 80.8                            | 3.4                 | 78.4                | 5.8                          | .952                             | 10.19                                            | .05                                                                 | .83                                                                 |
| 13    | 81.5                            | 3.4                 | 79.1                | 5.8                          | .973                             | .40                                              | .09                                                                 | .83                                                                 |
| 14    | 82.1                            | 2.7                 | 80.2                | 4.6                          | 1.008                            | .77                                              | 1.69                                                                | .86                                                                 |
| 15    | 82.1                            | 3.7                 | 79.5                | 6.3                          | 0.986                            | .53                                              | 2.30                                                                | .82                                                                 |
| 16    | 81.4                            | 3.1                 | 79.2                | 5.3                          | .976                             | .45                                              | 1.90                                                                | .85                                                                 |
| 17    | 81.0                            | 1.9                 | 79.7                | 3.2                          | .992                             | .66                                              | .13                                                                 | .90                                                                 |
| 18    | 80.5                            | 2.4                 | 78.8                | 4.1                          | .964                             | .36                                              | .43                                                                 | .88                                                                 |
| 19    | 80.7                            | 2.5                 | 78.9                | 4.3                          | .967                             | .39                                              | .50                                                                 | .87                                                                 |
| 20    | 80.2                            | 2.3                 | 78.6                | 3.9                          | .958                             | .30                                              | .34                                                                 | .89                                                                 |
| 21    | 79.4                            | 3.2                 | 77.2                | 5.4                          | .916                             | 9.85                                             | .83                                                                 | .84                                                                 |
| 22    | 80.4                            | 3.7                 | 77.8                | 6.3                          | .934                             | 10.01                                            | 2.20                                                                | .82                                                                 |
| 23    | 81.5                            | 3.6                 | 79.0                | 6.1                          | .970                             | .37                                              | .20                                                                 | .83                                                                 |
| 24    | 79.7                            | 4.4                 | 76.6                | 7.5                          | .899                             | 9.61                                             | .60                                                                 | .79                                                                 |
| 25    | 79.4                            | 2.8                 | 77.4                | 4.8                          | .922                             | .91                                              | 1.63                                                                | .86                                                                 |
| 26    | 79.3                            | 4.6                 | 76.1                | 7.8                          | .885                             | .48                                              | 2.65                                                                | .78                                                                 |
| 27    | 80.8                            | 4.6                 | 77.6                | 7.8                          | .928                             | .91                                              | .77                                                                 | .78                                                                 |
| 28    | 81.9                            | 4.3                 | 78.9                | 7.3                          | .967                             | 10.32                                            | .67                                                                 | .79                                                                 |
| 29    | 81.5                            | 5.0                 | 78.5                | 8.0                          | .955                             | .18                                              | .92                                                                 | .78                                                                 |
| 30    | 81.8                            | 4.7                 | 79.0                | 7.5                          | .970                             | .33                                              | .77                                                                 | .79                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer at<br>32° Fah. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                        | Inches.                                                      | Inches. | Inches. | o                             | o                                                                | o    | o     |
| Mid-<br>night. | 29.681                                         | 29.807                                                       | 29.537  | 0.270   | 82.2                          | 84.6                                                             | 79.0 | 5.6   |
| 1              | .672                                           | .805                                                         | .519    | .286    | 82.0                          | 84.2                                                             | 79.2 | 5.0   |
| 2              | .663                                           | .800                                                         | .503    | .297    | 81.7                          | 83.8                                                             | 78.8 | 5.0   |
| 3              | .655                                           | .791                                                         | .488    | .303    | 81.4                          | 83.2                                                             | 78.4 | 4.8   |
| 4              | .648                                           | .781                                                         | .469    | .312    | 81.2                          | 83.0                                                             | 78.2 | 4.8   |
| 5              | .656                                           | .798                                                         | .464    | .334    | 81.1                          | 82.8                                                             | 78.0 | 4.8   |
| 6              | .671                                           | .811                                                         | .479    | .332    | 81.0                          | 83.0                                                             | 78.2 | 4.8   |
| 7              | .687                                           | .824                                                         | .499    | .325    | 82.0                          | 84.8                                                             | 79.6 | 5.2   |
| 8              | .705                                           | .846                                                         | .506    | .340    | 83.8                          | 87.0                                                             | 81.3 | 5.7   |
| 9              | .716                                           | .851                                                         | .519    | .332    | 85.3                          | 88.2                                                             | 81.8 | 6.4   |
| 10             | .718                                           | .855                                                         | .523    | .332    | 86.3                          | 90.2                                                             | 82.2 | 8.0   |
| 11             | .708                                           | .846                                                         | .516    | .330    | 87.2                          | 91.0                                                             | 82.2 | 8.8   |
| Noon.          | .688                                           | .836                                                         | .502    | .334    | 87.8                          | 91.2                                                             | 80.4 | 10.8  |
| 1              | .661                                           | .808                                                         | .481    | .327    | 88.2                          | 92.8                                                             | 81.2 | 11.6  |
| 2              | .633                                           | .782                                                         | .461    | .321    | 88.1                          | 92.8                                                             | 80.0 | 12.8  |
| 3              | .611                                           | .769                                                         | .444    | .325    | 88.2                          | 93.6                                                             | 80.7 | 12.9  |
| 4              | .603                                           | .758                                                         | .448    | .310    | 87.7                          | 93.0                                                             | 81.4 | 11.6  |
| 5              | .604                                           | .746                                                         | .456    | .290    | 86.8                          | 92.6                                                             | 80.2 | 12.4  |
| 6              | .622                                           | .760                                                         | .480    | .280    | 85.2                          | 90.7                                                             | 80.5 | 10.2  |
| 7              | .642                                           | .774                                                         | .490    | .284    | 84.4                          | 89.0                                                             | 80.5 | 8.5   |
| 8              | .666                                           | .786                                                         | .519    | .267    | 83.6                          | 88.4                                                             | 80.4 | 8.0   |
| 9              | .686                                           | .801                                                         | .551    | .250    | 83.0                          | 85.8                                                             | 80.0 | 5.8   |
| 10             | .695                                           | .812                                                         | .555    | .257    | 82.7                          | 85.6                                                             | 79.6 | 6.0   |
| 11             | .690                                           | .809                                                         | .550    | .259    | 82.4                          | 85.0                                                             | 79.2 | 5.8   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 80.4                            | 1.8                 | 79.1                | 3.1                          | 0.973                            | 10.47                                            | 1.07                                                                | 0.91                                                                |
| 1              | 80.2                            | 1.8                 | 78.9                | 3.1                          | .967                             | .41                                              | .06                                                                 | .91                                                                 |
| 2              | 80.2                            | 1.5                 | 79.1                | 2.6                          | .973                             | .47                                              | 0.90                                                                | .92                                                                 |
| 3              | 80.0                            | 1.4                 | 79.0                | 2.4                          | .970                             | .46                                              | .81                                                                 | .93                                                                 |
| 4              | 79.8                            | 1.4                 | 78.8                | 2.4                          | .964                             | .40                                              | .81                                                                 | .93                                                                 |
| 5              | 79.8                            | 1.3                 | 78.9                | 2.2                          | .967                             | .43                                              | .74                                                                 | .93                                                                 |
| 6              | 79.8                            | 1.2                 | 79.0                | 2.0                          | .970                             | .46                                              | .68                                                                 | .94                                                                 |
| 7              | 80.4                            | 1.6                 | 79.3                | 2.7                          | .979                             | .53                                              | .94                                                                 | .92                                                                 |
| 8              | 81.0                            | 2.8                 | 79.0                | 4.8                          | .970                             | .40                                              | 1.70                                                                | .86                                                                 |
| 9              | 81.5                            | 3.8                 | 78.8                | 6.5                          | .974                             | .29                                              | 2.35                                                                | .81                                                                 |
| 10             | 81.6                            | 4.7                 | 78.3                | 8.0                          | .949                             | .12                                              | .90                                                                 | .78                                                                 |
| 11             | 81.8                            | 5.4                 | 78.6                | 8.6                          | .958                             | .19                                              | 3.18                                                                | .76                                                                 |
| Noon.          | 82.0                            | 5.8                 | 78.5                | 9.3                          | .955                             | .16                                              | .44                                                                 | .75                                                                 |
| 1              | 82.3                            | 5.9                 | 78.8                | 9.4                          | .964                             | .25                                              | .51                                                                 | .75                                                                 |
| 2              | 81.9                            | 6.2                 | 78.2                | 9.9                          | .946                             | .07                                              | .65                                                                 | .73                                                                 |
| 3              | 82.2                            | 6.0                 | 78.6                | 9.6                          | .958                             | .17                                              | .59                                                                 | .74                                                                 |
| 4              | 81.9                            | 5.8                 | 78.4                | 9.3                          | .952                             | .12                                              | .44                                                                 | .75                                                                 |
| 5              | 81.4                            | 5.4                 | 78.2                | 8.6                          | .946                             | .07                                              | .14                                                                 | .76                                                                 |
| 6              | 81.2                            | 4.0                 | 78.4                | 6.8                          | .952                             | .17                                              | 2.44                                                                | .81                                                                 |
| 7              | 81.2                            | 3.2                 | 79.0                | 5.4                          | .970                             | .40                                              | 1.91                                                                | .85                                                                 |
| 8              | 80.9                            | 2.7                 | 79.0                | 4.6                          | .970                             | .40                                              | .63                                                                 | .87                                                                 |
| 9              | 80.5                            | 2.5                 | 78.7                | 4.3                          | .961                             | .33                                              | .49                                                                 | .87                                                                 |
| 10             | 80.5                            | 2.2                 | 79.0                | 3.7                          | .970                             | .42                                              | .30                                                                 | .89                                                                 |
| 11             | 80.5                            | 1.9                 | 79.2                | 3.2                          | .976                             | .50                                              | .11                                                                 | .90                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                                                                                                                                                                                                                                                                                             |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 139.0                 | Inches ...                      | S. by W. & S.                     | lb                     | Clear to 7 A. M. Scatd. $\curvearrowright$ to 1 P. M. $\curvearrowright$ & $\curvearrowright$ afterwards. Lightning to E at 7 & 11 P. M. Scatd. $\curvearrowright$ to 6 A. M. Scatd. $\curvearrowright$ to 6 P. M. Overcast afterwards. Thunder at 9 & 10 P. M. Lightning at 9, 10 & 11 P. M. Rain from 7 to 11 P. M. $\curvearrowright$ & $\curvearrowright$ . Lightning at 10 P. M. Light rain at midnight & 8 A. M. |
| 2     | 141.0                 | 3.08                            | S. & S. W.                        |                        | Overcast nearly the whole day. Thunder & Lightning from midnight to 3 A. M. Rain at 1, 2 & 4 & from 8 to 10 A. M. $\curvearrowright$ to Noon. $\curvearrowright$ to 6 P. M. Overcast afterwards. Rain at 7 A. M. & at 3 & 8 P. M.                                                                                                                                                                                      |
| 3     | 130.6                 | ...                             | W. S. W. & N. W.                  |                        | Clear to 3 A. M. $\curvearrowright$ to 8 P. M. Clear afterwards. Slight rain at 9 A. M. & 5 P. M.                                                                                                                                                                                                                                                                                                                      |
| 4     | ...                   | 0.42                            | S. S. W. & S. W.                  |                        | Clear to 5 A. M. $\curvearrowright$ to 3 P. M. $\curvearrowright$ afterwards. Lightning to N W from 8 to 11 P. M.                                                                                                                                                                                                                                                                                                      |
| 5     | 128.0                 | 0.20                            | Variable.                         |                        | $\curvearrowright$ to 4 P. M. Overcast afterwards. Thunder at 11 P. M. Lightning from 9 to 11 P. M. Rain at 1, 2 & 11 A. M. & at 5 & 11 P. M.                                                                                                                                                                                                                                                                          |
| 6     | ...                   | ...                             | E. S. E. & variable               |                        | Overcast. Rain constantly from midnight to 4 P. M.                                                                                                                                                                                                                                                                                                                                                                     |
| 7     | 129.2                 | ...                             | S. & S. W.                        |                        | Scatd. $\curvearrowright$ to 6 A. M. Scatd. $\curvearrowright$ to 1 P. M. Overcast to 8 P. M. Clear afterwards.                                                                                                                                                                                                                                                                                                        |
| 8     | ...                   | 0.73                            | Variable.                         |                        | $\curvearrowright$ nearly the whole day. Slight rain at 11 P. M.                                                                                                                                                                                                                                                                                                                                                       |
| 9     | ...                   | 3.84                            | Variable.                         |                        | Scatd. $\curvearrowright$ to 6 P. M. Clear afterwards. Rain at midnight, 1 & 6 A. M. & between 3 & 4 P. M.                                                                                                                                                                                                                                                                                                             |
| 10    | ...                   | ...                             | S. S. E. & E. S. E.               |                        | Clear to 5 A. M. Scatd. $\curvearrowright$ to 7 P. M. Clear afterwards.                                                                                                                                                                                                                                                                                                                                                |
| 11    | 140.2                 | ...                             | S.S.E,S., & S. by E.              |                        | Clear to 4 A. M. Scatd. $\curvearrowright$ to 6 P. M. Scatd. $\curvearrowright$ to 9 P. M. Clear afterwards. Rain at Noon & 1½ P. M.                                                                                                                                                                                                                                                                                   |
| 12    | 149.2                 | 0.18                            | S. S. E. & S. by E.               |                        | Clear to 7 A. M. $\curvearrowright$ afterwards. Light rain at 8 P. M.                                                                                                                                                                                                                                                                                                                                                  |
| 13    | 142.7                 | ...                             | S. S. E. & S. E.                  |                        |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 14    | 133.8                 | 0.27                            | S. S. E. & S.                     |                        |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 15    | 143.2                 | ...                             | S. S. W. & S.                     |                        |                                                                                                                                                                                                                                                                                                                                                                                                                        |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                                    |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 16    | 148.2                 | 2.52                            | S. & variable.                    | ib<br>...              | Clear to 5 A. M. Scatd. $\sim$ i to 1 P. M. Overcast afterwards. Thunder at 4, 6 & 7 P. M. Lightning at 7 P. M. Rain at 3, 4, 7 & 8 P. M.     |
| 17    | ...                   | 0.39                            | N. E. & N. N. E.                  | ...                    | Overcast nearly the whole day. Rain from 11 $\frac{1}{2}$ A. M. to 2 P. M. & at 5 P. M.                                                       |
| 18    | ...                   | 1.29                            | E. N. E. & S. E.                  |                        | Clear to 3 A. M. Scatd. $\searrow$ i to 7 A. M. $\sim$ i afterwards. Rain from 9 $\frac{1}{2}$ A. M. to 12 $\frac{1}{2}$ A. M.                |
| 19    | 142.4                 | 0.78                            | E. S. E. & variable               |                        | Clear to 5 A. M. $\sim$ i to 11 A. M. Overcast afterwards. Lightning & Thunder at 5 P. M. Rain at 7 A. M. Noon, 1 & from 5 to 7 P. M.         |
| 20    | 143.7                 | 1.00                            | S. S. E. & S. E.                  |                        | $\sim$ i & $\searrow$ i. Rain at 1 & 3 P. M.                                                                                                  |
| 21    | 136.2                 | 0.09                            | S. S. E.                          |                        | Clouds of different kinds. Rain at 12 $\frac{1}{2}$ & at 5 $\frac{1}{2}$ P. M.                                                                |
| 22    | 147.8                 | ...                             | S. E. & S. by E.                  |                        | Clear to 4 A. M. $\sim$ i to 6 P. M. Clear afterwards.                                                                                        |
| 23    | 140.2                 | ...                             | S. by E. & S. S. W.               |                        | Clear to 7 A. M. $\sim$ i to 4 P. M. $\searrow$ i afterwards.                                                                                 |
| 24    | 140.0                 | ...                             | N. W. & W.                        |                        | $\sim$ i to 9 A. M. Clouds of different kinds afterwards. Light rain at 7 P. M.                                                               |
| 25    | ...                   | 0.03*                           | W. & variable.                    |                        | Scatd. $\searrow$ i to 2 A. M. Overcast to 4 P. M. Scatd. $\searrow$ i afterwards Slight rain at 4 & 5 A. M.                                  |
| 26    | 140.2                 | 0.14                            | E. S. E. & S. E.                  |                        | Scatd. $\searrow$ i to 5 A. M. Scatd. $\sim$ i to 1 P. M. Scatd. $\searrow$ i afterwards. Rain at 8 & 9 P. M.                                 |
| 27    | 846.2                 | 0.84                            | S. by E., S. S. E. & S.           |                        | Clear to 7 A. M. Scatd. $\searrow$ i to 10 A. M. Scatd. $\sim$ i to 5 P. M. $\searrow$ i afterwards. Thunder at 6 P. M. Rain at 6 & 7 P. M.   |
| 28    | 147.4                 | 0.05                            | S. & S. E.                        |                        | Clear to 7 A. M. Scatd. $\sim$ i to 6 P. M. Clear afterwards. Light rain at 5 P. M.                                                           |
| 29    | 138.2                 | 0.12                            | S. & variable.                    |                        | Scatd. $\searrow$ i to 7 A. M. Scatd. $\sim$ i to 6 P. M. Overcast afterwards. Lightning & Thunder from 7 to 9 P. M. Rain between 8 & 9 P. M. |
| 30    | 145.2                 | ...                             | S. S. W. & variable               |                        | Clear to 8 A. M. Scatd. $\sim$ i afterwards.                                                                                                  |

$\searrow$  i Cirri, — i Strati,  $\sim$  i Cumuli,  $\searrow$  i Cirro-strati,  $\sim$  i Cumulo strati,  $\searrow$  i Nimbi,  $\sim$  i Cirro cumuli.

\* Rain Gauge 1 Foot 2 Inches above ground.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of September 1866.*

MONTHLY RESULTS.

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|                                                                   | Inches. |
|-------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month... ..                  | 29.666  |
| Max. height of the Barometer occurred at 10 A. M. on the 23rd ... | 29.855  |
| Min. height of the Barometer occurred at 3 P. M. on the 9th ...   | 29.444  |
| <i>Extreme range</i> of the Barometer during the month ...        | 0.411   |
| Mean of the daily Max. Pressures ... ..                           | 29.724  |
| Ditto ditto Min. ditto ... ..                                     | 29.597  |
| <i>Mean daily range</i> of the Barometer during the month ...     | 0.127   |

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|                                                                   | °    |
|-------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month ... ..                    | 83.4 |
| Max. Temperature occurred at 3 P. M. on the 30th ... ..           | 93.6 |
| Min. Temperature occurred at 5 A. M. on the 26th ... ..           | 78.0 |
| <i>Extreme range</i> of the Temperature during the month ... ..   | 15.6 |
| Mean of the daily Max. Temperature ... ..                         | 89.5 |
| Ditto ditto Min. ditto, ... ..                                    | 80.5 |
| <i>Mean daily range</i> of the Temperature during the month... .. | 9.0  |

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|                                                             |      |
|-------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month ... ..              | 81.0 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer   | 3.3  |
| Computed Mean Dew-point for the month ... ..                | 78.7 |
| Mean Dry Bulb Thermometer above computed mean Dew-point ... | 5.6  |

|                                                   | Inches. |
|---------------------------------------------------|---------|
| Mean Elastic force of Vapour for the month ... .. | 0.961   |

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|                                                                        | Troy grain. |
|------------------------------------------------------------------------|-------------|
| Mean Weight of Vapour for the month ... ..                             | 10.29       |
| Additional Weight of Vapour required for complete saturation ...       | 1.99        |
| Mean degree of humidity for the month, complete saturation being unity | 0.84        |

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|                                                                                                     | Inches.       |
|-----------------------------------------------------------------------------------------------------|---------------|
| Rained 23 days,—Max. fall of rain during 24 hours ... ..                                            | 3.84          |
| Total amount of rain during the month ... ..                                                        | 15.97         |
| Total amount of rain indicated by the Gauge attached to the anemo-<br>meter during the month ... .. | 15.07         |
| Prevailing direction of the Wind ... ..                                                             | S. S. E. & S. |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahrt. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of Tempera-<br>ture during the day. |      |       |
|-------|--------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-------------------------------------------|------|-------|
|       |                                                  | Max.                                      | Min.    | Diff.   |                               | Max.                                      | Min. | Diff. |
|       | Inches.                                          | Inches.                                   | Inches. | Inches. | o                             | o                                         | o    | o     |
| 1     | 29.759                                           | 29.808                                    | 29.689  | 0.119   | 85.2                          | 91.2                                      | 82.0 | 9.2   |
| 2     | .795                                             | .857                                      | .745    | .112    | 84.3                          | 92.2                                      | 81.4 | 10.8  |
| 3     | .853                                             | .915                                      | .791    | .124    | 85.6                          | 90.4                                      | 81.0 | 9.4   |
| 4     | .849                                             | .913                                      | .785    | .128    | 84.0                          | 90.6                                      | 80.0 | 10.6  |
| 5     | .815                                             | .864                                      | .733    | .131    | 84.4                          | 91.2                                      | 80.4 | 10.8  |
| 6     | .821                                             | .884                                      | .759    | .125    | 83.7                          | 88.0                                      | 81.0 | 7.0   |
| 7     | .819                                             | .882                                      | .748    | .134    | 84.1                          | 89.8                                      | 79.6 | 10.2  |
| 8     | .847                                             | .901                                      | .780    | .121    | 82.7                          | 87.4                                      | 79.4 | 8.0   |
| 9     | .841                                             | .903                                      | .782    | .121    | 81.5                          | 89.2                                      | 77.8 | 11.4  |
| 10    | .779                                             | .854                                      | .705    | .149    | 80.2                          | 85.4                                      | 77.0 | 8.4   |
| 11    | .799                                             | .875                                      | .743    | .132    | 82.5                          | 88.6                                      | 78.0 | 10.6  |
| 12    | .876                                             | .938                                      | .832    | .106    | 83.1                          | 89.8                                      | 78.0 | 11.8  |
| 13    | .877                                             | .953                                      | .808    | .145    | 84.1                          | 89.9                                      | 79.2 | 10.7  |
| 14    | .855                                             | .923                                      | .797    | .126    | 85.0                          | 90.5                                      | 81.0 | 9.5   |
| 15    | .839                                             | .902                                      | .773    | .129    | 84.4                          | 90.2                                      | 80.7 | 9.5   |
| 16    | .869                                             | .928                                      | .816    | .112    | 81.9                          | 88.4                                      | 78.8 | 9.6   |
| 17    | .905                                             | .951                                      | .857    | .094    | 83.2                          | 90.0                                      | 78.0 | 12.0  |
| 18    | .936                                             | .998                                      | .880    | .118    | 82.4                          | 88.0                                      | 77.4 | 10.6  |
| 19    | .909                                             | .981                                      | .841    | .140    | 82.6                          | 88.8                                      | 77.0 | 11.8  |
| 20    | .869                                             | .965                                      | .787    | .178    | 83.7                          | 90.2                                      | 77.6 | 12.6  |
| 21    | .820                                             | .875                                      | .751    | .124    | 81.5                          | 85.6                                      | 77.7 | 7.9   |
| 22    | .778                                             | .836                                      | .706    | .130    | 80.5                          | 84.2                                      | 78.0 | 6.2   |
| 23    | .749                                             | .810                                      | .668    | .142    | 80.2                          | 87.0                                      | 75.8 | 11.2  |
| 24    | .638                                             | .715                                      | .566    | .149    | 75.9                          | 77.5                                      | 74.0 | 3.5   |
| 25    | .628                                             | .802                                      | .514    | .288    | 79.2                          | 82.7                                      | 76.5 | 6.2   |
| 26    | .850                                             | .915                                      | .778    | .137    | 75.8                          | 79.4                                      | 71.9 | 7.5   |
| 27    | .924                                             | .982                                      | .848    | .134    | 78.2                          | 83.4                                      | 73.6 | 9.8   |
| 28    | .950                                             | 30.004                                    | .900    | .104    | 78.9                          | 86.0                                      | 73.6 | 12.4  |
| 29    | .922                                             | 29.994                                    | .879    | .115    | 79.6                          | 85.6                                      | 74.0 | 11.6  |
| 30    | .904                                             | .966                                      | .849    | .117    | 79.3                          | 85.4                                      | 74.8 | 10.6  |
| 31    | .895                                             | .954                                      | .843    | .111    | 79.6                          | 84.6                                      | 75.4 | 9.2   |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satu-<br>ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| 1     | 81.4                            | 3.8                 | 78.7                | 6.5                          | 0.961                            | 10.26                                            | 2.35                                                                | 0.81                                                                |
| 2     | 80.7                            | 3.6                 | 78.2                | 6.1                          | .946                             | .13                                              | .15                                                                 | .83                                                                 |
| 3     | 81.1                            | 4.5                 | 77.9                | 7.7                          | .937                             | .00                                              | .76                                                                 | .78                                                                 |
| 4     | 80.7                            | 3.3                 | 78.4                | 5.6                          | .952                             | .19                                              | 1.98                                                                | .84                                                                 |
| 5     | 80.6                            | 3.8                 | 77.9                | 6.5                          | .937                             | .02                                              | 2.29                                                                | .81                                                                 |
| 6     | 80.7                            | 3.0                 | 78.6                | 5.1                          | .958                             | .28                                              | 1.79                                                                | .85                                                                 |
| 7     | 79.8                            | 4.3                 | 76.8                | 7.3                          | .905                             | 9.69                                             | 2.52                                                                | .79                                                                 |
| 8     | 79.5                            | 3.2                 | 77.3                | 5.4                          | .919                             | .88                                              | 1.84                                                                | .84                                                                 |
| 9     | 78.5                            | 3.0                 | 76.4                | 5.1                          | .893                             | .62                                              | .69                                                                 | .85                                                                 |
| 10    | 77.8                            | 2.4                 | 76.1                | 4.1                          | .885                             | .55                                              | .33                                                                 | .88                                                                 |
| 11    | 79.5                            | 3.0                 | 77.4                | 5.1                          | .922                             | .91                                              | .73                                                                 | .85                                                                 |
| 12    | 79.2                            | 3.9                 | 76.5                | 6.6                          | .896                             | .61                                              | 2.25                                                                | .81                                                                 |
| 13    | 79.6                            | 4.5                 | 76.4                | 7.7                          | .893                             | .56                                              | .65                                                                 | .78                                                                 |
| 14    | 80.0                            | 5.0                 | 76.5                | 8.5                          | .896                             | .57                                              | .96                                                                 | .76                                                                 |
| 15    | 79.4                            | 5.0                 | 75.9                | 8.5                          | .879                             | .40                                              | .91                                                                 | .76                                                                 |
| 16    | 77.9                            | 4.0                 | 75.1                | 6.8                          | .857                             | .21                                              | .23                                                                 | .81                                                                 |
| 17    | 77.0                            | 6.2                 | 72.7                | 10.5                         | .792                             | 8.49                                             | 3.40                                                                | .71                                                                 |
| 18    | 75.7                            | 6.7                 | 71.0                | 11.4                         | .751                             | .07                                              | .54                                                                 | .70                                                                 |
| 19    | 76.1                            | 6.5                 | 71.5                | 11.1                         | .763                             | .20                                              | .48                                                                 | .70                                                                 |
| 20    | 77.6                            | 6.1                 | 73.3                | 10.4                         | .809                             | .66                                              | .41                                                                 | .72                                                                 |
| 21    | 78.2                            | 3.3                 | 75.9                | 5.6                          | .879                             | 9.46                                             | 1.85                                                                | .84                                                                 |
| 22    | 77.6                            | 2.9                 | 75.6                | 4.9                          | .871                             | .39                                              | .59                                                                 | .86                                                                 |
| 23    | 77.2                            | 3.0                 | 75.1                | 5.1                          | .857                             | .25                                              | .63                                                                 | .85                                                                 |
| 24    | 74.3                            | 1.6                 | 73.2                | 2.7                          | .806                             | 8.77                                             | 0.80                                                                | .92                                                                 |
| 25    | 75.8                            | 3.4                 | 73.4                | 5.8                          | .811                             | .76                                              | 1.80                                                                | .83                                                                 |
| 26    | 72.6                            | 3.2                 | 70.4                | 5.4                          | .736                             | .02                                              | .52                                                                 | .84                                                                 |
| 27    | 74.2                            | 4.0                 | 71.4                | 6.8                          | .761                             | .23                                              | 2.02                                                                | .80                                                                 |
| 28    | 73.7                            | 5.2                 | 70.1                | 8.8                          | .729                             | 7.89                                             | .58                                                                 | .75                                                                 |
| 29    | 74.3                            | 5.3                 | 70.6                | 9.0                          | .741                             | 8.00                                             | .69                                                                 | .75                                                                 |
| 30    | 74.4                            | 4.9                 | 71.0                | 8.3                          | .751                             | .12                                              | .47                                                                 | .77                                                                 |
| 31    | 73.2                            | 6.4                 | 68.7                | 10.9                         | .697                             | 7.52                                             | 3.17                                                                | .70                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | °                          | °                                                        | °    | °     |
| Mid-night. | 29.842                                    | 29.953                                                 | 29.560  | 0.393   | 79.8                       | 84.4                                                     | 75.2 | 9.2   |
| 1          | .834                                      | .949                                                   | .534    | .415    | 79.5                       | 84.2                                                     | 74.6 | 9.6   |
| 2          | .826                                      | .946                                                   | .522    | .424    | 79.2                       | 83.8                                                     | 74.0 | 9.8   |
| 3          | .819                                      | .939                                                   | .421    | .408    | 78.9                       | 84.0                                                     | 73.0 | 11.0  |
| 4          | .817                                      | .936                                                   | .514    | .422    | 78.7                       | 83.8                                                     | 72.7 | 11.1  |
| 5          | .830                                      | .954                                                   | .523    | .431    | 78.5                       | 83.6                                                     | 72.4 | 11.2  |
| 6          | .846                                      | .970                                                   | .533    | .437    | 78.3                       | 83.0                                                     | 71.9 | 11.1  |
| 7          | .861                                      | .987                                                   | .562    | .425    | 79.1                       | 83.8                                                     | 72.6 | 11.2  |
| 8          | .881                                      | 30.001                                                 | .596    | .405    | 80.9                       | 86.8                                                     | 73.8 | 13.0  |
| 9          | .891                                      | .004                                                   | .627    | .377    | 82.7                       | 87.8                                                     | 74.6 | 13.2  |
| 10         | .895                                      | .004                                                   | .648    | .356    | 84.0                       | 90.4                                                     | 76.0 | 14.4  |
| 11         | .880                                      | 29.998                                                 | .645    | .353    | 85.1                       | 91.0                                                     | 75.8 | 15.2  |
| Noon.      | .856                                      | .965                                                   | .631    | .334    | 85.6                       | 91.2                                                     | 76.2 | 15.0  |
| 1          | .825                                      | .937                                                   | .621    | .316    | 86.3                       | 91.4                                                     | 76.8 | 14.6  |
| 2          | .800                                      | .921                                                   | .606    | .315    | 86.8                       | 92.2                                                     | 75.8 | 16.4  |
| 3          | .785                                      | .911                                                   | .577    | .334    | 86.4                       | 91.2                                                     | 74.8 | 16.4  |
| 4          | .787                                      | .904                                                   | .577    | .327    | 84.7                       | 90.4                                                     | 74.9 | 15.5  |
| 5          | .791                                      | .913                                                   | .573    | .340    | 84.2                       | 90.4                                                     | 75.1 | 15.3  |
| 6          | .804                                      | .923                                                   | .571    | .352    | 82.5                       | 88.0                                                     | 75.1 | 12.9  |
| 7          | .821                                      | .935                                                   | .566    | .369    | 81.7                       | 86.6                                                     | 76.8 | 9.8   |
| 8          | .842                                      | .945                                                   | .590    | .355    | 81.1                       | 86.0                                                     | 76.2 | 9.8   |
| 9          | .856                                      | .954                                                   | .597    | .357    | 80.6                       | 85.3                                                     | 75.4 | 9.9   |
| 10         | .862                                      | .961                                                   | .588    | .373    | 80.2                       | 85.2                                                     | 75.0 | 10.2  |
| 11         | .855                                      | .958                                                   | .576    | .382    | 79.8                       | 85.0                                                     | 74.7 | 10.3  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 77.7                            | 2.1                 | 76.2                | 3.6                          | 0.887                            | 9.58                                             | 1.17                                                                | 0.89                                                                |
| 1              | 77.5                            | 2.0                 | 76.1                | 3.4                          | .885                             | .57                                              | .09                                                                 | .90                                                                 |
| 2              | 77.3                            | 1.9                 | 76.0                | 3.2                          | .882                             | .54                                              | .02                                                                 | .90                                                                 |
| 3              | 77.1                            | 1.8                 | 75.8                | 3.1                          | .876                             | .48                                              | 0.99                                                                | .91                                                                 |
| 4              | 76.9                            | 1.8                 | 75.6                | 3.1                          | .871                             | .42                                              | .99                                                                 | .91                                                                 |
| 5              | 76.8                            | 1.7                 | 75.6                | 2.9                          | .871                             | .42                                              | .93                                                                 | .91                                                                 |
| 6              | 76.7                            | 1.6                 | 75.6                | 2.7                          | .871                             | .42                                              | .86                                                                 | .92                                                                 |
| 7              | 77.0                            | 2.1                 | 75.5                | 3.6                          | .868                             | .38                                              | 1.15                                                                | .89                                                                 |
| 8              | 77.2                            | 3.7                 | 74.6                | 6.3                          | .843                             | .09                                              | 2.01                                                                | .82                                                                 |
| 9              | 77.9                            | 4.8                 | 74.5                | 8.2                          | .840                             | .03                                              | .69                                                                 | .77                                                                 |
| 10             | 78.2                            | 5.8                 | 74.1                | 9.9                          | .830                             | 8.89                                             | 3.28                                                                | .73                                                                 |
| 11             | 78.4                            | 6.7                 | 73.7                | 11.4                         | .819                             | .76                                              | .81                                                                 | .70                                                                 |
| Noon.          | 78.4                            | 7.2                 | 73.4                | 12.2                         | .811                             | .66                                              | 4.10                                                                | .68                                                                 |
| 1              | 78.5                            | 7.8                 | 73.0                | 13.3                         | .801                             | .53                                              | .49                                                                 | .66                                                                 |
| 2              | 78.5                            | 8.3                 | 73.5                | 13.3                         | .814                             | .67                                              | .54                                                                 | .66                                                                 |
| 3              | 78.3                            | 8.1                 | 72.6                | 13.8                         | .790                             | .42                                              | .64                                                                 | .65                                                                 |
| 4              | 77.6                            | 7.1                 | 72.6                | 12.1                         | .790                             | .45                                              | 3.97                                                                | .68                                                                 |
| 5              | 77.7                            | 6.5                 | 73.1                | 11.1                         | .803                             | .60                                              | .64                                                                 | .70                                                                 |
| 6              | 77.8                            | 4.7                 | 74.5                | 8.0                          | .840                             | 9.03                                             | 2.61                                                                | .78                                                                 |
| 7              | 77.9                            | 3.8                 | 75.2                | 6.5                          | .860                             | .24                                              | .13                                                                 | .81                                                                 |
| 8              | 77.9                            | 3.2                 | 75.7                | 5.4                          | .873                             | .41                                              | 1.76                                                                | .84                                                                 |
| 9              | 78.0                            | 2.6                 | 76.2                | 4.4                          | .887                             | .58                                              | .43                                                                 | .87                                                                 |
| 10             | 77.8                            | 2.4                 | 76.1                | 4.1                          | .885                             | .55                                              | .33                                                                 | .88                                                                 |
| 11             | 77.5                            | 2.3                 | 75.9                | 3.9                          | .879                             | .49                                              | .26                                                                 | .88                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations  
 taken at the Surveyor General's Office, Calcutta,  
 in the month of October 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1 ft. 2 in. above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                                                      |
|-------|-----------------------|--------------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1     | 148.4                 | 0.05                                 | S. by W.                          | lb                     | Scatd. ☉ to 2 P. M. Overcast to 6 P. M. Clear afterwards. Rain at Noon & 6 P. M. Thunder from 1 to 5 P. M. Lightning at 4 P. M. |
| 2     | 148.0                 | 0.45                                 | S. & variable                     |                        | Clear to 5 A. M. Scatd. ☉ to 6 P. M. Clear afterwards. Rain from 3 to 5 P. M.                                                   |
| 3     | 143.7                 | ...                                  | W. by N. & variable               |                        | Clear to 7 A. M. Scatd. ☉ to 5 P. M. Clear afterwards.                                                                          |
| 4     | 127.2                 | 1.14                                 | W. by N. & S. S. E.               |                        | Clear to 7 A. M. ☉ & ☽ to 2 P. M. Overcast afterwards. Rain from 4 to 6 P. M.                                                   |
| 5     | 154.2                 | ...                                  | S. S. E. & S. W.                  |                        | Clear to 5 A. M. Scatd. ☉ to 7 P. M. Clear afterwards.                                                                          |
| 6     | ...                   | ...                                  | S. & variable.                    |                        | Clear to 5 A. M. Scatd. ☉ to Noon. ☽ & ☽ afterwards.                                                                            |
| 7     | 149.2                 | ...                                  | S. & S. S. E.                     |                        | Scatd. ☉ to 6 P. M. ☽ afterwards. Light rain between Noon & 1 P. M.                                                             |
| 8     | 120.1                 | ...                                  | S. & variable.                    |                        | Clear to 7 A. M. Scatd. ☉ to 7 P. M. Clear afterwards. Light rain at 4 P. M.                                                    |
| 9     | 126.2                 | 1.23                                 | E. by N. & E. S. E.               |                        | Scatd. ☽ to 3 A. M. Scatd. ☽ to 9 A. M. Scatd. ☉ to 3 P. M. Overcast to 7 P. M. Clear afterwards. Rain from 3 to 7 P. M.        |
| 10    | 115.2                 | 1.39                                 | N. N. E. & N. E.                  |                        | Clear to 5 A. M. Overcast to 6 P. M. ☽ afterwards. Rain between 3 & 4 P. M.                                                     |
| 11    | ...                   | ...                                  | N. N. E. & E.                     |                        | Overcast to 3 A. M. ☉ to 6 P. M. Clear afterwards.                                                                              |
| 12    | 144.0                 | ...                                  | N. E.                             |                        | Clear to 6 A. M. Scatd. ☉ to 6 P. M. Clear afterwards.                                                                          |
| 13    | 143.0                 | ...                                  | N. E. & N. N. W.                  |                        | Clear to 7 A. M. Scatd. ☉ to 4 P. M. Scatd. ☽ afterwards.                                                                       |
| 14    | 143.5                 | ...                                  | W. N. W. & N. W.                  |                        | Scatd. ☉ to 5 P. M. Clear afterwards.                                                                                           |
| 15    | 126.0                 | ...                                  | S. E. & E. S. E.                  |                        | Clouds of different kinds till 10 A. M. Scatd. ☉ to 9 P. M. Clear afterwards.                                                   |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1 ft. 2 in. above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                        |
|-------|-----------------------|--------------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------------------------------------------|
|       | °                     | Inches                               |                                   | lb                     |                                                                                                   |
| 16    | 145.2                 | ...                                  | S. by E. & N. W.                  | ...                    | Clear to 5 A. M. Scatd. \i to 9 A. M. \i to 3 P. M. Scatd. \i afterwards.                         |
| 17    | 144.6                 | ...                                  | E. N. E. & S. by E.               |                        | Clear nearly the whole day. Foggy from 9 to 11 P. M.                                              |
| 18    | 140.2                 | ...                                  | N. E. & N. by E.                  |                        | Clear to 11 A. M. \i to 3 P. M. Clear to 8 P. M. Scatd. \i afterwards. Foggy at 11 P. M.          |
| 19    | 144.8                 | ...                                  | N. by E. & N. E.                  |                        | Clear to 10 A. M. Scatd. \i to 4 P. M. Clear afterwards.                                          |
| 20    | 142.2                 | ...                                  | NE.&ENE.&NNE.                     |                        | Clear to 5 A. M. \i & \i afterwards.                                                              |
| 21    | ...                   | 0.77                                 | S. & N. E. & S. S. E.             |                        | Overcast to 11 A. M. Scatd. \i to 6 P. M. Thin clouds afterwards.                                 |
| 22    | ...                   | 0.15                                 | N.NE.&SSE&ESE.                    |                        | Thin clouds to 3 A. M. Overcast to 10 A. M. \i afterwards. Rain from 5 to 8 A. M.                 |
| 23    | 146.8                 | 0.57                                 | N. N. E. & N. E.                  |                        | Overcast & \i. Rain from 7 to 9 A. M. & between 3 & 4 P. M.                                       |
| 24    | ...                   | 2.00                                 | E. N. E.                          |                        | Overcast. Low scuds from E from Noon to 6 P. M. Rain nearly the whole day.                        |
| 25    | ...                   | 0.08                                 | W. S. W. & S. W.                  |                        | \i & \i Low scuds from S from 7 A. M. to 2 P. M. Light rain at midnight, 4 & 5 A. M. & at 8 P. M. |
| 26    | 115.0                 | ...                                  | N. N. W. & N. W.                  |                        | Clouds of different kinds to 6 P. M. Clear afterwards.                                            |
| 27    | 130.0                 | ...                                  | N. N. W.                          |                        | Scatd. \i to Noon. Scatd. \i to 5 P. M. Clear afterwards.                                         |
| 28    | ...                   | ...                                  | N. N. W. & N. W.                  |                        | Clear to 10 A. M. Scatd. \i to 7 P. M. Clear afterwards. Foggy at midnight.                       |
| 29    | 146.5                 | ...                                  | N. N. W.                          |                        | Clear to 9 A. M. Scatd. \i to 4 P. M. Clear afterwards.                                           |
| 30    | 147.0                 | ...                                  | N. N. W.                          |                        | Clear to 7 A. M. Scatd. \i to 4 P. M. \i & \i afterwards.                                         |
| 31    | 146.0                 | ...                                  | N.W.&N.byW.&N.                    |                        | \i & \i to 5 P. M. Clear afterwards.                                                              |

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, ~ i Cumulo strati, \i Nimbi, \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of October 1866.*

MONTHLY RESULTS.

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|                                                                      | Inches. |
|----------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month... ..                     | 29.838  |
| Max. height of the Barometer occurred at 9 & 10 A. M. on the 28th... | 30.004  |
| Min. height of the Barometer occurred at 4 A. M. on the 25th ...     | 29.514  |
| <i>Extreme range</i> of the Barometer during the month ... ..        | 0.490   |
| Mean of the daily Max. Pressures ... ..                              | 29.905  |
| Ditto ditto Min. ditto ... ..                                        | 29.773  |
| <i>Mean daily range</i> of the Barometer during the month ... ..     | 0.132   |

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|                                                                   | °    |
|-------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month ... ..                    | 81.9 |
| Max. Temperature occurred at 2 P. M. on the 2nd ... ..            | 92.2 |
| Min. Temperature occurred at 6 A. M. on the 26th ... ..           | 71.9 |
| <i>Extreme range</i> of the Temperature during the month ... ..   | 20.3 |
| Mean of the daily Max. Temperature ... ..                         | 87.5 |
| Ditto ditto Min. ditto, ... ..                                    | 77.8 |
| <i>Mean daily range</i> of the Temperature during the month... .. | 9.7  |

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|                                                             |      |
|-------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month ... ..              | 77.7 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer   | 4.2  |
| Computed Mean Dew-point for the month ... ..                | 74.8 |
| Mean Dry Bulb Thermometer above computed mean Dew-point ... | 7.1  |

|                                                   | Inches. |
|---------------------------------------------------|---------|
| Mean Elastic force of Vapour for the month ... .. | 0.849   |

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|                                                                        | Troy grain. |
|------------------------------------------------------------------------|-------------|
| Mean Weight of Vapour for the month ... ..                             | 9.13        |
| Additional Weight of Vapour required for complete saturation ...       | 2.31        |
| Mean degree of humidity for the month, complete saturation being unity | 0.80        |

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|                                                                                                     | Inches. |
|-----------------------------------------------------------------------------------------------------|---------|
| Rained 12 days,—Max. fall of rain during 24 hours ... ..                                            | 2.00    |
| Total amount of rain during the month ... ..                                                        | 7.83    |
| Total amount of rain indicated by the Gauge attached to the anemo-<br>meter during the month ... .. | 7.25    |
| Prevailing direction of the Wind ... .. N. N. W. & N. E.                                            |         |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.907                                          | 29.963                                    | 29.861  | 0.102   | 80.0                          | 86.0                                          | 74.2 | 11.8  |
| 2     | .954                                            | 30.013                                    | .911    | .102    | 79.9                          | 85.4                                          | 74.8 | 10.6  |
| 3     | .989                                            | .059                                      | .943    | .116    | 81.7                          | 88.6                                          | 75.9 | 12.7  |
| 4     | 30.002                                          | .074                                      | .945    | .129    | 82.1                          | 87.8                                          | 77.0 | 10.8  |
| 5     | 29.972                                          | .045                                      | .921    | .124    | 79.9                          | 84.0                                          | 76.5 | 7.5   |
| 6     | .946                                            | .001                                      | .888    | .113    | 79.5                          | 85.0                                          | 75.6 | 9.4   |
| 7     | .936                                            | .009                                      | .872    | .137    | 78.9                          | 84.9                                          | 73.4 | 11.5  |
| 8     | .910                                            | 29.979                                    | .847    | .132    | 78.6                          | 86.6                                          | 72.0 | 14.6  |
| 9     | .900                                            | .961                                      | .846    | .115    | 78.3                          | 85.8                                          | 72.0 | 13.8  |
| 10    | .859                                            | .915                                      | .786    | .129    | 76.7                          | 84.0                                          | 70.0 | 14.0  |
| 11    | .885                                            | .944                                      | .829    | .115    | 75.7                          | 83.6                                          | 68.0 | 15.6  |
| 12    | .983                                            | 30.047                                    | .925    | .122    | 76.6                          | 83.6                                          | 70.8 | 12.8  |
| 13    | 30.021                                          | .096                                      | .965    | .131    | 77.2                          | 84.8                                          | 70.8 | 14.0  |
| 14    | .011                                            | .074                                      | .953    | .121    | 77.4                          | 85.2                                          | 71.2 | 14.0  |
| 15    | .054                                            | .124                                      | 30.003  | .121    | 77.1                          | 84.8                                          | 70.4 | 14.4  |
| 16    | .082                                            | .143                                      | .037    | .106    | 77.0                          | 84.1                                          | 71.0 | 13.1  |
| 17    | .097                                            | .163                                      | .029    | .134    | 76.2                          | 83.9                                          | 70.2 | 13.7  |
| 18    | .063                                            | .142                                      | 29.991  | .151    | 76.0                          | 83.6                                          | 70.0 | 13.6  |
| 19    | .050                                            | .121                                      | 30.007  | .114    | 76.0                          | 83.4                                          | 70.0 | 13.4  |
| 20    | .032                                            | .106                                      | 29.971  | .135    | 75.5                          | 82.6                                          | 69.2 | 13.4  |
| 21    | .026                                            | .094                                      | .959    | .135    | 75.4                          | 82.6                                          | 69.8 | 12.8  |
| 22    | .021                                            | .083                                      | .964    | .119    | 74.1                          | 81.8                                          | 67.2 | 14.6  |
| 23    | .000                                            | .058                                      | .939    | .119    | 73.1                          | 81.0                                          | 66.7 | 14.3  |
| 24    | 29.990                                          | .064                                      | .931    | .133    | 71.4                          | 80.1                                          | 64.8 | 15.3  |
| 25    | .985                                            | .059                                      | .919    | .140    | 71.3                          | 79.6                                          | 64.0 | 15.6  |
| 26    | .936                                            | 29.999                                    | .876    | .123    | 70.4                          | 79.0                                          | 62.8 | 16.2  |
| 27    | .945                                            | .991                                      | .890    | .101    | 70.1                          | 78.0                                          | 62.0 | 16.0  |
| 28    | 30.000                                          | 30.060                                    | .955    | .105    | 72.0                          | 80.0                                          | 64.4 | 15.6  |
| 29    | .029                                            | .095                                      | .983    | .112    | 71.8                          | 80.4                                          | 64.2 | 16.2  |
| 30    | .038                                            | .107                                      | .974    | .133    | 71.7                          | 81.0                                          | 65.0 | 16.0  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew Point. | Mean Elastic force of vapour. | Mean Weight of Vapour in a Cubic foot of air. | Additional Weight of Vapour required for complete saturation. | Mean degree of Humidity, complete saturation being unity. |
|-------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|       | o                          | o                   | o                   | o                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| 1     | 73.3                       | 6.7                 | 68.6                | 11.4                      | 0.695                         | 7.50                                          | 3.31                                                          | 0.69                                                      |
| 2     | 73.8                       | 6.1                 | 69.5                | 10.4                      | .715                          | .72                                           | .06                                                           | .72                                                       |
| 3     | 76.4                       | 5.3                 | 72.7                | 9.0                       | .792                          | 8.52                                          | 2.85                                                          | .75                                                       |
| 4     | 76.2                       | 5.9                 | 72.1                | 10.0                      | .778                          | .36                                           | 3.15                                                          | .73                                                       |
| 5     | 74.0                       | 5.9                 | 69.9                | 10.0                      | .725                          | 7.82                                          | 2.96                                                          | .73                                                       |
| 6     | 73.3                       | 6.2                 | 69.0                | 10.5                      | .704                          | .59                                           | 3.07                                                          | .71                                                       |
| 7     | 72.2                       | 6.7                 | 67.5                | 11.4                      | .670                          | .26                                           | .21                                                           | .69                                                       |
| 8     | 72.4                       | 6.2                 | 68.1                | 10.5                      | .684                          | .38                                           | .00                                                           | .71                                                       |
| 9     | 71.8                       | 6.5                 | 67.2                | 11.1                      | .664                          | .19                                           | .09                                                           | .70                                                       |
| 10    | 68.1                       | 8.6                 | 62.1                | 14.6                      | .561                          | 6.08                                          | .72                                                           | .62                                                       |
| 11    | 67.8                       | 7.9                 | 62.3                | 13.4                      | .565                          | .15                                           | .36                                                           | .65                                                       |
| 12    | 69.6                       | 7.0                 | 64.7                | 11.9                      | .611                          | .64                                           | .13                                                           | .68                                                       |
| 13    | 70.2                       | 7.0                 | 65.3                | 11.9                      | .623                          | .76                                           | .19                                                           | .68                                                       |
| 14    | 70.6                       | 6.8                 | 65.8                | 11.6                      | .634                          | .87                                           | .14                                                           | .69                                                       |
| 15    | 70.5                       | 6.6                 | 65.9                | 11.2                      | .636                          | .90                                           | .02                                                           | .70                                                       |
| 16    | 70.5                       | 6.5                 | 65.9                | 11.1                      | .636                          | .90                                           | 2.99                                                          | .70                                                       |
| 17    | 68.9                       | 7.3                 | 63.8                | 12.4                      | .593                          | .45                                           | 3.21                                                          | .67                                                       |
| 18    | 69.6                       | 6.4                 | 65.1                | 10.9                      | .619                          | .74                                           | 2.86                                                          | .70                                                       |
| 19    | 70.2                       | 5.8                 | 66.1                | 9.9                       | .640                          | .96                                           | .64                                                           | .73                                                       |
| 20    | 69.4                       | 6.1                 | 65.1                | 10.4                      | .619                          | .75                                           | .71                                                           | .71                                                       |
| 21    | 68.8                       | 6.6                 | 64.2                | 11.2                      | .601                          | .54                                           | .89                                                           | .69                                                       |
| 22    | 67.1                       | 7.0                 | 62.2                | 11.9                      | .563                          | .14                                           | .93                                                           | .68                                                       |
| 23    | 66.2                       | 6.9                 | 60.7                | 12.4                      | .536                          | 5.86                                          | .93                                                           | .67                                                       |
| 24    | 94.3                       | 7.1                 | 58.6                | 12.8                      | .499                          | .47                                           | .88                                                           | .66                                                       |
| 25    | 64.8                       | 6.5                 | 59.6                | 11.7                      | .516                          | .66                                           | .67                                                           | .68                                                       |
| 26    | 63.4                       | 7.0                 | 57.8                | 12.6                      | .486                          | .34                                           | .76                                                           | .66                                                       |
| 27    | 64.2                       | 5.9                 | 59.5                | 10.6                      | .515                          | .65                                           | .38                                                           | .70                                                       |
| 28    | 65.9                       | 6.1                 | 61.0                | 11.0                      | .541                          | .93                                           | .57                                                           | .70                                                       |
| 29    | 65.7                       | 6.1                 | 60.8                | 11.0                      | .537                          | .89                                           | .56                                                           | .70                                                       |
| 30    | 65.4                       | 6.3                 | 60.4                | 11.3                      | .530                          | .82                                           | .61                                                           | .69                                                       |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Faht. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.990                                    | 30.104                                                 | 29.861  | 0.243   | 73.2                       | 80.8                                                     | 67.4 | 13.4  |
| 1          | .984                                      | .102                                                   | .852    | .250    | 72.6                       | 80.2                                                     | 66.6 | 13.6  |
| 2          | .977                                      | .100                                                   | .845    | .255    | 72.0                       | 79.4                                                     | 65.6 | 13.8  |
| 3          | .971                                      | .100                                                   | .833    | .267    | 71.6                       | 79.0                                                     | 64.8 | 14.2  |
| 4          | .969                                      | .105                                                   | .829    | .276    | 71.0                       | 78.0                                                     | 64.0 | 14.0  |
| 5          | .978                                      | .111                                                   | .850    | .261    | 70.4                       | 77.4                                                     | 64.0 | 13.4  |
| 6          | .994                                      | .122                                                   | .872    | .250    | 69.9                       | 77.0                                                     | 63.2 | 13.8  |
| 7          | 30.016                                    | .144                                                   | .894    | .250    | 70.3                       | 77.4                                                     | 62.0 | 15.4  |
| 8          | .037                                      | .154                                                   | .902    | .252    | 73.0                       | 79.8                                                     | 64.4 | 15.4  |
| 9          | .052                                      | .163                                                   | .910    | .253    | 75.6                       | 81.8                                                     | 67.0 | 14.8  |
| 10         | .050                                      | .157                                                   | .915    | .242    | 78.7                       | 85.2                                                     | 69.9 | 15.3  |
| 11         | .028                                      | .132                                                   | .893    | .239    | 80.7                       | 87.0                                                     | 73.2 | 13.8  |
| Noon.      | .002                                      | .105                                                   | .860    | .245    | 82.0                       | 87.4                                                     | 75.0 | 12.4  |
| 1          | 29.971                                    | .072                                                   | .825    | .247    | 82.6                       | 87.8                                                     | 76.7 | 11.1  |
| 2          | .949                                      | .049                                                   | .801    | .248    | 83.1                       | 87.4                                                     | 77.4 | 10.0  |
| 3          | .936                                      | .037                                                   | .786    | .251    | 83.0                       | 88.6                                                     | 78.0 | 10.6  |
| 4          | .932                                      | .043                                                   | .789    | .254    | 81.5                       | 87.0                                                     | 76.4 | 10.6  |
| 5          | .941                                      | .059                                                   | .798    | .261    | 80.3                       | 85.8                                                     | 75.8 | 10.0  |
| 6          | .953                                      | .072                                                   | .805    | .267    | 78.2                       | 84.2                                                     | 73.3 | 10.9  |
| 7          | .971                                      | .087                                                   | .840    | .247    | 76.8                       | 83.0                                                     | 71.6 | 11.4  |
| 8          | .989                                      | .095                                                   | .853    | .242    | 75.9                       | 82.3                                                     | 69.6 | 12.7  |
| 9          | 30.001                                    | .112                                                   | .866    | .246    | 75.1                       | 81.6                                                     | 69.4 | 12.2  |
| 10         | .007                                      | .111                                                   | .867    | .244    | 74.3                       | 81.2                                                     | 68.6 | 12.6  |
| 11         | .002                                      | .108                                                   | .868    | .240    | 73.6                       | 80.8                                                     | 68.2 | 12.6  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 69.1                            | 4.1                 | 65.8                | 7.4                          | 0.634                            | 6.94                                             | 1.88                                                                | 0.79                                                                |
| 1              | 68.6                            | 4.0                 | 65.4                | 7.2                          | .626                             | .85                                              | .81                                                                 | .79                                                                 |
| 2              | 68.2                            | 3.8                 | 65.2                | 6.8                          | .621                             | .81                                              | .69                                                                 | .80                                                                 |
| 3              | 67.7                            | 3.9                 | 64.6                | 7.0                          | .609                             | .69                                              | .71                                                                 | .80                                                                 |
| 4              | 67.3                            | 3.7                 | 64.3                | 6.7                          | .603                             | .63                                              | .62                                                                 | .80                                                                 |
| 5              | 66.9                            | 3.5                 | 64.1                | 6.3                          | .599                             | .59                                              | .51                                                                 | .81                                                                 |
| 6              | 66.6                            | 3.3                 | 64.0                | 5.9                          | .597                             | .57                                              | .41                                                                 | .82                                                                 |
| 7              | 66.8                            | 3.5                 | 64.0                | 6.3                          | .597                             | .57                                              | .51                                                                 | .81                                                                 |
| 8              | 68.1                            | 4.9                 | 64.2                | 8.8                          | .601                             | .57                                              | 2.19                                                                | .75                                                                 |
| 9              | 69.4                            | 6.2                 | 65.1                | 10.5                         | .619                             | .74                                              | .74                                                                 | .71                                                                 |
| 10             | 70.7                            | 8.0                 | 65.1                | 13.6                         | .619                             | .70                                              | 3.71                                                                | .64                                                                 |
| 11             | 71.3                            | 9.4                 | 64.7                | 16.0                         | .611                             | .58                                              | 4.46                                                                | .60                                                                 |
| Noon.          | 71.3                            | 10.7                | 63.8                | 18.2                         | .593                             | .37                                              | 5.10                                                                | .56                                                                 |
| 1              | 71.0                            | 11.6                | 62.9                | 19.7                         | .576                             | .17                                              | .51                                                                 | .53                                                                 |
| 2              | 71.0                            | 12.1                | 62.5                | 20.6                         | .568                             | .08                                              | .78                                                                 | .51                                                                 |
| 3              | 70.9                            | 12.1                | 62.4                | 20.6                         | .567                             | .06                                              | .76                                                                 | .51                                                                 |
| 4              | 70.4                            | 11.1                | 62.6                | 18.9                         | .570                             | .13                                              | .18                                                                 | .54                                                                 |
| 5              | 70.7                            | 9.6                 | 64.0                | 16.3                         | .597                             | .44                                              | 4.47                                                                | .59                                                                 |
| 6              | 71.2                            | 7.0                 | 66.3                | 11.9                         | .644                             | .98                                              | 3.27                                                                | .68                                                                 |
| 7              | 70.9                            | 5.9                 | 66.8                | 10.0                         | .655                             | 7.11                                             | 2.72                                                                | .72                                                                 |
| 8              | 70.5                            | 5.4                 | 66.7                | 9.2                          | .653                             | .10                                              | .33                                                                 | .74                                                                 |
| 9              | 70.0                            | 5.1                 | 66.4                | 8.7                          | .646                             | .04                                              | .30                                                                 | .75                                                                 |
| 10             | 69.7                            | 4.6                 | 66.5                | 7.8                          | .648                             | .07                                              | .05                                                                 | .78                                                                 |
| 11             | 69.3                            | 4.3                 | 66.3                | 7.3                          | .644                             | .05                                              | 1.88                                                                | .79                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1 ft. 2 in. above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                              |
|-------|-----------------------|--------------------------------------|-----------------------------------|------------------------|-----------------------------------------------------------------------------------------|
| 1     | 150.8                 | ...                                  | N. by W. & N. W.                  | lb                     | ☁ to 5 A. M. ☁ to 1 P. M. ☁ & ☁ to 5 P. M., clear afterwards.                           |
| 2     | 145.0                 | ...                                  | N. & N. E. & N. by W.             |                        | Clear to 3 A. M. ☁ to 5 P. M., clear afterwards.                                        |
| 3     | 145.0                 | ...                                  | N. & N. N. W.                     |                        | Clear to 5 P. M. ☁ to 10 A. M. ☁ & ☁ to 7 P. M., clear afterwards.                      |
| 4     | 147.0                 | ...                                  | N. N. W.                          |                        | Clear to 7 A. M. ☁ to 6 P. M. ☁ afterwards.                                             |
| 5     | 141.0                 | ...                                  | N. & N. N. W. & N. W.             |                        | ☁ to 7 A. M. ☁ to 3 P. M. Overcast afterwards, Thin Rain at 5, 6 & 11 P. M.             |
| 6     | 145.5                 | ...                                  | N. by W.                          |                        | Overcast to 6 A. M., ☁ to 2 P. M., clear afterwards, Slight Rain at 4 A. M.             |
| 7     | 145.0                 | ...                                  | N. by W. & N.                     |                        | Clear to 9 A. M. Scatd. ☁ to 1 P. M., clear afterwards.                                 |
| 8     | 146.0                 | ...                                  | N. N. W. & N.                     |                        | Clear                                                                                   |
| 9     | 148.0                 | ...                                  | N. N. E. & N.                     |                        | Clear to 7 A. M. Scatd. ☁ to 6 P. M., clear afterwards.                                 |
| 10    | 143.0                 | ...                                  | N. N. W.                          |                        | Clear.                                                                                  |
| 11    | 138.0                 | ...                                  | N. W. & N. N. W.                  |                        | Clear.                                                                                  |
| 12    | 140.0                 | ...                                  | N. W. & W.                        |                        | ☁ to 8 A. M. clear to 11 A. M. ☁ to 5 P. M. ☁ afterwards.                               |
| 13    | 140.0                 | ...                                  | W.                                |                        | Clear to 10 A. M. Scatd. ☁ to 7 P. M., clear afterwards.                                |
| 14    | 142.8                 | ...                                  | W. & N. & N. by W.                |                        | Clear, slightly foggy at 10 P. M.                                                       |
| 15    | 147.0                 | ...                                  | N. by E. & N. W.                  |                        | Clear to 10 A. M. Scatd. ☁ to 4 P. M. Scatd. ☁ afterwards.                              |
| 16    | 149.0                 | ...                                  | N. & N. N. W. & N. N. E.          |                        | Clear to 4 A. M. Scattered ☁ to 7 A. M. Scatd. ☁ & ☁ afterwards.                        |
| 17    | 138.0                 | ...                                  | NW & N by E & E. N. E.            |                        | Clear to 9 A. M. Scatd. ☁ to 6 P. M. Scatd. ☁ afterwards. Slightly foggy at 7 & 8 P. M. |
| 18    | 148.0                 | ...                                  | N.                                |                        | Clear to 11 A. M. Scattered ☁ afterwards.                                               |
| 19    | 144.4                 | ...                                  | N. E.                             |                        | Scatd. ☁ & ☁ to 2 P. M., clear afterwards.                                              |
| 20    | 148.0                 | ...                                  | N. N. W. & N. by W.               |                        | Clear to 10 A. M. Scatd. ☁ to 3 P. M. ☁ afterwards.                                     |
| 21    | 145.5                 | ...                                  | N. N. E. & N. N. W.               |                        | Clear to 10 A. M. Scatd. ☁ to 4 P. M., clear afterwards.                                |
| 22    | 141.4                 | ...                                  | N. W. & N.                        |                        | Clear to Noon. Scatd. ☁ afterwards. Slightly Foggy from 8 to 11 P. M.                   |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1866.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1 ft. 2 in. above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                |
|-------|-----------------------|--------------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------------------|
| 23    | 142.0                 | ...                                  | N. N. E. & N. by W.               | ...                    | Clouds of different kinds to 5 P. M., clear afterwards, Foggy at 11 P. M. |
| 24    | 140.2                 | ...                                  | N.                                |                        | Scatd. $\searrow$ i to 9 A. M., $\searrow$ i afterwards. Foggy at 8 P. M. |
| 25    | 137.0                 | ...                                  | N. by W. & N. W.                  |                        | Clear to 10 A. M. Scatd. $\circ$ i to 6 P. M., clear afterwards.          |
| 26    | 139.8                 | ...                                  | N. W. & N. N. W.                  |                        | Clear to 11 A. M. Scatd. $\circ$ i to 3 P. M., clear afterwards.          |
| 27    | 133.0                 | ...                                  | N. N. W. & N. W.                  |                        | Chiefly clear.                                                            |
| 28    | 145.0                 | ...                                  | N. by W. & N. by E.               |                        | Clear to 11 A. M. Scatd. $\circ$ i to 5 P. M., clear afterwards.          |
| 29    | 140.0                 | ...                                  | N. by E. & N. W.                  |                        | Clear.                                                                    |
| 30    | 142.0                 | ...                                  | N. W. & N. by E.                  |                        | Clear.                                                                    |

$\searrow$  i Cirri, — i Strati,  $\circ$  i Cumuli,  $\searrow$  i Cirro-strati,  $\circ$  i Cumulo strati,  $\searrow$  i Nimbi,  $\searrow$  i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of November 1866.*

MONTHLY RESULTS.

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|                                                                     | Inches. |
|---------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month... ..                    | 29.988  |
| Max. height of the Barometer occurred at 9 A.M. on the 17th ... ..  | 30.163  |
| Min. height of the Barometer occurred at 3 P. M. on the 10th ... .. | 29.786  |
| Extreme range of the Barometer during the month ... ..              | 0.377   |
| Mean of the daily Max. Pressures ... ..                             | 30.053  |
| Ditto ditto Min. ditto ... ..                                       | 29.930  |
| Mean daily range of the Barometer during the month ... ..           | 0.123   |

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|                                                            | °    |
|------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month ... ..             | 76.1 |
| Max. Temperature occurred at 3 P. M. on the 3rd ... ..     | 88.6 |
| Min. Temperature occurred at 7 A. M. on the 27th ... ..    | 62.0 |
| Extreme range of the Temperature during the month ... ..   | 26.6 |
| Mean of the daily Max. Temperature ... ..                  | 83.4 |
| Ditto ditto Min. ditto, ... ..                             | 69.8 |
| Mean daily range of the Temperature during the month... .. | 13.6 |

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|                                                                |      |
|----------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month ... ..                 | 69.5 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer      | 6.6  |
| Computed Mean Dew-point for the month ... ..                   | 64.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point ... .. | 11.2 |

|                                                   | Inches. |
|---------------------------------------------------|---------|
| Mean Elastic force of Vapour for the month ... .. | 0.615   |

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|                                                                        | Troy grain. |
|------------------------------------------------------------------------|-------------|
| Mean Weight of Vapour for the month ... ..                             | 6.70        |
| Additional Weight of Vapour required for complete saturation ... ..    | 2.93        |
| Mean degree of humidity for the month, complete saturation being unity | 0.70        |

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|                                                                                                     | Inches.             |
|-----------------------------------------------------------------------------------------------------|---------------------|
| Drizzled 2 days,—Max. fall of rain during 24 hours ... ..                                           | Nil                 |
| Total amount of rain during the month ... ..                                                        | Nil                 |
| Total amount of rain indicated by the Gauge attached to the anemo-<br>meter during the month ... .. | Nil                 |
| Prevailing direction of the Wind ... ..                                                             | N. W. N. N. W. & N. |



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
• in the month of December 1866.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Falt. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 30.023                                          | 30.072                                    | 29.962  | 0.110   | 71.7                          | 82.0                                          | 64.0 | 18.0  |
| 2     | .017                                            | .088                                      | .935    | .153    | 71.8                          | 80.6                                          | 64.6 | 16.0  |
| 3     | .014                                            | .100                                      | .947    | .153    | 69.8                          | 80.6                                          | 61.4 | 19.2  |
| 4     | .011                                            | .065                                      | .941    | .124    | 68.4                          | 78.0                                          | 60.2 | 17.8  |
| 5     | 29.985                                          | .062                                      | .911    | .151    | 68.2                          | 78.0                                          | 60.0 | 18.0  |
| 6     | .961                                            | .044                                      | .904    | .140    | 67.0                          | 76.6                                          | 60.6 | 16.0  |
| 7     | 30.006                                          | .071                                      | .944    | .127    | 65.9                          | 77.0                                          | 57.6 | 19.4  |
| 8     | .071                                            | .159                                      | 30.000  | .159    | 65.8                          | 76.0                                          | 57.0 | 19.0  |
| 9     | .071                                            | .131                                      | .029    | .102    | 65.4                          | 76.0                                          | 56.8 | 19.2  |
| 10    | .104                                            | .173                                      | .054    | .119    | 67.1                          | 76.4                                          | 59.0 | 17.4  |
| 11    | .130                                            | .185                                      | .085    | .100    | 67.9                          | 78.0                                          | 60.0 | 18.0  |
| 12    | .113                                            | .195                                      | .045    | .150    | 67.0                          | 76.8                                          | 59.0 | 17.8  |
| 13    | .025                                            | .096                                      | 29.955  | .141    | 67.5                          | 77.0                                          | 59.6 | 17.4  |
| 14    | .014                                            | .078                                      | .959    | .119    | 68.0                          | 77.2                                          | 60.6 | 16.6  |
| 15    | .065                                            | .122                                      | 30.022  | .100    | 67.2                          | 77.2                                          | 58.7 | 18.5  |
| 16    | .136                                            | .208                                      | .087    | .121    | 67.9                          | 77.5                                          | 59.8 | 17.7  |
| 17    | .145                                            | .222                                      | .076    | .146    | 66.7                          | 76.6                                          | 58.8 | 17.8  |
| 18    | .144                                            | .217                                      | .088    | .129    | 68.0                          | 77.2                                          | 61.0 | 16.2  |
| 19    | .171                                            | .256                                      | .119    | .137    | 67.5                          | 77.3                                          | 58.4 | 18.9  |
| 20    | .195                                            | .273                                      | .121    | .152    | 66.9                          | 76.6                                          | 58.6 | 18.0  |
| 21    | .164                                            | .226                                      | .108    | .118    | 67.1                          | 76.0                                          | 58.8 | 17.2  |
| 22    | .164                                            | .232                                      | .117    | .115    | 67.1                          | 76.0                                          | 58.8 | 17.2  |
| 23    | .158                                            | .231                                      | .097    | .134    | 66.5                          | 76.0                                          | 58.2 | 17.8  |
| 24    | .170                                            | .254                                      | .124    | .130    | 66.0                          | 75.6                                          | 58.0 | 17.6  |
| 25    | .163                                            | .249                                      | .096    | .153    | 65.3                          | 74.2                                          | 57.4 | 16.8  |
| 26    | .119                                            | .186                                      | .050    | .136    | 65.4                          | 75.8                                          | 56.6 | 19.2  |
| 27    | .075                                            | .138                                      | .012    | .126    | 65.4                          | 75.4                                          | 56.0 | 19.4  |
| 28    | .088                                            | .159                                      | .035    | .124    | 65.1                          | 75.4                                          | 56.4 | 19.0  |
| 29    | .023                                            | .113                                      | 29.952  | .161    | 64.8                          | 75.8                                          | 56.8 | 19.0  |
| 30    | 29.960                                          | .033                                      | .890    | .143    | 65.4                          | 77.4                                          | 55.6 | 21.8  |
| 31    | .979                                            | .049                                      | .934    | .115    | 67.1                          | 77.0                                          | 58.0 | 19.0  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1866.*

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew Point. | Mean Elastic force of vapour. | Mean Weight of Vapour in a Cubic foot of air. | Additional Weight of Vapour required for complete saturation. | Mean degree of Humidity, complete saturation being unity. |
|-------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|       | o                          | o                   | o                   | o                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| 1     | 65.6                       | 6.1                 | 60.7                | 11.0                      | 0.536                         | 5.87                                          | 2.56                                                          | 0.70                                                      |
| 2     | 64.4                       | 7.4                 | 58.5                | 13.3                      | .498                          | .45                                           | 3.00                                                          | .65                                                       |
| 3     | 63.2                       | 6.6                 | 57.9                | 11.9                      | .488                          | .36                                           | 2.59                                                          | .67                                                       |
| 4     | 60.6                       | 7.8                 | 54.4                | 14.0                      | .434                          | 4.78                                          | .84                                                           | .63                                                       |
| 5     | 61.6                       | 6.6                 | 56.3                | 11.9                      | .462                          | 5.10                                          | .48                                                           | .67                                                       |
| 6     | 59.8                       | 7.2                 | 54.0                | 13.0                      | .428                          | 4.73                                          | .57                                                           | .65                                                       |
| 7     | 59.3                       | 6.6                 | 54.0                | 11.9                      | .428                          | .74                                           | .32                                                           | .67                                                       |
| 8     | 58.8                       | 7.0                 | 53.2                | 12.6                      | .416                          | .62                                           | .42                                                           | .66                                                       |
| 9     | 59.4                       | 6.0                 | 54.6                | 10.8                      | .437                          | .85                                           | .10                                                           | .70                                                       |
| 10    | 61.3                       | 5.8                 | 56.7                | 10.4                      | .469                          | 5.18                                          | .14                                                           | .71                                                       |
| 11    | 62.7                       | 5.2                 | 58.5                | 9.4                       | .498                          | .50                                           | .01                                                           | .73                                                       |
| 12    | 61.9                       | 5.1                 | 57.8                | 9.2                       | .486                          | .38                                           | 1.92                                                          | .74                                                       |
| 13    | 61.5                       | 6.0                 | 56.7                | 10.8                      | .469                          | .17                                           | 2.25                                                          | .70                                                       |
| 14    | 61.5                       | 6.5                 | 56.3                | 11.7                      | .462                          | .10                                           | .43                                                           | .68                                                       |
| 15    | 61.0                       | 6.2                 | 56.0                | 11.2                      | .458                          | .07                                           | .28                                                           | .69                                                       |
| 16    | 61.6                       | 6.3                 | 56.6                | 11.3                      | .467                          | .16                                           | .35                                                           | .69                                                       |
| 17    | 60.7                       | 6.0                 | 55.9                | 10.8                      | .456                          | .05                                           | .18                                                           | .70                                                       |
| 18    | 61.5                       | 6.5                 | 56.3                | 11.7                      | .462                          | .10                                           | .43                                                           | .68                                                       |
| 19    | 60.9                       | 6.6                 | 55.6                | 11.9                      | .452                          | .00                                           | .42                                                           | .67                                                       |
| 20    | 60.1                       | 6.8                 | 54.7                | 12.2                      | .438                          | 4.85                                          | .43                                                           | .67                                                       |
| 21    | 60.6                       | 6.5                 | 55.4                | 11.7                      | .449                          | .96                                           | .36                                                           | .68                                                       |
| 22    | 60.8                       | 6.3                 | 55.8                | 11.3                      | .455                          | 5.04                                          | .28                                                           | .69                                                       |
| 23    | 59.9                       | 6.6                 | 54.6                | 11.9                      | .437                          | 4.84                                          | .35                                                           | .67                                                       |
| 24    | 58.9                       | 7.1                 | 53.2                | 12.8                      | .416                          | .62                                           | .46                                                           | .65                                                       |
| 25    | 58.3                       | 7.0                 | 52.7                | 12.6                      | .409                          | .55                                           | .38                                                           | .66                                                       |
| 26    | 58.1                       | 7.3                 | 52.3                | 13.1                      | .404                          | .49                                           | .46                                                           | .65                                                       |
| 27    | 58.9                       | 6.5                 | 53.7                | 11.7                      | .423                          | .70                                           | .25                                                           | .68                                                       |
| 28    | 59.3                       | 5.8                 | 54.7                | 10.4                      | .438                          | .87                                           | .02                                                           | .71                                                       |
| 29    | 59.6                       | 5.2                 | 55.4                | 9.4                       | .449                          | .99                                           | 1.84                                                          | .73                                                       |
| 30    | 59.9                       | 5.5                 | 55.5                | 9.9                       | .450                          | 5.00                                          | .95                                                           | .72                                                       |
| 31    | 61.6                       | 5.5                 | 57.2                | 9.9                       | .476                          | .26                                           | 2.06                                                          | .72                                                       |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer at<br>32° Fahit. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the month. |      |       |
|----------------|--------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|------------------------------------------------------------------|------|-------|
|                |                                                  | Max.                                                         | Min.    | Diff.   |                               | Max.                                                             | Min. | Diff. |
|                | Inches.                                          | Inches.                                                      | Inches. | Inches. | °                             | °                                                                | °    | °     |
| Mid-<br>night. | 30.082                                           | 30.205                                                       | 29.958  | 0.247   | 63.2                          | 68.6                                                             | 58.6 | 10.0  |
| 1              | .076                                             | .195                                                         | .952    | .243    | 62.6                          | 68.4                                                             | 58.4 | 10.0  |
| 2              | .069                                             | .188                                                         | .946    | .242    | 61.9                          | 68.0                                                             | 58.2 | 9.8   |
| 3              | .063                                             | .186                                                         | .943    | .243    | 61.2                          | 67.4                                                             | 58.0 | 9.4   |
| 4              | .060                                             | .182                                                         | .940    | .242    | 60.6                          | 67.0                                                             | 57.4 | 9.6   |
| 5              | .070                                             | .196                                                         | .949    | .247    | 60.0                          | 66.3                                                             | 56.7 | 9.6   |
| 6              | .085                                             | .212                                                         | .968    | .244    | 59.2                          | 65.0                                                             | 56.4 | 8.6   |
| 7              | .103                                             | .231                                                         | .982    | .249    | 59.0                          | 64.6                                                             | 55.6 | 9.0   |
| 8              | .126                                             | .253                                                         | .993    | .260    | 62.2                          | 66.5                                                             | 57.6 | 8.9   |
| 9              | .148                                             | .266                                                         | 30.033  | .233    | 65.9                          | 69.8                                                             | 62.6 | 7.2   |
| 10             | .150                                             | .273                                                         | .031    | .242    | 69.6                          | 73.2                                                             | 65.0 | 8.2   |
| 11             | .131                                             | .259                                                         | .008    | .251    | 72.6                          | 76.4                                                             | 69.2 | 7.2   |
| Noon.          | .097                                             | .231                                                         | 29.973  | .258    | 74.7                          | 79.0                                                             | 71.0 | 8.0   |
| 1              | .064                                             | .186                                                         | .930    | .256    | 75.8                          | 80.0                                                             | 73.2 | 6.8   |
| 2              | .040                                             | .157                                                         | .908    | .249    | 76.8                          | 81.2                                                             | 74.2 | 7.0   |
| 3              | .026                                             | .135                                                         | .891    | .244    | 76.8                          | 82.0                                                             | 74.1 | 7.9   |
| 4              | .021                                             | .124                                                         | .890    | .234    | 75.2                          | 80.2                                                             | 72.9 | 7.3   |
| 5              | .030                                             | .129                                                         | .904    | .225    | 73.3                          | 77.6                                                             | 71.3 | 6.3   |
| 6              | .044                                             | .142                                                         | .914    | .228    | 70.3                          | 74.7                                                             | 68.5 | 6.2   |
| 7              | .060                                             | .162                                                         | .932    | .230    | 68.3                          | 73.0                                                             | 66.0 | 7.0   |
| 8              | .076                                             | .174                                                         | .949    | .225    | 66.9                          | 72.0                                                             | 64.2 | 7.8   |
| 9              | .091                                             | .194                                                         | .967    | .227    | 65.8                          | 70.7                                                             | 62.6 | 8.1   |
| 10             | .101                                             | .221                                                         | .969    | .252    | 64.9                          | 69.8                                                             | 59.9 | 9.9   |
| 11             | .093                                             | .212                                                         | .961    | .251    | 64.1                          | 69.2                                                             | 59.0 | 10.2  |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1866.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer, | Dry Bulb above Wet, | Computed Dew Point, | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a Cubic foot of air. | Additional Weight of<br>Vapour required for<br>complete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                              |                                                                     |
| Mid-<br>night. | 59.6                            | 3.6                 | 56.4                | 6.8                          | .464                             | 5.17                                             | 1.32                                                                | 0.80                                                                |
| 1              | 59.1                            | 3.5                 | 55.9                | 6.7                          | .456                             | .09                                              | .28                                                                 | .80                                                                 |
| 2              | 58.6                            | 3.3                 | 55.6                | 6.3                          | .452                             | .06                                              | .17                                                                 | .81                                                                 |
| 3              | 58.1                            | 3.1                 | 55.3                | 5.9                          | .447                             | .01                                              | .09                                                                 | .82                                                                 |
| 4              | 57.6                            | 3.0                 | 54.9                | 5.7                          | .441                             | 4.94                                             | .04                                                                 | .83                                                                 |
| 5              | 57.1                            | 2.9                 | 54.5                | 5.5                          | .435                             | .88                                              | 0.99                                                                | .83                                                                 |
| 6              | 56.7                            | 2.5                 | 54.4                | 4.8                          | .434                             | .87                                              | .86                                                                 | .85                                                                 |
| 7              | 56.4                            | 2.6                 | 54.1                | 4.9                          | .429                             | .83                                              | .86                                                                 | .85                                                                 |
| 8              | 57.9                            | 4.3                 | 54.0                | 8.2                          | .432                             | .78                                              | 1.51                                                                | .76                                                                 |
| 9              | 59.9                            | 6.0                 | 55.1                | 10.8                         | .444                             | .93                                              | 2.13                                                                | .70                                                                 |
| 10             | 61.7                            | 7.9                 | 55.4                | 14.2                         | .449                             | .94                                              | .96                                                                 | .63                                                                 |
| 11             | 62.8                            | 9.8                 | 55.0                | 17.6                         | .442                             | .84                                              | 3.82                                                                | .56                                                                 |
| Noon.          | 63.3                            | 11.4                | 55.3                | 19.4                         | .447                             | .88                                              | 4.35                                                                | .53                                                                 |
| 1              | 63.4                            | 12.4                | 54.7                | 21.1                         | .438                             | .76                                              | .78                                                                 | .50                                                                 |
| 2              | 63.8                            | 13.0                | 54.7                | 22.1                         | .438                             | .75                                              | 5.08                                                                | .48                                                                 |
| 3              | 63.7                            | 13.1                | 54.5                | 22.3                         | .435                             | .72                                              | .11                                                                 | .48                                                                 |
| 4              | 63.2                            | 12.0                | 54.8                | 20.4                         | .440                             | .78                                              | 4.59                                                                | .51                                                                 |
| 5              | 63.8                            | 9.5                 | 56.2                | 17.1                         | .461                             | 5.03                                             | 3.81                                                                | .57                                                                 |
| 6              | 63.6                            | 6.7                 | 58.2                | 12.1                         | .493                             | .42                                              | 2.66                                                                | .67                                                                 |
| 7              | 62.9                            | 5.4                 | 58.6                | 9.7                          | .499                             | .51                                              | .09                                                                 | .73                                                                 |
| 8              | 62.1                            | 4.8                 | 58.3                | 8.6                          | .494                             | .46                                              | 1.82                                                                | .75                                                                 |
| 9              | 61.6                            | 4.2                 | 58.2                | 7.6                          | .493                             | .46                                              | .58                                                                 | .78                                                                 |
| 10             | 61.0                            | 3.9                 | 57.9                | 7.0                          | .488                             | .41                                              | .44                                                                 | .79                                                                 |
| 11             | 60.3                            | 3.8                 | 56.9                | 7.2                          | .472                             | .25                                              | .42                                                                 | .79                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1 ft. 2 in. above Ground. | Prevailing direction of the Wind. | Max. Pressure of Wind. | General aspect of the Sky.                                                                        |
|-------|-----------------------|--------------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------------------------------------------|
|       | o                     | Inches                               |                                   | lb                     |                                                                                                   |
| 1     | 141.0                 | ...                                  | N. by W. & N. N. W.               |                        | Clear to 4 P. M. Scatd. \i to 8 P. M., clear afterwards.                                          |
| 2     | 141.2                 | ...                                  | N. & N. by W.                     |                        | Clear to 7 A. M. \i & \i to 3 P. M., clear afterwards.                                            |
| 3     | 143.4                 | ...                                  | N. & N. by E.                     |                        | Clear to 11 A. M. \i to 3 P. M., clear afterwards.                                                |
| 4     | 138.4                 | ...                                  | W. N. W. & N. N. W.               |                        | Clear. Slightly foggy at 9 & 10 P. M.                                                             |
| 5     | 138.0                 | ...                                  | W. by N. & N. W.                  |                        | Clear.                                                                                            |
| 6     | 138.8                 | ...                                  | W. & W. N. W.                     |                        | Clear                                                                                             |
| 7     | 139.0                 | ...                                  | N. W. & N. N. W.                  |                        | Clear. Foggy from 7 to 11 P. M.                                                                   |
| 8     | 138.0                 | ...                                  | N. N. E. & N. N. W.               |                        | Clear.                                                                                            |
| 9     | 135.0                 | ...                                  | N. W.                             |                        | Clear.                                                                                            |
| 10    | 134.2                 | ...                                  | N. W. & W. & N.                   |                        | Clear.                                                                                            |
| 11    | 136.0                 | ...                                  | N. & N. N. W.                     |                        | Clear. Slightly foggy at 7 P. M.                                                                  |
| 12    | 138.0                 | ...                                  | N. & N. W.                        |                        | Clear. Slightly foggy at 10 & 11 P. M.                                                            |
| 13    | 137.0                 | ...                                  | W. N. W. & W. S. W.               |                        | Clear. Foggy at 6 & 7 A. M. & from 7 to 11 P. M.                                                  |
| 14    | 140.0                 | ...                                  | W. S. W. & variable.              |                        | Clear.                                                                                            |
| 15    | 131.2                 | ...                                  | N. by E. & W. by N.               |                        | Clear. Slightly foggy from 7 to 10 P. M.                                                          |
| 16    | 138.0                 | ...                                  | N. & variable.                    |                        | Chiefly clear. Foggy from 7 to 10 P. M.                                                           |
| 17    | 135.5                 | ...                                  | N. by E & N. W.                   |                        | Clear. Foggy at 6 A. M. & from 7 to 11 P. M.                                                      |
| 18    | 134.0                 | ...                                  | N. & N. N. E.                     |                        | Clear to 5 A. M. \i to 1 P. M. clear afterwards. Foggy from Midnight to 4 A. M. & at 9 & 10 P. M. |
| 19    | 139.0                 | ...                                  | N. by W. & N.                     |                        | Clear.                                                                                            |
| 20    | 136.0                 | ...                                  | N. by W. & N. N. W.               |                        | Clear.                                                                                            |
| 21    | 133.0                 | ...                                  | N. N. W. & N. W.                  |                        | Clear.                                                                                            |
| 22    | 135.0                 | ...                                  | N. by W. & N. N. W.               |                        | Clear to 9 A. M. Scatd. \i to 6 P. M., clear afterwards.                                          |
| 23    | 136.0                 | ...                                  | N. by W.                          |                        | Clear to 6 A. M. Scatd. \i to 6 P. M., clear afterwards. Foggy at 8 & 9 P. M.                     |
| 24    | 136.8                 | ...                                  | N. W.                             |                        | Clear.                                                                                            |
| 25    | 133.0                 | ...                                  | N. N. W. & N. by W.               |                        | Clear.                                                                                            |
| 26    | 137.6                 | ...                                  | N.                                |                        | Clear.                                                                                            |
| 27    | 136.0                 | ...                                  | N. by W.                          |                        | Clear. Slightly foggy from 8 to 11 P. M.                                                          |
| 28    | 135.2                 | ...                                  | N. by W. & N. N. W. & N. W.       |                        | Clear. Foggy from Midnight to 2 A. M. & from 7 to 11 P. M.                                        |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1866.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1<br>ft. 2 in. above<br>Ground. | Prevailing<br>direction of the<br>Wind. | Max. Pres-<br>sure of Wind. | General aspect of the Sky.                                      |
|-------|-----------------------|--------------------------------------------|-----------------------------------------|-----------------------------|-----------------------------------------------------------------|
| 29    | 0<br>133.0            | Inches<br>...                              | N.W.&N.N.W.&N.                          | lb<br>...                   | Clear. Foggy from Midnight to 4 A. M. & from 8 to 11 P. M.      |
| 30    | 138.2                 | ...                                        | W.N.W.&SSW.&S.                          |                             | Clear. Slightly foggy from Midnight to 6 A. M. & at 8 & 9 P. M. |
| 31    | 138.0                 | ...                                        | S.                                      |                             | Chiefly clear.                                                  |

∩i Cirri, —i Strati, ∩i Cumuli, ∩i Cirro-strati, ~i Cumulo strati, ~i Nimbi,  
∩i Cirro cumuli:

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta, in the  
month of December 1866.*

MONTHLY RESULTS.

|                                                                     | Inches. |
|---------------------------------------------------------------------|---------|
| Mean height of the Barometer for the month... ..                    | 30.079  |
| Max. height of the Barometer occurred at 10 A.M. on the 20th ... .. | 30.273  |
| Min. height of the Barometer occurred at 4 P. M. on the 30th ... .. | 29.890  |
| <i>Extreme range</i> of the Barometer during the month ... ..       | 0.383   |
| Mean of the daily Max. Pressures ... ..                             | 30.151  |
| Ditto ditto Min. ditto ... ..                                       | 30.019  |
| <i>Mean daily range</i> of the Barometer during the month ... ..    | 0.132   |

o

|                                                                   |      |
|-------------------------------------------------------------------|------|
| Mean Dry Bulb Thermometer for the month ... ..                    | 67.1 |
| Max. Temperature occurred at 3 P. M. on the 1st ... ..            | 82.0 |
| Min. Temperature occurred at 7 A. M. on the 30th ... ..           | 55.6 |
| <i>Extreme range</i> of the Temperature during the month ... ..   | 26.4 |
| Mean of the daily Max. Temperature ... ..                         | 77.0 |
| Ditto ditto Min. ditto, ... ..                                    | 58.9 |
| <i>Mean daily range</i> of the Temperature during the month... .. | 18.1 |

|                                                                |      |
|----------------------------------------------------------------|------|
| Mean Wet Bulb Thermometer for the month ... ..                 | 60.7 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer      | 6.4  |
| Computed Mean Dew-point for the month ... ..                   | 55.6 |
| Mean Dry Bulb Thermometer above computed mean Dew-point ... .. | 11.5 |

Inches.

|                                                   |       |
|---------------------------------------------------|-------|
| Mean Elastic force of Vapour for the month ... .. | 0.452 |
|---------------------------------------------------|-------|

Troy grain.

|                                                                        |      |
|------------------------------------------------------------------------|------|
| Mean Weight of Vapour for the month ... ..                             | 5.00 |
| Additional Weight of Vapour required for complete saturation ... ..    | 2.32 |
| Mean degree of humidity for the month, complete saturation being unity | 0.68 |

Inches.

|                                                                                                     |     |
|-----------------------------------------------------------------------------------------------------|-----|
| Rained No. days,—Max. fall of rain during 24 hours ... ..                                           | Nil |
| Total amount of rain during the month ... ..                                                        | Nil |
| Total amount of rain indicated by the Gauge attached to the anemo-<br>meter during the month ... .. | Nil |
| Prevailing direction of the Wind... .. N. & N. N. W. & N. W.                                        |     |



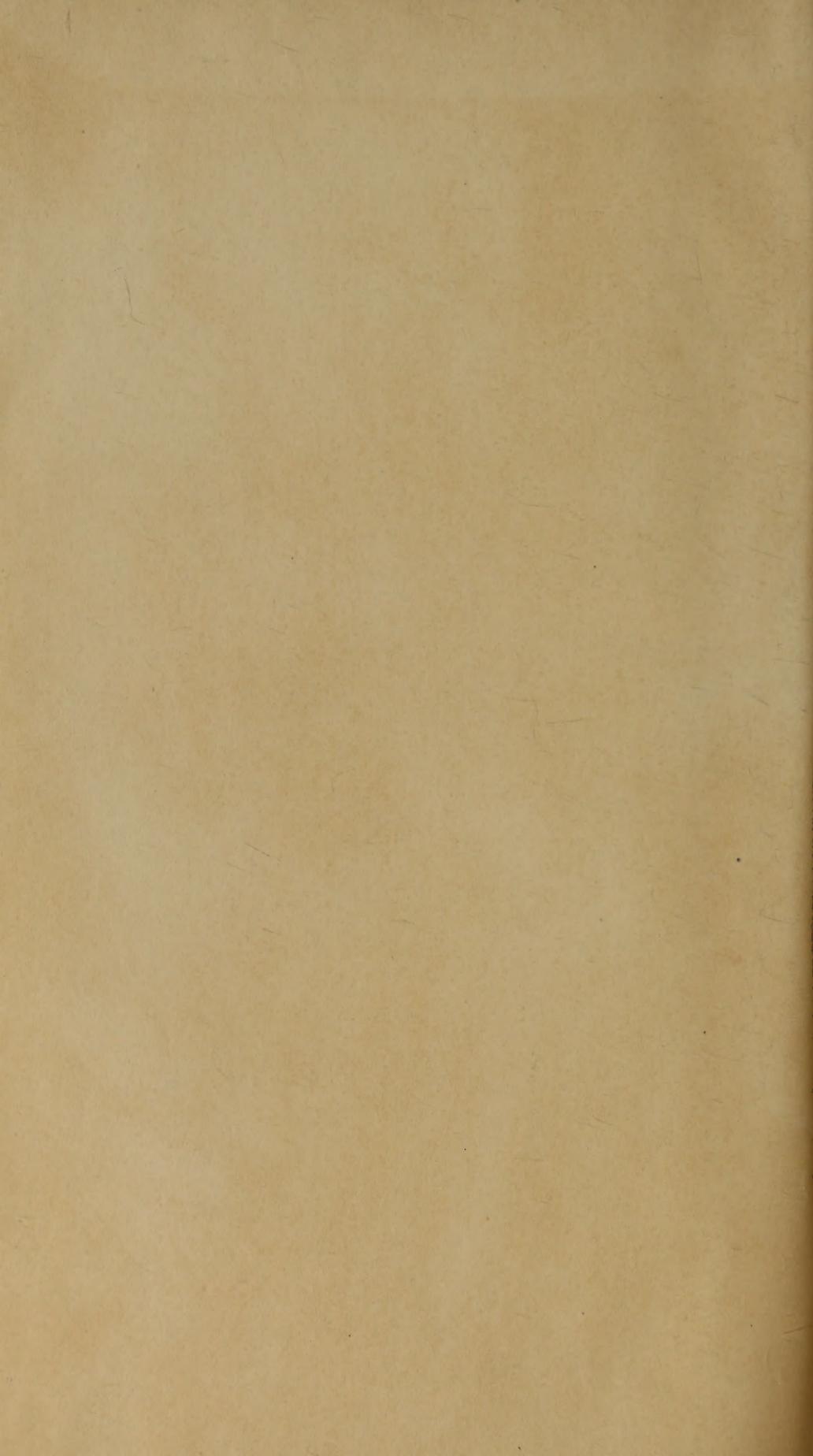












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