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JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL:

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THE SECRETARIES.

PART II. No. I.—1868.

MUSEUM ASIATIC SOCIETY CALCUTTA

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CONTENTS.

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About two years ago a subscription list was circulated amongst the Members of the Asiatic Society with the view of raising funds for the purchase of a duplicate of the marble bust of the late Dr. Hugh Falconer, for the Society's Museum. Forty-four subscriptions were promised, and of these forty-two had been realised at the date of the receipt of the bust, which has now been lodged in the Society's Rooms.

On the basis of an estimate of the probable cost, formed in 1866, it was decided that each individual subscription should be fixed at Rs. 20; from fluctuations, however, in the rate of exchange, and from other causes, the expenditure on account of the bust has exceeded the receipts, and an appeal is therefore now addressed to members of the Society who have not yet subscribed, for the purpose of raising funds to meet this deficiency.

As already mentioned, forty-two subscriptions, or Rs. 840, have been realised which, with an item of Rs. 5-12-10 interest, makes a total of receipts amounting to Rs. 845-12-10. The two additional subscriptions promised will probably be paid, and together with a subscription subsequently received from W. T. Blanford, Esquire, will raise the receipts to a total of Rs. 905-12-10. The expenditure has amounted to Rs. 996-8-1: there remains therefore a balance of Rs. 90-11-3 yet to be provided for.

It would be well that a stand for the Bust should be procured, the estimated cost of which would be about Rs. 20, and it is hoped that the present appeal will result in the receipt of a sufficient sum to meet both objects.

S. B. Partridge,

Hon. Sec. Falconer Memorial Fund.

Calcutta, 28*th September*, 1867.

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JOURNAL

OF THE

ASIATIC SOCIETY.

Part II.—PHYSICAL SCIENCE.

No. I.—1868.

Ornithological Observations in the Sutlej valley, N. W. Himalaya,

by F. Stoliczka, Esq., Ph. D.

Palæontologist to the Geological Survey of India.

[Received 18th July 1867.]

When writing the preface to the third volume of the 'Birds of India,' Dr. Jerdon remarks that the publication of the two former volumes of the same work had already attracted great interest to Indian Ornithology. The very large amount of the most accurate statements as to specific distinctions, on the habits and on the geographical distribution afford indeed facilities of no ordinary kind, and they not only serve to direct other observations, but they are useful in most cases also as a guide to the record of any additional facts, which further inquiry may bring forward. Had it been possible to add illustrations of at least the more important types of each family, the student in India could scarcely have wished for a better Manual of Indian Ornithology.

During my geological wanderings through the N. W. Himalaya, I have made various observations on Indian Zoology and Botany, specially with the object of collecting materials for a fauna and flora of Western Tibet. Only for a comparatively short time have I been enabled to pay any attention to the fauna of the Cis-Himalayan

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regions. Thus, when staying last year for about six weeks in the neighbourhood of Chini, in the province of Kunawar, I compiled a few notes on some of the main features and relations, which present themselves between the flora and fauna of the more interior and higher ranges of the N. W. Himalaya and those of the temperate, continental portions of Europe, (Verhandlungen der zool. bot. Gesellschaft, Wien, 1866, p. 850). In my present communication I intend to deal with a more special subject and propose to bring before our readers a few observations on the *Ornithology of the Sutlej valley.*

My remarks and enumeration of species will be restricted,—so to say—to the Himalayan facies of the avi-fauna, for the fauna of the so-called sub-tropical forests of the lower Himalayan hills scarcely differs from the Indian fauna in general. But it will be readily understood that, even within this limited area, I cannot pretend to give at present a complete list of all the ornithological treasures which actually are to be met with. A good many birds are merely occasional visitors to the valley, in their periodical wanderings to Tibet and Central Asia. Others, properly belonging to the Indian tropical fauna, appear almost accidentally without making any prolonged stay in the valley. It is difficult to procure all the information required about such rare species, and I only can mention them, so far as they came under my notice, from reliable authorities or from personal observations. Of the general character of the avi-fauna, however, I trust to give at least an approximately correct idea.

It was, as I have already stated, with a view to obtain some Tibetan and Central-Asiatic birds, which do not come in winter as low down as the Indian plains, that I undertook to employ shikarees during the winter-time in the interior of the hills. My expectations on this point have not been quite frustrated. I have not only received a tolerably correct account of the avi-fauna during the winter in this portion of the valley, but I have been at the same time placed in possession of valuable materials, which enable me to make a few additions to this branch of the Indian fauna.

It has been already* mentioned, that the exclusion of the birds

* Ibis 1866, II. p. 228, and elsewhere.

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of the more Northern regions of the N. W. Himalaya — as well as those of the eastern provinces of Bengal — from Dr. J e r d o n 's work, is greatly to be regretted. It is not strictly correct that the birds of Western Tibet* and Kashmir have been treated in this manner; for not only are most of these provinces situated to the South of the river Indus, and within the limits of our Indian empire, but the larger number of the birds, which inhabit these regions in summer, are, during the winter, visitors of Northern India proper; or at least of the lower ranges of the Indian or Southern slopes of the Himalaya mountains. It is true that the birds of these provinces in some respects represent a distinct facies, as compared with the tropical character of the Indian fauna generally, but this is not sufficient ground for supposing that they are not *birds of India.* For if the validity of this opinion be admitted, the entire fauna of Northern Nepal and nearly of the whole of Sikkim must be excluded from the Indian fauna.

On the contrary, the affinities and relations of the various facies in a fauna are entitled to the special care of naturalists, because these relations are of the highest importance for the study of the geographical distribution, not only of single species, but more properly of the character of the different zoological provinces of our globe. Besides this, the comparison of two or more neighbouring facies of the fauna very often facilitates the knowledge of the species themselves in so far as they shew us, whether certain variations may be considered sufficient to warrant those distinctions, upon which we generally base our '*species.*'

In many cases the comparison of Indian birds with so called representative species in Western Asia and Europe is still a great desideratum, although these comparisons may prove to be in favour of several identifications. I would, for instance, only call to mind our *Turtur moena* or *rupestris*, and the common *T. auritus*, *Corvus tibetanus* and *C. corax*, *Turdus Huttoni* and *T. viscivorus*, *Pica botanensis* and *P. caudata*, *Regulus Hymalayanus* and *R. cristatus*, and others. For my own part I believe many of these species to be respectively identical. To return to our present subject,— the avi-fauna of the Sutlej valley

* Including Spiti and Lahul, which are British provinces.

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—it is perhaps necessary to remark, that the present records are principally based upon my own observations, which I had occasion to make during the summer-months—from May to October—in the greater portion of the valley,—having also at the same time made a large collection of birds. The references to the fauna in the winter-months are, as already noticed, based upon materials which have been procured by my shikarees, and also upon information from a few friends. In cases where specimens of new or little known birds have been procured, short descriptions may not be out of place, except where the additional remarks have already been supplied, in which cases the respective references,—so far they have come to my knowledge—will be given. Being aware of the great difficulty, which exists in this country, of obtaining sufficiently reliable reference to literature in this branch of Zoology, and also materials for comparison, I have mostly avoided naming any new species, but in several instances I have given indications of such by giving short descriptions. These may provisionally serve for identification, or at least for comparison. Should further inquiries make some of my as yet deficient determinations more successful, I hope to be able to communicate the results subsequently.* I may, however, draw the attention of Ornithologists in India to a few interesting species: as, for instance, the *Accipiter nisoides*, Blyth, whether it be a distinct species from *Acc. gularis*, Schlegel; to *Cypselus pacificus*, Lath. and the very similar *Cyp. leucogenys*, Blyth; to an apparently new species of *Munia*, several new forms of *Phylloscopinæ*, one or two new species of *Accentor*, a new *Montifringilla*, a *Linota*, a *Fringillauda*, a doubtfully young *Hydrobata*, and others.

Before entering upon any details, it seems desirable to say a few words on the physical construction, and on the climatological conditions of the Sutlej valley; and as the fauna and flora of a country are in many respects connected with, or even dependent upon each other, a short reference to the main features of the vegetation of the valley may essentially aid in attaining this object.

Through the valuable investigation of Moorcroft, Strachey and other distinguished travellers it is pretty well known, that the Sutlej rises to the west

* Having since visited the principal museums of Europe and having had opportunities of comparing a few of the doubtful species, I shall occasionally add a few notes, (Feb. 1868.)

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of the Mansarowara lake, but its proper sources,—as likewise those of the Indus—have not as yet been traced with undoubted accuracy. The course of the river through the Chinese province Nari (or Googhi) is only imperfectly known, although some additional observations may be expected from the brothers Schlagintweits' expedition. The information, which has up to this time been procured, shows that the climate of Nari does not materially differ from that of W. Tibet in general, it being characterized by an excessive dryness of the atmosphere at all times of the year, by great contrasts* during the summer in the diurnal and nocturnal temperatures, and by very severe cold† in winter. The whole country is very rough in its configuration; the few level places being restricted to old river terraces or lake-basins, the elevation of which varies from 10 to 15,000 feet, while many of the neighbouring hills rise above 20,000 feet; 19,000 being about the mean of their elevation. The snow line lies at about 19,000 feet. A very limited quantity of moisture is supplied from the Indian side through the Sutlej valley during the months of July and August, but its influence rapidly decreases in the more eastern parts of the province. The total fall of snow during the winter can, I think, rarely exceed two feet. The cultivation of cereals succeeds, only where water for irrigation can be abundantly supplied. The arboreal vegetation is restricted to a few *apricot, poplar* and *willow* trees, the first growing up to 11,000 feet, while the two others are occasionally found up to 13,000; all of them, however, generally only in the neighbourhood of villages. The same is the case with the *Juniperus excelsa.* Its geographical range appears to have formerly been much wider, and a very great care is at present bestowed upon this *sacred tree* of the Buddhists. Grassy plains afford ample pasturage for cattle, being a little more extensive towards the head of the valley, where several former lakes have, in consequence of the accumulation of debris from glacier streams and avalanches, and on account of the increase‡ of evaporation caused by the dryness of the atmosphere, either decreased in extent or altogether disappeared.

The fauna has an essentially Tibetan character. The Kyang, *Equus hemionus*, is very plentifully met with in a wild state; the Yak, *Poephagus grunniens*, has become domesticated and is at present very rarely found wild to the south of the Indus; *Ovis Ammon, Ovis nahura* (barhel), *Moschus moschiferus*, and other Ruminants are, however, still tolerably common. *Ursus tibetanus*, *Lynchus europeus*, *Vulpes montanus* and *ferilatus*, *Mustella erminea* and others are also not rare. Of birds a large number of Fringillidæ, Ruticillinæ, Alaudidæ, Corvidæ and others, mostly of a European type, are to be met with.

* Often amounting to 100 degrees within 24 hours, the maximum of solar heat being 130° and the minimum before sunrise 30° or below it.

† Usually below zero at night, and at day time seldom much higher than the freezing point of water, which is not always 32°.

‡ I believe this to be chiefly due to the devastation of arboreal vegetation, which is said to have been formerly rather abundant.

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As to Reptiles and Fishes, I have not been able to procure any information, but I should think that they are not specifically very different from those of W. Tibet.

The population as compared with the area, is very small, generally pursuing a nomade life. The people belong to the Caucasian race, not to the Malayan; they generally live during the winter in small villages in the lower and less inhospitable portions of the valley, while in summer they wander with their flocks of sheep and cattle towards the head of the valley, to the higher places of pasture. Some of the tribes have no substantial buildings at all, and live all the year round in black tents (made of the hair of the yak).

Proceeding westwards from the Kunawar frontier, near Shipki, we find that the Sutlej has forced its passage through the principal N. W. Himalayan chain, cutting its bed to a depth of several thousand feet. Former terraces and old gravel beds of the river [and also of its tributaries] are seen, three and four thousand feet above the present level, which descends from about 8,000 feet at Shipki—N. lat. 31°, 58′; E. long. 78°, 40′—to 3,000 feet below Kotegurh—N. lat. 31° 24′; long. 77°, 38′.—Within this entire length (amounting to about 160 miles) from Shipki to Suni (N. of Simla) the Sutlej flows in a narrow channel between perpendicular cliffs of gneiss, the width of which seldom exceeds a few hundred feet. The Wangur and the Baspa rivers, both of which are situated within the branches of the central Himalayan chain are the only large tributaries* on the Indian slopes. They are well known to travellers in these parts of the hills as the finest retreats, where a delightful climate combines a beauty of vegetation and an Alpine grandeur of snow fields and glaciers, not easily to be found in other parts of the hills. The highest peaks in the central chain rise on an average somewhat above 22,000 feet, and the limit of snow lies in general at about 17,000 feet, increasing to about 18,500 on the Tibetan slopes.

In the Sutlej valley itself, only the higher terraces, situated between 6 and 9,000 feet, are generally sufficiently large to afford room for cultivation and settlement, the slopes of the mountains being mostly precipitous. The width of the valley is even at those higher elevations merely a few miles. On the whole, its physical conditions are not particularly favorable to agriculture, nor is there much room for a large population. The circumstance, however, that the river has cut its course right across the principal range of the N. W. Himalaya, (without making such a distant circuit, as is done by the Indus on one side and the Brahmaputra on the other) entitles the Sutlej valley to its fame as the *principal highway to Central Asia.*

Indeed, following the course of the river from the plains at Rupoor up as

* The largest tributary is the Spiti river: its valley has in general rather a Tibetan climate and a corresponding fauna and flora.

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far as Shalkhar, on the Spiti river, and then travelling a few marches through the present Chinese province '*Sto-tsho*' along another tributary, the Para river, we come upon the elevated plains of the Tibetan province Rupshu; cross the Turghoo-la (or Jaborseesa-pass,—only about 17,000 feet high) to the hot springs of Puga, and thus reach the upper Indus valley, without any such difficulties, as snow beds, glaciers and avalanches &c., which usually are experienced in traversing high passes. The ascent of the Turghoo-la is, on the whole, scarcely two thousand feet, and the incline is so gradual, that even a cart-road, if required, could be made with little expense and no difficulty. It is, however, not my object here, to point out a new route to Central Asia, but it is necessary to draw attention to the great facilities, which, at the same time, this route affords to the migration of birds, because these and other favorable circumstances must be consulted, when an explanation of many of the peculiarities in the character of the avi-fauna of the valley has to be given.

Viewing the general physical construction of the valley within the central chain of the N. W. Himalaya, the greatest peculiarity consists in its small width, while the neighbouring hills rise to a very considerable elevation, and thus exhibit very different conditions of climate within a comparatively small geographical area. These apparently anomalous conditions are best exemplified from the occurrence of a few characteristic Indian plants. Thus, for instance, in some places, *Euphorbia antiqua*, *Ficus religiosa*, *Musa* and other more or less tropical plants are found on the base of a hill, while the higher portions of the same declivity are adorned with the finest cedar and pine forests and, above the limit of these trees, with numerous glacial or Alpine plants, the summits being crowned with eternal snow and ice.

It no doubt greatly depends upon the extent both of the arboreal vegetation and of the brush wood, whether the slopes of the mountains at different elevations always shew equally marked distinctions in the fauna, as they do in the flora. But, when the different climatal conditions are placed within such narrow geographical limits, it will easily be understood that their approximation is particularly favorable for the migration of species, which in time become used to a somewhat different climate, if the respective localities are suitable to allow an easy passage. I shall subsequently note several instances, which appear to be the result of such a gradual acclimatization.

The province Kunawar, in which many of the ornithological observations here recorded were made, extends from Shipki to Wangtu bridge (N. lat. 31°, 27',; E. long 78°, 3'). A large portion of this province is situated on the N. eastern declivity of the central Himalayan range, and has much Tibetan admixture in its fauna and flora. Travelling from the Chinese frontier to the west we soon see the Tibetan *Caragœna* and the *Juniperus squamosa* replaced by the larger *Junip. excelsa*, *Pinus excelsa* and a few others; fine specimens of apricot

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and poplar-trees become abundant, and the first vineyards are to be observed in the neighbourhood of small cottages. *Myricaria elegans,* so common in the Spiti-and Para-valleys is hardly to be noticed anywhere. The first extensive forests of the Hymalayan Cedar, *Cedrus deodora,* the eatable pine, *Pinus Gerardiana, Abies excelsa* and others, are met with to the west of Chini, which is one of the best known places in this portion of the hills, and lies almost in the middle of Kunawar. The village of Chini itself is situated at an elevation of about 9,000 feet on an old river terrace, several others of which exist here between heights of 7 and 10,000 feet, affording the only suitable places for cultivation. The population is, therefore, in this neighbourhood rather large. The extensive cultivation attracts at the same time several birds, which are not to be met with in any of the more eastern provinces.

The regular formation of the Dhaoladhar — and the Baralatse — ranges, which is so prominently marked in their N. Western and S. Eastern extensions is here much disturbed and interrupted. Both the chains divide numerously, being connected by different spurs or branches, which often exceed in elevation the main range. The climate is in some respects intermediate between that of India and that of Tibet. The mean temperature varies in summer (between May and September) from 45 to 80 degrees within 24 hours; the solar heat amounting to about 100 and very seldom rising to 120 degrees. In winter the thermometer stands lowest (below Zero at night time) in January and the first half of February; the mean temperature of the winter-months being about 32°. There in no particular regularity as to the fall of moisture in the rainy season. Occasional showers occur in the summer months, especially in June and July. The total fall of rain, especially including the heavy snow falls in February, does not probably much exceed six inches.

The limit of vegetation almost corresponds with that of the snow line, lying between 17 and 18,000 feet; the limit of the growth of trees being very nearly 12,000 feet. We often find at this limit *Betula Bajpaltra,* and in other places *Pinus excelsa,* which ranges almost higher and extends farther into the interior than either *Pinus Gerardiana* or *Cedrus deodora.* The eatable pine is, I think, peculiar to the Sutlej valley and the seeds are a favorite food of the rare *Sitta leucopsis.* FRINGILLIDÆ, like *Metopomia pusilla, Loxia Himalayana, Propasser rhodochrous,* or *Fregilus Hymalayanus,* are usually found at the limit of trees, where they generally also breed.

Other less common species of trees in the neighbourhood of Chini are *Picea Webbiana, Pinus Smithiana, Abies excelsa, Taxus baccata,* two species of *Acer, Alnus elongata, Fraxinus, Quercus* or *Ilex &c.,* all more or less recalling a European character of vegetation. In forests, as well as on the more open and grassy slopes of the hills, are also found a number of common European plants, for instance *Ranunculus acris, Caltha palustris, Adonis æstivalis,*

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Taraxacum officinale, Convolvulus arvensis, Euphrasia officinalis, Epilobium roseum and *angustifolium, Polemonium cœruleum, Thlaspi arvense* and several others, characterising the flora as one of a temperate climate. The peculiar species of the avi-fauna of the province Kunawar are *Cyornis ruficauda, Fregilus Himalayanus, Emberiza Stewarti, Metopomia pusilla, Sitta leucopsis, Ruticilla cinereocapilla, Sylviparus modestus, Alsocomus Hodgsonii,* and many others which are during the summer very rarely, or almost never, to be observed to the west of the Wangtu bridge, or on elevations below 8,000 feet. On the other hand occur, in almost immediate association with the former, species like the purple-tailed Honeysucker, *Aethopyga Gouldiœ, Dicrurus longicaudatus, Palœornis schisticeps,* and others which are usually met with only lower down; they appear to have been so far acclimatized, that they are found breeding even on these high elevations between 9 and 10,000 feet, still they are now comparatively rare birds. A large number are migratory, and in winter make room for others which arrive from Tibet and Central Asia; these latter species chiefly belong to the FRINGILLIDÆ, ALAUDIDÆ and CORVIDÆ. PHASIANIDÆ, PICIDÆ, and a few RAPTORES are not migratory, but they are numerically not so much represented as the others.

The next province on the western frontier of Kunawar is Bissahir, adjacent to which are the hill states about Simla and the southern portions of Kulu. When we proceed from the Wangtu bridge down the valley, we already find ourselves on the southern declivities of the great barrier between the Tibetan and the Indian climate. The rainy season sets in here with full force towards the end of June, and lasts till the end of September. The vegetation on suitable localities and on moderate elevations is luxuriant especially at this time of the year; it has much admixture of the Indian subtropical types and also a great number of plants identical with those of India in general.

The fauna of these more western portions of the Sutlej valley can be viewed under two somewhat different sections; namely that of the greater elevations between 12,000 and about 6,000 feet, and that of the lesser elevation 4000 or 5,000 down to about 1,000 feet.

The former section includes some of the largest forests of the Himalayan Cedar, especially in the neighbourhood of Nachar, stretching on one side into the Wangur— and Baspa— valleys, and on the other, along the tops of the hills, to almost the immediate vicinity of Simla. About Gaora and Serahan,— between 7 and 9,000 feet— some of the finest specimens of the *Ulmus Himalayensis, Pavia indica, Juglans regia,* mulberry and other trees occur, and besides a thick vegetation of low forests and brush-woods. There exists on these moderate elevations a particularly mild climate; the supply of water is abundant during the whole year, and some of the places best adapted for cultivations of grain &c. are to be found here; the population is, therefore,

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larger than on either the higher or the lower elevations. The fauna on the whole much resembles that of Kunawar, though many of the southern species of birds, insects, &c., are here more abundantly found than they are met with in the eastern provinces. Specially common and characteristic for the climate of the summer months are *Sphenocercus sphenurus, Muscicapula supercilliaris, Hemichelidon fuliginosus, Pomatorhinus erythrogenys, Trochalopteron variegatum, Abrornis xanthoschistos, Pyrrhula erythrocephala, Pericrocotus brevirostris, Gallophasis albocristatus,* and many others. In winter several species of the PARINÆ, RUTICILLINÆ, ACCENTORINÆ and others are here more abundant than on the lower ranges.

The Indian character of the flora and fauna becomes prevalent the more we proceed southward, and the more we descend to lesser elevations. At the Wangtu bridge, the base of the Sutlej valley is only about 5,000 feet above the sea-level; at Rampoor (the principal town of Bissahir, east long. 77°, 45′; north lat. 31°, 26′) scarcely 4,000 feet; below Kotegurh about 3,000 feet; and thus rapidly decreases until it is reduced in the vicinity of Belaspoor (long. 76°, 48′; lat. 31°, 23′) to almost 1,000 feet. The climate of these lower portions of the valley is in some respects peculiar, but on the whole much resembling that of Northern India, especially of the Punjab.

There are several indications, that the valley has formerly been better populated, than it is at the present time. The reasons of the decrease of the population seem principally to rest in the change of the climate, which most probably was effected by the destruction of the arboreal vegetation. The characteristic tree of the lower elevations is the *Pinus longifolia*, but there can be little doubt that the *Cedrus deodara* was formerly much more common; both these trees, and especially the latter, appear to have been at an early period very much reduced in number, and in consequence of this the influence of the periodical rains and of the rapid changes of the weather soon became sensibly felt. The heavy showers have, after a lapse of a comparatively short time, washed away all the unprotected soil and left behind them bare rocks. Again, on account of the want of arboreal vegetation, the temperature in the shade during the summer often rises in the narrow parts of the valley to 90, and sometimes even above 100 degrees, hot winds being in the months of May or June in the neighbourhood of Rampoor not uncommon. We may justly say that there is a kind of interruption in the growth of the vegetation twice in a year, during the winter and partially also in the hot season. This is no doubt a great impediment to the cultivation of cereals as likewise of all other kind of plants and has, therefore, indirectly a great influence upon the inhabitants of the country in general. We thus gradually come to the conclusion, that the devastation of the forests has, indeed, a great deal to do with the final depopulation of a hill-country, because the irregularities of the weather, its rapid changes and extremes, when they once come into operation, are every year increasing, and soon create almost insurmountable difficulties to agricultural cultivation.

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At no great distance to the West from Wangtu bridge we meet, at an elevation of about 6,000 feet, with the first noteworthy, sub-tropical plant, the *Euphorbia antiqua,* and about one mile from Rampoor at a height of about 5,000 feet we come across the first specimens of *Ficus religiosa.* On the same tree we meet with the first specimens of the familiar Mina, *Acridotheres tristis, Temeneuchus pagodarum* and other common Indian species of birds. Several flowering trees and bushes attract the *Arachnechthra asiatica, Piprisoma agile, Sibia capistrata* and others. In low brushwoods are found *Pratincola caprata* and *ferrea, Otocompsa leucogenys, Munia Malabarica, Reguloides trochiloides* and other familiar birds of the plains. *Corvus splendens* and the noisy *Milvus govinda* bring the traveller from the last groves of pine-trees under the shade of a *Ficus indica,* or into a garden of *Musæ* and orange trees. Such is the neighbourhood of Belaspoor, which already possesses all the characteristics of a true Indian flora and fauna and will, therefore, be considered as the limit to which my observations on the Himalayan avi-fauna of the Sutlej valley will apply.

Thus the country, from which the materials for the subsequent remarks have been obtained, extends almost from the Tibetan frontier at Shipki to Belaspoor, a distance of about 180 miles measured along the course of the river Sutlej; the direct line across the mountains being, however, only about 110 miles. The provinces situated in that portion of the N. W. Himalaya are Kunawar, Bissahir, the Southern portion of Kulu, and a few of the small hill states in the neighbourhood of Simla. This area lies between the 31st and 32nd degree of North latitude and very nearly between the 77th and 79th degree of east longitude. The elevations vary on an average from one thousand to about thirteen thousand feet, for scarcely any birds live in these parts of the valley for a great length of time above the latter limit, though further to east in Tibet the same are usually found at considerably higher elevation. With reference to the arboreal vegetation to which we have so often drawn attention and which forms such a prominent feature in the physical character of the country, we may in general state that the avi-fauna referred to in the following pages, characterizes the geographical range of the Himalayan Conifer trees, beginning at low elevations,—about Belaspoor,—with the *Pinus longifolia* and terminating, in the East of Kunawar,—with the *Pinus Gerardiana* and the *Juniperus excelsa.*

The arrangement followed in the enumeration of the families and species is that of Dr. JERDON'S BIRDS OF INDIA,' to the volumes and page of which reference is given in Roman and Arabic numbers, respectively.

I. Fam. VULTURIDÆ.

The vultures, usually feeding on the carcasses of different animals, which occasionally perish under the stress of the weather in crossing high passes on the N. W. Himalaya ranges, are the two following;

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1. Gyps fulvus, *Gmel.*, (I. 8), which is the common European species, and

2. Gyps indicus, *Scop.*, (I. 9), which is very rare in the interior of the hills.

3. Neophron Ginginianus, *Lath.*, (Ibis 1866. II. p. 233—*Neoph. percnopterus* apud Jerdon, I. 12) is often seen in summer on the lower ranges about Belaspoor and Suket, but is almost never to be observed further in the interior.

4. Gypaetus barbatus, *Lin.*, (I. 13) is common all through the Sutlej valley and through W. Tibet; it generally retires in winter from the Northern parts of W. Tibet to the more Southern hills, but permanently resides about Chini. The Chukor, *Caccabis chukor*, and other partridges are his favourite meal. It is, however, well known, that this bearded eagle often accepts any other refuse of bones and meat, being very often seen near the houses of hill stations.

When marching through Lahul in 1865, the people assured me that it very often carries off lambs and kids and is very bold at the time of breeding. The natives of Kulu, about Plash and the eastern districts, prize the meat very highly, which is not only eaten by the low class, the Kolies, but rather more by the higher class, the Kanits. They generally tie a chukor on a short string, and stick four or five sharpened spears in the ground crossing each other, so as partially at least to cover the bird and at the same time to radiate with their points in different directions. The eagle is watched from some distance and, as soon as it throws itself with its usual great force and velocity upon the prey, it is overpowered with large clubs before it can extricate the spears from its body.

The Himalayan *Gyp. barbatus* is, as regards the deep yellow and reddish hue of its plumage, identical with the African variety, while the Alpine specimens,—which are becoming very rare,—generally have a much paler plumage.

II. Fam. FALCONIDÆ.

5. Falco peregrinus, *Gmel.*, (I. 21) is often seen in the spring about Kotegurh, but I have not observed it between May and the middle of September anywhere else in the Sutlej valley.

A male specimen, shot near Kotegurh in March, has the lower

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plumage remarkably yellowish rusty, only slightly albescent on the throat, where the quills of the feathers are white, while those of the rest of the plumage are pale brown.

6. Hypotriorchis subbuteo, *Lin.*, (I. 33). I found a pair of old birds near Chini in August 1866, but I could not ascertain whether they breed here, although it seems very probable. Jerdon says that they do not breed in this country, referring of course to India proper.

7. Hypotriorchis severus, *Horsf.*, (I. 34) is not common in the forests about Kotegurh and in Kulu, and during the summer seems to migrate further to North.

8. Hypotriorchis Chiquera, *Daud.*, (I. 36) occasionally breeds near Belaspoor, where I found several young birds about the end of May, but I never met with a specimen in the interior of the hills.

9. Tinunculus alaudarius, *Briss.*, (I. 38) common all through the N. W. Himalayas, on the southern side as well as in W. Tibet. I found this common European hawk breeding near Chini in narrow crevices of rocks. The eggs are dirty white, mottled and irregularly spotted with reddish brown. The young birds vary extremely in colour of their plumage, but the old ones are in every way identical with those from Europe.

10. Erythropus vespertinus, *Lin.*, (I. 40) rather rarely seen, and only in the lower hills.

11. Astur palumbarius, *Lin.*, (I. 45) occasionally appears near Kotegurh in the spring, probably on its way to Central Asia, for I have not observed it during the summer months any where in the eastern parts of the Sutlej valley, not even in Kulu.

12. Accipiter nisus, *Lin.*, (I. 51) comparatively rare in the interior, but more common in the lower hills.

13. Accipiter virgatus, *Tem.*, (I. 52) is by far more common than the last, especially about Kotegurh, Rampoor, the Kulu valley, and also more westward towards Kashmir, but I have not seen it to the east of the forests of Nachar.

14. Accipiter? nisoides, *Blyth*, (*an A. gularis*, Schegel!) 1845, J. A. S. B. Vol. XV. p. 727. The following is a description of a full grown male,* an evidently freshly moulted specimen; it was

* Known by dissection.

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shot in the middle of August 1866 in a pine-forest at Rogi, about 6 miles W. of Chini.

Above, dark brown, ashy on the rump and upper tailcoverts; all the feathers on the head, especially in front, and on the sides of neck margined and tipped with pale rufous, the rest of the feathers above and on the scapulars being only tipped with darker rufous and terminating with very fine silvery hairs; a narrow supercilium, and partially on the nape, white; ear-coverts brown, rufescent at the lower base; wings brown, the feathers with distant dusky bars on the inner webs and pale rufous or ochrey about the middle; the secondaries are tipped pale, the tertiaries more distinctly rufous and both also terminate with long silvery films; tail ashy, each feather with four dusky bands, the outermost pair only on the inner web banded, all are tipped pale rufous, and on the extreme edges with a silvery grey colour, though these edges appear to be very soon worn off.

Below, chin and throat white, each feather with a very short dusky mesial streak, the streaks being near the tips a little stronger than on the sides, where the white passes into fulvous; the rest of the plumage below is very closely banded with pale and rufous brown, each of the feathers having three broad bands of a light brown colour, being margined posteriorly and partially also anteriorly with a rufous brown; the remainder of each feather is pure white. On the abdomen and thighcoverts the bands become very narrow, and the latter are internally much rufous; the lower tail coverts are pure white, partially tipped with pale brown; tail below albescent, with cross bands distinctly conspicuous. The sides of the body are much rusty brown; the inner wingcoverts whitish, barred with numerous, narrow cross-bars of blackish brown and pale ochry.

Length of wing 8 inch.; tail $5\frac{3}{4}$ inch.; tarsus $2\frac{1}{8}$ inch.; middle toe $1\frac{5}{8}$; outer toe $1\frac{1}{4}$., with a small claw; inner toe $1\frac{1}{8}$ inch, inner claw alone nearly $\frac{1}{2}$ inch, and almost more than double the strength of the outer; hind-toe nearly 1 inch, of which the claw is about the half in length. It is evident that these measurements are intermediate between those of Mr. Blyth's *A. nisoides* and the common *A. nisus* of Linné.

On comparing Mr. Blyth's originals in the Indian Museum I found, that one of the three originals is lost, the other two very much resem-

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ble in the upper dark brown colouring our specimen, and one of them has some of the tips of the scapulars and tertiaries distinctly tipped with rufous brown. The cross bars below are, however, ochreous yellow, only with a slight ferruginous tint on the sides of the breast, but not nearly to the extent as described in our specimen. This cannot be, however, of very great importance, for the same colour is very variable in *A. nisus.* The throat is white, and so far as the feathers are preserved, they present a few dark streaks about the middle, though on this point neither of the specimens is quite perfect and it is only to be regretted that such valuable originals were not better cared for. The measurements given by Mr. Blyth are, wing 7¼ inch; tail 8½ inch. The two respective specimens in the Indian Museum have the wings 7½ and 7¾, and the tail 5½ and 5⅝ inches. Mr. Blyth supposed the specimens to be females, but they could with as much reason be regarded as males. Still it cannot be questioned that the typical specimens referred to, are remarkably small as compared with usual specimens of *A. nisus.* I found this difference especially apparent after having a short time previously procured in the lower hills several specimens of the last species. The claws appear remarkably strong compared with the size of the bird, and the general deep brown colour is always very conspicuous, when compared with the ashy hue of *A. nisus;* still I think it wants further proof, until the species is firmly established.

Mr. Blyth in his Commentary (Ibis 1866, p. 239,) says, "Dr. Jerdon writes word, that *A. nisoides* is not rare in the interior of the Himalaya," and it is not unlikely that Dr. Jerdon observed it in the same portion of the hills, where my specimen was procured, for he visited the Sutlej valley in 1864. The species cannot be easily mistaken for *A. virgatus*, which is comparatively very common and much larger.*

15. Aquila chrysaetos, *Lin.*, (I. 55) is often seen about Kotegurh, and further towards east.

A few other eagles and buzzards are not very rare in different parts of the Sutlej valley; but I have not succeeded in procuring specimens of either of them. The only species, which I have obtained in the beginning

* Mr. Blyth tells me, that his *A. nisoides* is really identical with *A. gularis* of Schlegel (Feb. 1868).

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of August 1866, in a forest near Chini, was a young specimen of what I believe to be *Aquila pennata*, Gmel., (I. 63). The specimen is only about three-fourths grown; in colouring it exactly agrees with the old bird, except that the inner webs of the tail feathers are not barred; a white shoulder tuft is distinctly traceable. Dr. Jerdon says, that the young bird of *A. pennata* is white beneath. This makes the question of the identity of our bird doubtful, although, as I have said, there is no difference in its colouring from that of an old *A. pennata*. The specimen is not a young *Neopus*, which always has the beak in proportion somewhat more slender.*

16. Neopus Malaiensis, *Reinw.*, (I. 65) is common about Simla.

17. Buteo canescens, *Hodgs.*, (I. 88), is occasionally found at Kotegurh, but not beyond in the eastern districts.

18. Circus cineraceus, *Mont.*, (I. 97) occurs in the low hills, where it may be seen to haunt in fields and low bushes, specially in the months of September and October.

19. Haliastur Indus, *Bodd.*, (I. 101) is only an occasional visitant of the lower hills; I have observed it between Suket and Mandi on marshy ground, but not further in the interior. It is sometimes seen in the Kashmir valley about Srinaggur.

20. Milvus Govinda, *Sykes*, (I. 104), common about Kotegurh but very rarely seen further to the East than Rampoor, except during the time of breeding. It does not approach the Tibetan climate.

III. Fam. *STRIGIDÆ.*

Species belonging to this family are comparatively rare, although several of them may still be found in the wooded districts between Kotegurh and the Baspa valley.

21. Syrnium Newarense, *Hodgs.*, (I. 122). An unusually large specimen of 21 inches in length, with the wing of a little over 18 inches, and the tail of 10½ inches was shot at Kotegurh in February 1866.

22. Syrnium nivicolum, *Hodgs.*, (I. 124). I procured one specimen of this species above Chini, at an elevation of 14,000 feet and

* See Ibis, 1867, p. 140. I cannot help thinking that Lieut. Beavan, who was very eager to give notice of some of my specimens of birds, is mistaken in pronouncing the species to be a young of *Neop. Malaiensis*, Reinw. (Feb. 1868.)

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another specimen was shot by my shikarees at Kotegurh in winter 1866. It is in this portion of the hills rather a rare bird.

The greater coverts of the primaries have a white terminal spot on the outer webs. The spots on the outer webs of the quills are fulvous brown, paler on the inner; the cross bands on the two central tail feathers are indistinct, and the plumage is generally finely mottled with light brown all over; the tips of all tail-feathers are white. Below, on the sides of the breast, and on the abdomen most of the feathers are centrally streaked brown, each being marked with three cross bars.

23. Otus vulgaris, *Flem.*, (I. 125) not common in the forests near Nachar.

24. Athene cuculoides, *Vig.*, (I. 145), common enough about Kotegurh, but very rare further in the interior.

25. Glaucidium Brodiæi, *Burt.*, (I. 146) must breed very early in the spring, for I met fully grown young birds about the end of May. The species is not rare on the Hatu mountain near Kotegurh, on elevations of 7 to 8,000 feet, and is occasionally seen all through the wooded districts of the Sutlej valley, but not beyond the more extensive forests. It chiefly feeds on small lizards, frogs and insects.

IV. *Fam. HIRUNDINIDÆ.*

26. Hirundo rustica, *L.*, (I. 157) is common about Kotegurh, and further to East.

27. Hirundo filifera, *Steph.*, (I. 159). I met with this species near Belaspoor, in October 1866; the birds were few and probably migrating to the plains, for I found them during the previous year rather numerous in the eastern portions of Kashmir.

28. Hirundo erythropygia, *Sykes*, (Ibis, 1866, vol. II. p. 337). The smaller type, which Blyth considers as distinct from *H. daurica*, Lin., is common all through the Sutlej valley, especially in the portion between Kotegurh and the frontier of Tibet.

29. Cotile rupestris, *Scop.*, (I. 166). This is a common species all through the valley, and also occurs on the Indus in W. Tibet; it may have been occasionally mistaken for *C. riparia* which is, however, much rarer; I have only once procured a specimen in Spiti.

30. Chelidon Cashmiriensis, *Gould*, (I. 1167) breeds occasionally near Kotegurh, but it is more common in the Kulu valley. I do not remember to have observed *Ch. urbica*, except late in autumn

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in the low hills.

31. Cypselus Melba, *L.*, (I. 175), common during the winter about Belaspoor, and in the valley below Kotegurh; in summer it migrates into Tibet and Central Asia, a few birds only being occasionally seen in the vicinity of Chini.

32. Cypselus apus, *Lin.*, (I. 177). I have procured near Chini specimens which are perfectly identical with the European bird, and the species is also common on the Indus in W. Tibet, especially about Lei. I never got a specimen of the newly so called *C. acuticauda*, *Blyth*, if this ought to be really regarded as a distinct species, which does not seem to be very probable.

33. Cypselus affinis, *Gray*, (I. 177) is only occasionally seen in the valley; one specimen was procured below Kotegurh in March 1867.

34. Cypselus pacificus, *Lath.*, (Ibis, 1866, Vol. II. p. 340). It appears that this species, to which (according to Blyth,) Gould refers *C. vittatus*, J. and S., *C. australis*, Gould and *Hirundo apus*, *var. β.* of Pallas as synonyms, only differs from *Cyp. leuconyx*, Blyth, by the blackish-brown claws. I shot last year near Chini several specimens of a *Cypselus* which, on comparing them in the Indian Museum with the original specimen of *Cyp. leuconyx*, do not exhibit the slightest difference in size, though they distinctly have blackish claws, with no trace of white. The length of the wings differs from 6¼ to 6⅝. The birds are to all appearance identical with the specimens from the N. W. Himalaya, determined by Blyth as *C. vittatus*, of which Jerdon says (I. 180) that they belong to *Cyp. leuconyx*. As far as these specimens of the so-called *C. vittatus* in the Museum are preserved, their claws appear to have been brown and not white. I cannot trace satisfactorily, how far the distinctions pointed out to exist between *C. leuconyx* and *C. pacificus* are correct; the species do not seem to differ in colouring. Dr. Jerdon says (loc. cit. p. 180), that the blackish brown is 'darkest on the head,' while in my and in Blyth's specimens of *C. vittatus*, only the back is glossy blackish brown and the head, nape and neck pale brown, exactly like in *Cyp. affinis*; there is also in all our specimens a slight, pale supercillium traceable, being more distinct in front.

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V. *Fam. CAPRIMULGIDÆ.*

The species of this family are comparatively rare, and only to be found in the lower hills. I have often observed on the road from Simla towards Suket the following,—

35. CAPRIMULGUS INDICUS, *Lath.*, (I. 192), which is also occasionally seen about Kotegurh, in company with the smaller

36. CAPRIMULGUS ASIATICUS *Lath.* (I. 197).

VI. *Fam. MEROPIDÆ.*

37. MEROPS VIRIDIS, *Lin.*, (I 205), is only confined to the lower ranges and is from March till the end of October not uncommon in Southern Kulu and about Belaspoor. Neither the European *Merops apiaster* which is said to be found in winter, nor any of the other species belonging to this family have been observed.

VII. *Fam. CORACIIDÆ.*

38. CORACIAS INDICA, *Lin.*, (I. 214) is very common in the lower hills about Belaspoor, but has not been seen further towards East than Kotegurh.

39. CORACIAS GARULA, *Lin.*, (I. 218). I only shot one specimen near Nadaon at the end of October 1865, but I have repeatedly seen this species in the northern Kashmir valley; it is also found in Western Tibet.

VIII. *Fam. HALCYONIDÆ.*

40. HALCYON FUSCUS, *Bodd.*, (I. 224), common about Belaspoor and not leaving during the winter the lower ranges of hills.

41. ALCEDO BENGALENSIS, *Gmel.*, (I. 230), is the only species which is occasionally seen as far east as Chini, though it is always rare.

42. CERYLE RUDIS, *Lin.*, (I. 232), only in the lower hills to be met with.

43. CRYLE GUTTATA, *Vig.*, (I. 239), occurs on the small streams beyond Rampoor, between Gaora and Serahan, up to an elevation of 7,000 feet; in Kashmir it is very common.

IX. *Fam. PSITTACIDÆ.*

Several species of parrots are during the summer-months found on the lower ranges of the Himalayas, but they do not go in the interior. Among the more common species are—

44. PALÆORNIS ALEXANDRI, *Lin.* (I. 286),

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45. Palæornis torquatus, *B o d d.*, (I. 257) and

46. Palæornis rosa, *B o d d.*, (I. 259). Only the first and last species may occasionally be seen above Suni, in the southern portions of the Kulu-valley, and about Kotegurh; none of them occur more eastward.

47. Palæornis shisticeps, *H o d g s.*, (I. 261), is rather common in the neighbourhood of Chini; I found it breeding near Urni (about 10 miles W. of Chini) at an elevation of about 8,000 feet. Towards the end of August,—at which time the young birds are nearly full grown,—its shrilling voice may be heard between Serahan and Nachar almost in every ravine, wherever the elder and the elm are abundant, on the seeds of which it principally feeds.

The young bird has no vinaceous spot on the shoulders of the wings, the head is dull grey with a greenish tinge, and nearly two-thirds of the basal portions of all the feathers and the quills in their entire length are slaty.

X. *F a m. PICIDÆ.*

48. Picus himalayanus, *J. and S e l b y*, (I. 269) may be considered as the true representative of the European *P. major*, though it is a somewhat smaller bird. The third pair of the outer tail feathers is usually towards the tip whitish, tinged rufous, and interrupted on both webs by a blackish bar, the tip itself being whitish. The female is above uniformly black.

Common in the cedar and pine forests all through the valley as far East as Chini, and ascending here to elevations of about 11,000 feet.

49. Picus brunneifrons, *V i g.*, (I. 273). The third outer pair of tail feathers is usually also provided with 2-4 spots of white; sometimes there are even one or two spots on the inner webs, the tips being rarely white; the streak below the eye is very seldom black, but generally light brown, as also is the front of the head.

This species is common in the lower ranges of the hills; I have not seen it to the East of Nachar, but about Gaora (E. of Rampoor) it occurs at elevations of 8 and 9,000 feet.

50. Gecinus squammatus, *V i g.*, (I. 286). Common all through the forests of the valley up to Chini, and ascending to elevations of nearly 11,000 feet.

I procured in August 1866 near Pangi, a few miles beyond

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Chini, a pair of what I suppose to be young birds of this species, exhibiting, however, some noteworthy differences. Both the specimens are a little smaller than those usually known as *G. squammatus ;* the green is duller above than below, throat dirty greenish grey; the feathers on the fore breast and on the vent are margined with black, while in specimens of *G. squammatus*, shot at Kotegurh and in the western parts of the valley, the black margined feathers be gin on the lower half of the breast, its frontal half being green, the colour becoming duller on the neck and the throat. The middle tail feathers are margined with green, not being wholly black, as in typical *G. squammatus.* The streaks above and below the eye are almost white, while in *squammatus* they are distinctly tinged with green. The beak is also shorter, and apparently somewhat broader near the base.

It is, as already stated, much more likely that we have to deal here with a young bird in a certain stage of plumage—perhaps the winter plumage of the first year,—than with a distinct species. The red on the front of the head of the male is tolerably well developed, although not so pure as in old specimens of *squammatus*, it is, however, much purer than is usual in young specimens of this species.

51. Gecinus striolatus, *Blyth*, (I. 287) is very rarely met with in the forests west of Kotegurh.

There are several other species of Picidæ to be found in the lower hills, but none of them is common even as far north or east as Kotegurh. The only other species which deserve special notice are the following ;

52. Vivia innominata, *Burt.* (I. 300).

The male has above the nostrils a pale yellow frontal zone, interrupted on the culmen of the beack ; next to it is an ashy green stripe ; the feathers on the forehead are greenish, or ashy white with a slight green tinge on their basal half, then black or blackish brown, and tipped with golden yellow, having the lateral margins whitish, Supercilliar stripe white, widening towards the nape and mingled with dusky near its termination ; ear-coverts ashy brown ; a white stripe extends from the upper mandible in the direction of the scapulars, having below a blackish stripe, which originates at the base of the lower mandible. Front edges of the wings whitish ; wing coverts and all the wing feathers dusky brown ; the latter (except the first two or three quills) on the outer edges greenish, the green colour increasing

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towards the tertiaries; the edges of the white inner webs of the two central tail feathers are generally also black. The white below has usually a green tinge, but is purer on the throat; each of the feathers has about the middle of its length a round black spot, gradually passing into crossbars on the vent.

The female has the head above uniformly greenish, occasionally somewhat dull brown. Dr. Jerdon's description—loc. cit.—seems to have been taken from an imperfect female specimen only.

The *Vivia minuta* of Temminck has the head of the male scarlet above, posteriorly black with small white spots; otherwise it is like the Himalayan species, which though not very rare about Kotegurh is very seldom met with beyond the Nachar forests. Near Kotegurh it occurs between 6 and 8,000 feet, and about Serahan up to 9000 feet; it is a permanent resident of the valley.

53. YUNX TORQUILLA *Lin.*, (I. 303). I only procured, at the end October 1866 one specimen near Belaspoor; it was probably migrating from Kashmir, or from Chamba, where this species is common during the summer months.

IX. *Fam. MEGALÆMIDÆ.*

The species belonging to this family are mostly confined to the lower elevations: they are very rarely met with above 9,000 feet.

54. MEGALÆMA VIRENS, *Bodd.*, (I. 308), is common in the forests about Gaora (7,000—8,000 feet).

55. MEGALÆMA HODGSONI, *Bonap.*, (Ibis 1866, p. 358—M. LINEATA, *Vieill.* apud *Jerdon* I. 309), generally only occurs at elevations not exceeding 3000 feet, while the next,

56. MEGALÆMA CANICEPS, *Frankl.* (I. 310), has not been seen even beyond Belaspoor, though common in the Dhoon, south of Kangra and about Nadoan.

57. XANTHOLÆMA INDICA, *Lath.*, (I. 315) is also common in the low hills, but it does not go even as far east as Kotegurh, where the bottom of the valley is only about 3,000 feet above the level of the sea.

XII. *Fam. CUCULIDÆ.*

58. CUCULUS CANORUS, *Lin.*, (I. 322) is, between April and November, common all through the valley, probably migrating into Central Asia. I have also seen it south of Lei in W. Tibet. Its

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call and the great variability of the plumage perfectly agree with the European bird.

59. Cuculus poliocephalus, *Lath.*, (I. 329), is very rare in the interior of the N. W. Himalayas. A specimen, obtained near Pangi in August 1866, has the upper plumage uniformly rufous-bay, with dusky cross bars, being somewhat less numerous on the neck; below whitish with a rufous tinge on the throat and on the front of the breast, purer towards the vent, all the feathers having narrow cross, black bars.

60. Hierococcyx sparverioides, *Vig.*, (I. 331), only occurs in the lower hills and scarcely above elevations of 3,000 feet.

61. Coccystes melanoleucus, *Gmel.* (I. 339), is in the summer months tolerably common about Koteguth, and ascends elevations up to 8,000 feet; but I have not seen it beyond Nachar, although it usually prefers brushwoods to pine forests.

XIII. *Fam. NECTARINIDÆ.*

62. Arachnothera magna, *Hodgs.*, (I. 360), only occurs in the lower hills about Belaspoor with the next species,

63. Æthopyga miles, *Hodgs.*, (I. 362).

64. Æthopyga Gouldiæ, *Vig.*, (I. 364). The male has the black on the head, above and in front, tinged with purple, gradually changing to steel-blue on the nape; a purplish spot somewhat below the ear coverts; shoulder-tuft steel-blue; throat violet, with a somewhat dull black median stripe, extending longitudinally towards the breast. Supercilliar stripe, cheeks, hind-neck, sides of neck, back, scapulars and lesser wing coverts deep crimson; lores and some feathers on the cheeks glossless black; rump yellow, upper tail coverts steel-blue, central tail feathers in the middle purplish, like some of the next edged bluish: the rest are blackish with greenish white tips, the white being especially conspicuous below and increasing towards the outer tail feathers. Wings and their longer coverts dusky brown, with the exception of the first and second, edged with olivaceous green, paling towards the tips; all the wing feathers are internally at the base white, a little less so on the extreme edges. Breast and belly bright yellow, paling towards the under tail coverts, and on the breast with more or less crimson. All the feathers with metallic lustre have their basal half black, the yellow feathers white.

The female is olive green above, brighter on the back and occasionally

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with some crimson feathers on the sides. All the feathers on the head and nape are centred dusky ; rump yellow; wings dusky, as in male, but somewhat more broadly edged with olivaceous green; tail edged with greenish, only the three or four outer pairs being tipped whitish. Below pale green, somewhat ashy on the throat, generally becoming yellowish towards the vent.

Bill brown, much paler below.

Very common about Kotegurh and through the whole valley as far east as Chini, living here at an elevation of between 9000 and 10,000 feet. This is probably the only honey-sucker, which frequents such great heights in the Himalayas. I never noticed here *Æ. Nipalensis* Hodgs., which is decidedly a larger species.

65. Arachnechthra asiaica, *Lath.*, (I. 370).

Male; the body has usually the same uniform glossy green colour, as the back and the head; the pale tips of the tail feathers are not always traceable and, when they are, it is generally only the case on the outer-most feathers; the sides of neck and the breast are purplish green, a longitudinal stripe on the throat and the rest of the lower plumage purplish black.

Female; above dark greenish grey; the feathers on the head narrowly centred dusky; wings dusky, externally edged paler, front edges white; tail blackish, the feathers with a purplish lustre on the outer-webs, tipped white, which increases towards the outer pairs; below greenish yellow, more distinctly so on the front of breast, paler on the throat and towards the vent, greenish ashy on the sides; thigh coverts yellowish.

The species occurs as far east as Wangtu bridge, and is especially common in the lower and warmer portions of the valley, as for instance near Rampoor; it does not, however, ascend to greater elevations, than 7,000 or 8,000 feet.

66. Piprisoma agile, *Tick.*, (I. 376,) not common, and generally to be met with in the low hills, where I observed it in May; it does not go to any considerable height, or to any distance in the interior, being very rare to the north or east of Kotegurh.

67. Myzanthe ignipectus, *Hodgs.*, (I. 377). The old male is above uniform dark bluish, metallic green; the young one is distinctly green and all the feathers are tipped fulvous; below the

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throat is more white in the young bird, than it is in the old one. Female above glossless olive brown, greenish on the scapulars and upper tail coverts, and possessing a green metallic shoulder-tuft; below greenish yellow, more white on the throat, and greenish or buff on the sides.

Tolerably common in the lower hills, but rather rare in the eastern parts of the valley. I found a pair near the Gaora bungalow at an elevation of about 7,000 feet: it was most probably breeding here. The species is also pretty common in Kulu and in the neighbourhood of Kishtwar; it most likely ranges over the whole of the southern declivities of the N. W. Himalayas.

XIV. *Fam. CERTHIADÆ.*

68. CERTHIA HIMALAYANA, *Vig.* (I. 380). The last primaries and the secondaries of the old bird are somewhat fulvous towards the termination of the outer webs; the tips of the secondaries are always pale.

The young birds have the fulvous spots on the upper plumage not so well developed, and all the feathers below are tipped very narrowly with dusky; the white is also not so pure as in the old birds, but there is no other perceptible difference between them except in the length of the bill. Very young specimens have the bill sometimes scarcely half an inch long, and from this all gradations are met with up to a length of very nearly one inch. Such considerable changes in the length of the bill are likewise common in the *Picidæ*, *Upupidæ* and allied families. Specific distinctions which are occasionally proposed upon the difference in the length of the bill are, therefore, not always sufficiently reliable.

This is the only species of *Certhia*, which is common in all the forests of the Sutlej valley, from above Belaspoor to near Sungnum, ranging almost from the plains up to elevations of nearly 12,000 feet. It is the true representative of *C. familiaris** of Europe.

69. TICHODROMA MURARIA, *Lin.*, (I. 383), is found all through the N. W. Himalayas, and during the summer months in W. Tibet and Central Asia.

70. SITTA HIMALAYENSIS, *J. and S.*, (I. 385), is not rare in the

* I am informed by Mr. Blyth, that this species has been lately procured in the Himalayas, (February, 1868.)

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lower hills and about Simla, but it is very seldom met with beyond the Wangtu bridge, and at elevations exceeding 9,000 feet.

71. Sitta leucopsis, *Gould*, (I. 385), is tolerably common in the neighbourhood of Chini, where it chiefly feeds on the seeds of *Pinus Gerardiana*, but it is very rarely to be seen near Simla or at Kotegurh, except in winter. In 1866, I observed it between Budrawar and Kishtwar at an elevation of 6,000 and 7,000 feet, feeding here on seeds of *Pinus excelsa.* Its voice is a loud, uniform melancholy call, while busily engaged in securing a pine-seed in the bark of a large tree.

I have never met with any other species of *Sitta* in the interior; wooded ranges of the N. W. Himalayas.

XV. *Fam. UPUPIDÆ.*

72. Upupa epops, *Lin.*, (I. 390), common during the summer all through the N. W. Himalayas and in W. Tibet. The plumage of the Tibetan bird does not differ in the least from that of the European.

XVI. *Fam. LANIIDÆ.*

73. Lanius erythronotus, *Vig.*, (I. 402), very common all through the N. W. Himalayas and W. Tibet.

The female has the grey on the head and back paler, the tertiaries more broadly edged with rufous or fulvous, and the tail feathers tipped pale; on the whole the grey and rufous colours are very variable in this species. The young bird is like the female, but all the colours are usually still paler.

74. Lanius Hardwickei, *Vig.*, (I. 405). The head above is often ashy-white, and the nape and back pure ashy. The tertiaries are, on the outer webs towards their tips, pale ferruginous, the two outermost tail feathers on each side being white, except on the terminal half which is black like the inner web, the tips however remaining white; the next two pairs have only the bases and the tips white, and on the four central feathers there are below occasionally traces of white tips perceptible.

The species is rather rarely met with about Kotegurh and only occurs as far east as Nachar. In 1865, I observed it between Budrawar and Kishtwar, but I do not remember it from Kashmir. Adams (Proc. Zool. Soc. 1858, p. 488) states that he never saw it on the Western Himalayas.

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75. Lanius arenarius, *Blyth*, (I. 407), was only once met with east of Chini, but it is during the summer more common in W. Tibet.

76. Pericrocotus speciosus, *Lath.*, (I. 419). I have only once procured a pair north of Belaspoor; it does not seem to be found in the interior of the hills.

77. Pericrocotus brevirostris, *Vig.*, (I. 421), is on the contrary found everywhere in the low hills, even in winter. During the summer months it migrates into the interior, ascending to the limit of forests. It is common about Chini, breeding on elevations between 9,000 and 10,000 feet. Some of my specimens are *fully* 9 inches long. The red and yellow patch on the wings of the male and female, respectively, extend only up to the first four quills, the 2-4th of which are, towards their termination, on the outer webs insinuated and edged with pale.

The young bird resembles in yellow colouring the female, but all the feathers above are tipped whitish, forming short cross bars; below, the yellow is paler, throat and breast barred with dusky and whitish, the white being more prominent on the vent and the lower tail coverts.

78. Dicrurus longicaudatus, *Hay*, (I. 430), is the only species of Drongs which is common all through the valley. It breeds about Chini at an elevation of between 9 and 10,000 feet and probably goes beyond the Kunawar frontier into Tibet.

XVII. *Family, MUSCICAPIDÆ.*

79. Tchitrea paradisi, *Lin.*, (I. 445), common in the summer months in Kulu and eastern Kashmir, but it is rather rare in the eastern portions of the Sutlej valley; I have never seen it much beyond the Nachar forests and above elevations of 9000 feet.

The colour of the plumage is known to be very variable. I met with old males, which had half of the tail feathers on one side white and on the other half ferruginous; and again some which had only the terminations of the long central feathers ferruginous. It is probable that even old birds often vary in the annual colouring of the plumage. Mr. Cassin (Journ. Am. Acad. Nat. Sc. Philadelphia, 1860, vol. IV. p. 323, pl. 50, figs. 1-2) describes from the west coast of Africa, under the name of *Muscipeta Duchalui*, two specimens, apparently belonging to this species.

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80. Leucocerca fuscoventris, *Frankl.*, (I. 451). I found this species in summer between Kotegurh and Nachar, on elevations of 5—9000 feet; it is a rare bird; one speciman was procured below Kotegurh in March 1867.

81. Leucocerca albofrontata, *Frankl*, (I. 452). Dr. Adams remarks that this species is only to be met with on the lower ranges of the western Himalayas. I obtained, in October 1865, several specimens above Belaspoor, but have never seen it much further in the interior.

82. Cryptolopha cinereocapilla, *Vieil.*, (I. 455). The bill is in young specimens much shorter and comparatively broader at the base than it is in old ones. The species does not go eastwards beyond the more wooded parts of the valley near the Wangtu-bridge, and hardly ever ascends to greater heights than 8000 feet; it is, however, most common at Kotegurh between 5000 and 6000 feet, and at similar elevations all over the lower, outer ranges of the N. W. Himalaya.

83. Hemichelidon fuliginosum, *Hodgs.*, (I. 438). The old male is above olivaceous ashy, the feathers on the head being broadly centred dusky; the wings and tail are darker, the middle portions of the inner webs of all the wing-feathers forming a large fulvous brown spot which is specially conspicuous when the bird is on the wing. Some feathers on the front of the head, above the nostrils, the lores, and partly the eyelids are white; the front edges of the wings, chin and throat are also albescent, passing on the breast into ashy grey, and on the vent, especially on the under-tail coverts, again into white.

The old female is almost exactly like the male; the white above the nostrils, on the chin and on the interior edges of the wings being, however, somewhat rufescent; the tertiaries and the longer wing coverts are usually also externally margined and tipped with fulvous or rufescent. The female generally appears to be somewhat larger than the male.

The young bird has the plumage above much darker, sometimes rather black or deep brown; all the feathers above and on the scapulars are centrally streaked whitish or pale fulvous, the streaks varying in breadth in different specimens, being however always conspicuous towards the tips. The wing coverts, tertiaries and, towards their terminations, partly also the secondaries are more or less broadly margined with ferruginous, the entire tips of the tail feathers being

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usually of the same colour. Below, the plumage is albescent, more or less gray, the feathers on the breast being edged with dusky. The change of plumage is very remarkable; there are scarcely two specimens to be met with which exactly agree in colouring.

It is very probable, that the young birds of this species assume their full plumage only after the second year. In the first, the pale streaks on the upper plumage seem to be large and of a more fulvous colour, the breast more dusky; in the second year the streaks are narrow, pale white, and the plumage below more albescent. Although I have no direct observations on this point, I think it probable from the fact that I obtained, far in the interior, birds of this last colouring in May, and those of the first description not before the end of June and then only on the lower elevations of the outer ranges; in the interior not before July.

The species is very common between 4,000 and 11,000 feet, at which elevations I often found it in the neighbourhood of Chini. It is not only seen on low branches, but very often on a dry perch near or on the top of a tree (especially of the oak), constantly dashing after insects and returning again to the same point. In 1865 I procured a specimen in Lahul, on the southern side of the Baralatse pass at an elevation of more than 13,000 feet, but I do not remember having seen it anywhere in W. Tibet, though it may occur. It is also rare in all the more western parts of the Himalayas, in Chamba, Kishtwar and Kashmir, while it appears to be frequently met with on the eastern ranges, towards Nepal.

84. Eumyias melanops, *Vig.*, (I. 463), is only a summer visitant to the hills; it breeds about Kotegurh, but does not go eastwards of the Nachar forests. Compared with other allied species it is considered to be rather a rare bird.

85. Cyornis ruficauda, *Swains.*, (I. 468). The lores and eyelids are whitish; wing feathers ashy brown, pale rufous on the edges of the inner webs and olivaceous on the outer edges. The rump is only slightly, the upper tail coverts bright ferruginous, and the tail somewhat darker.

Male and female do not seem to differ in colouring, except that the breast is somewhat more albescent in the latter.

In the young bird all the feathers above are more or less whitish, or

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fulvous on the central tips; the same pale colour also have all the outer edgings of the wing feathers, the tips of the tertiaries and the wing coverts, the latter being somewhat rufous. Below, the white is dashed all over with dusky, the feathers being edged dark; tail rufous, as in the old bird. This kind of spotted colouring of the young birds is characteristic for nearly all MUSCICAPIDÆ.

I found this species abundant among the apricot trees near Chini and Pangi, in Kunawar, between 9,000 and 10,000 feet. The young birds were full grown at the beginning of August. In habits it resembles other fly-catchers, generally sitting on a low branch of a tree and occasionally darting after the passing insects. I have never seen it ascending very high in the air, as for instance *Hem. fuliginosum* usually does. It is very probable that the species is also found further to the east, in Tibet, returning during the winter to the low hills or to the plains. The only other place, where I procured on the 15th June, 1865, a specimen of it, was at Kangsar in North Lahul, at an elevation of 11,000 feet.

The species, which Dr. Jerdon (loc. cit. p. 468) mentions under the name of *Musc. rubecula*, Swains., as being probably identical with *C. ruficauda* must be altogether a different bird; for among a number of more than 20 specimens of *C. ruficauda*, of both sexes and of young birds, there is not one which has a trace of orange on the throat and breast, or any blue colouring above. On account of the want of the last colour, this species may be considered as rather an abnormal form of the genus, identicating moreover a peculiar type of MUSCICAPIDÆ.

86. MUSCICAPULA SUPERCILIARIS, *Jerd.*, (I. 470).

Old male; above the sides of the head and of the breast are Prussian blue, brighter on the head; the feathers on the rump are on the basal half grey, then white and tipped blue: the shafts of the same are white, while those of the back and head are grey. Wings and tail are blackish, the feathers externally edged blue; tail-feathers white on their basal half, except the two central ones which are in their entire length black. A white superciliar strip extends towards the nape; lores deep bluish black; moustaches black; front edges of the wings and the inner margins of their feathers more or less albescent. Below, on the chin, throat, middle of breast, belly and lower tail-coverts pure white;

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the feathers being dark slaty on their basal half, except those on the chin and throat, which are entirely white.

In the *old female* all the blue of the male is ashy grey, with an olivaceous tinge, with a little blue on the head, back and especially on the upper tail-coverts, and occasionally also on the edges of the outer webs of the wing and tail feathers; both the latter are dusky brown, the tail having no white at the base; a very indistinct pale superciliar stripe is present; lores whitish; the front-head above the nostrils and partially the cheeks have a distinct rufous tinge. The white below is less pure, than in the male, and somewhat fulvous, especially on the chin and on the throat; the sides of the breast are pale grey.

Bill and legs black in both male and female.

The *young male* is above blackish brown, with more or less numerous, pale fulvous, triangular spots, with which all the feathers are centred towards the black tips. The external margins of the wing-coverts and the tertiaries are also pale; the tail is white on the basal half as in the old male. Below, the plumage on the chin and throat is pale fulvous, the front of the breast down towards the vent spotted, all the feathers being margined and tipped with dusky; purer white only on the under tailcoverts. The change of the plumage begins about the end of July or in August. The fulvous spots disappear and the young male is coloured, like the old female, but with much more blue above, especially on the back, on the scapulars, on the rump and on the head; the nape and the lateral spots on the breast remaining grey or somewhat olivaceous. In this state I found the young males retiring from the interior hills to the plains, or at least to the lower hills, but I have not been able to ascertain whether they do or not obtain their full colouring before the next spring.

The *young female* in every respect resembles the young male, except that the general colour above is more grey and less dark, the lateral spots on the breast being very indistinct; the tail has no white at the base, as likewise in the old female.

This species is one of the most common birds in the Sutlej valley and is seen all the way from Belaspoor to Pangi; I found it in general, in the N. W. Himalaya, ascending elevations up to 12,000 feet. About Kishtwar, it is still not uncommon, but it is rarer in the Sind-valley of Kashmir, being also occasionally met

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with in the neighbouring districts of little Tibet. I observed it between Dras and the Zoiji pass.

Blyth (Ibis 1866, p. 372) mentions, besides *M. æstigma*, two other allied species, *M. ciliaris* and *leucoshista*, as having been figured by Hodgson. None of these have been seen by me in the interior of the N. W. Himalayas.

87. Siphia strophiata, *Hodgs.*, (I. 479). The basal white on the outer tail feathers is decreasing (not *increasing*, as stated by Jerdon) in extent towards the outermost feathers. This species must in summer inhabit the more eastern regions of Tibet, near the sources of the Sutlej, for it only comes in winter to Kotegurh, and even then is rather rare. I noticed it also repeatedly in Rupshu and on the Indus. It appears to be more common in the eastern Himalayas.

88. Siphia (Erithrosterna) leucomelanura, *Hodgs.* (I. 479). I have met this species only twice, having procured a male near Kotegurh in September 1866, and in the next month a female specimen near Mahasu, N. East of Simla. It appears to be a very rare bird. The male has the breast light grey, but scarcely with any purplish tinge. The female resembles that of *Musc. superciliaris*, being olivaceous brown above and dusky on the inner webs of the wing-feathers; tail ferruginous, especially at the base; chin, throat and vent white, breast and part of abdomen pale olivaceous brown, especially on the sides; under tail-coverts slightly ferruginous.

The bill is much more feeble at the tip, than in typical *Siphia* and, if the distinctions of *Nitidula* and *Erythrosterna* from *Muscicapula* are admitted, it would be more correct to place this species in the genus *Erythrosterna*.

89. Erythrosterna leucura, *Gmel.*, (I. 481); very rare about Kotegurh, but apparently more common to the west, for I have procured several specimens near Srinagur, in Kashmir.

XVIII. *Family, MERULIDÆ.*

90. Pnoepyga sqammata, *Gould*, (I. 488), very rare in the forests about Nachar and near Chini; it is found about Kotegurh in winter. Another species, somewhat alied to *P. longicaudata*, *Moore*, occurs in W. Tibet; it is of the same size as the former, but has the plumage below yellowish white or cinerous, (not ferruginous).

91. Troglodytes nipalensis, *Hodgs.*, (I. 491), very rare about Serahan and Nachar, more common in winter about Kotegurh.

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92. MYIOPHONUS TEMMINCKII, *Vig.*, (I. 500), is usually known under the name of black-bird; very common all through the N. W. Himalayas and most probably also to be found in Central Asia. It breeds at Chini and Sungnum on an elevation of between 9 and 11,000 feet.

93. HYDROBATA ASIATICA, *Swains.*, (I. 506)), occurs all through the valley, but is not usually found beyond the limit of the forests.

94. HYDROBATA CASHMIRENSIS, *Gould*, (I. 507). I have only seen one specimen of this species on a small mountain stream between Chini and Sungnum, it is however more common in W. Tibet and in northern Kashmir.

95. HYDROBATA? SP. I have obtained through my shikarees a specimen of an apparently new species of *Hydrobata*, which was shot on the Sutlej river below Kotegurh at the beginning of March 1867. The following is a short description. Entire plumage light ashy grey, spotted with dull white, more white below, the white spots very large on the belly and breast; chin and throat yellowish white, each feather tipped dusky; wing and tail blackish, all the feathers narrowly margined with white; bill and legs pale or whitish brown. Length of wing 3¼ inch., tail very nearly two inches; bill only ⅝ of an inch long. The spotted plumage makes it probable that this species only is a young bird of some other known form, but this I am for the present unable to trace out. The young of *H. asiatica*, which is the only species common in the lower hills, has the throat and the front of the breast perfectly white, thus differing from our bird. The species might belong to *H. Cashmirensis*, but for this it is rather too small. Further materials only can settle this point.

The bill of *Hydrobata* much more resembles that of the MOTACILLIDÆ than to that of the MERULIDÆ; Bonaparte's classification of *Hydrobata*, in the neighbourhood of *Enicurus*, *Motacilla* a. oth., seems to be, therefore, a more natural one; the habits of these birds are also in favour of this classification.

96. ZOOTHERA MONTICOLA, *Vig.* (I. 509).

A single specimen of this species was procured near Kotegurh in February 1867. The general colouring of the bird certainly recalls that of many other *Merulinæ*, but the bill is somewhat similarly formed to that of *Pomatorhinus*. Head and nape are dark olivaceous brown, the

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feathers on the top of the head being centrally streaked pale brown; back, rump and scapulars blackish ashy, the feathers somewhat more ashy near the tips which are black; wings dusky brown, with a rufous tinge on the outerwebs; most of the longer wing coverts are centrally tipped pale brown; tail dusky brown, obsoletely barred on the outer webs, the outermost pair is paler than the rest; sides of neck olive brown, the feathers with pale brown spots and blackish tips; a short black streak extends down from the base of the lower mandible; chin and throat yellowish white, each feather tipped dusky; the feathers on the breast are olivaceous brown with black tips, some of them on the sides with pale spots; centre of the abdomen and vent white, the feathers tipped black; sides of vent rather uniform dusky, lower tailcoverts ashy, tipped with white.

97. Petrocossyphus cyaneus, *Lin.*, (I. 511), very common, extending all through the N. W. Himalayas, from the plains into W. Tibet; it also proceeds further to Central Asia and Siberia. The specimens from the lower hills occasionally have in summer some ferruginous colouring on the sides and the lower tail coverts, but those of W. Tibet have not a trace of it. They appear to be a little smaller than the European birds, but there is no real specific distinction between them. A specimen, shot in winter at Kotegurh, is entirely blue, with dusky wings and tail; it also has nowhere a trace of white or ferruginous. The plumage of the young bird, which in general resembles the female, exhibits variations quite similar to those known in the European species.

Of the second species of this genus *Pteroc. castaneocollis*,* *Less.* (I. 519), I obtained in the beginning of September 1865 a fine specimen north of Dras, in W. Tibet. It ought to occur in the Punjab during the winter. The colouring quite agrees with the description quoted by Dr. Jerdon.

98. Orocestes erythrogastra, *Vig.*, (I. 514) is only found in the lower hills about Simla and Kotegurh; but the next smaller species,

99. Orocestes cinclorhynchus, *Vig.*, (I. 515) goes further to

* I have since, in the Vienna Museum compared this with a young male of the European *H. saxatilis*, with which it perfectly agrees. The two species therefore very probably are identical, (Feb. 1868).

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East; it is common about Serahan and Nachar, but rare at Chini, and is not likely to be found to the east of the last cedar-forests.

100. Geocichla unicolor, *Tick.*, (I. 519) is rather rare in this part of the valley, but more common in Chamba, Kishtwar, Kashmir and even in little Tibet; it prefers wooded districts to rocky and bare places.

101. Turdulus Wardii, *Jerd.*, (I. 520), is not common in the lower hills. I have not seen it beyond Serahan, where once only, in August 1866, I met with three specimens; it is rarer in the N. W. Himalayas, than any of the other thrushes.

102. Merula boulboul, *Lath.*, (I. 525). The geographical range of this species is restricted to the lower hills about Simla and Kotegurh, it does not occur beyond Nachar, being far from a common bird, though found about Kotegurh the greater part of the winter.

103. Merula albocincta, *Royle*, (I. 526), common in winter about Simla and Kotegurh; its range in summer is between 8 and 12,000 feet.

104. Merula castanea, *Gould*, (I. 526), only arrives in winter at Kotegurh, and probably lives during the summer months in Central Asia and eastern Tibet, for I have not seen it about Chini or Sungnum, though it may occur in the highest forests, near the limit of trees.

105. Planesticus atrogularis, *Temm.*, (I. 529), is also, only a winter visitant to the neighbourhood of Kotegurh, but it is common at that time of the year.

Male; above earthy cinereous brown, most of the feathers on the front and top of the head, and sides of the neck centred dusky; wings and tail dusky, all feathers pale olivaceous on the edges of the outer webs; lores, sides of the head and of the lower neck, chin, throat and front of breast black, all feathers slightly tipped whitish; the rest of the plumage below white, ashy on the sides; inner wing coverts pale ferruginous; lower tail coverts mostly white, some of the longer ones broadly margined, but not tipped, with dark rufous brown. Bill light brown, yellowish at the base.

Female; above like the male, less dusky on the top of the head; lores blackish; sides of head ashy; chin and throat white with longitudinal brown streaks, especially on the sides; breast cinereous olive, each feather with a large triangular brown spot near the tip, which is white,

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sides ashy with dusky quills, vent and lower tail coverts mostly white, the latter somewhat rufous or dusky brown, as in the male.

106. TURDUS HODGSONI, *Lafr.*, (I. 531), is common all through the hills adjoining the Sutlej valley; it breeds about Chini and in Lahul. The young bird, and probably also the female, has the feathers above centrally streaked pale fulvous, and on the back tipped dark brown. The plumage below is very rarely ferruginous, but often fulvous; sometimes almost pure white. The size and number of the cordate, brown spots is very variable and scarcely in two specimens exactly the same. Sometimes they are very large and less numerous, not extending to the throat; in other specimens they are much smaller and conspicuous on all the feathers of the lower plumage. The size of the bird itself varies from 10 to 11½ inches. Its voice is exactly the same as that of the European *T. viscivorus*,* from which after all it may not be specifically distinct. It often feeds on the ground upon insects and berries, but is almost as often seen on trees.

107. OREOCINCLA MOLLISSIMA, Blyth, (I. 533), is chiefly confined to the lower hills, not usually exceeding elevations of 6,000 feet; it is not so common in the eastern parts of the Sutlej valley beyond Kotegurh, as it is more to west, in Chamba and in the eastern parts of Kashmir.

108. GRAMMATOPTILA STRIATA, *Vig.*, (II. 11), is only a winter visitant to Kotegurh, but then rather numerous. It must during the summer inhabit the higher forests along the central snowy range of the Himalayas, in North Kulu or in Kunawar, though I never met with it myself during the summer months in this portion of the hills.

109. PYCTORHIS SINENSIS, *Gmel.*, (II. 18), is confined to the lower hills only, being common about Belaspoor, but it is seldom seen even as far east as Kotegurh.

110. STACHYRIS PYRRHOPS, *Hodgs.*, (II. 21). All the feathers on the head have a pale rufous tinge, those next of the black throat have the quills also black; the quills of the rest of the lower plumage are pale rufescent, and of the upper olivaceous, similar to the general colouring of the bird; the back and abdomen have a prominent greenish tinge; the middle tail feathers are obscurely barred across, and much paler brown below, than above.

* The European species is in general smaller than the Himalayan one, which has the throat hardly streaked and of yellowish colour.

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This is comparatively a rare bird, though occurring all through the N. W. Himalayas, chiefly on elevations between 4 and 7,000 feet; it resembles in its habits to a tit, principally frequenting brushwood and low forests, where it eagerly searches after insects. In the Sutlej valley it is not found beyond the Wangtu bridge, breeding near Kotegurh, Jaora and Serahan, on heights of 5 to 7,000 feet.

111. POMATORHINUS ERYTHROGENYS, *Gould*, (II. 31). Old birds usually have a short blackish stripe extending backwards from the lower mandible; in young birds this stripe is rusty, as likewise the sides of the neck and of the breast. The inner webs of the wings are ashy brown, the outer olivaceous, of the same colour as the body and the tail; wings and tail are obsoletely barred with dark, cross lines.

Not common in the forests and thick brushwoods between Kotegurh and Nachar; it remains during the winter in the neighbourhood of Simla and Kotegurh.

112. GARRULAX ALBOGULARIS, *Gould*, (II. 38). The lateral tail feathers are barred with dusky cross lines, the tips are white; this species in summer retires to the denser forests beyond Kotegurh, but it is more common in winter about this station.

113. TROCHALOPTERON ERYTHROCEPHALUM, *Vig.*, (II. 43). The outer webs of all the wing feathers are bright greenish yellow, with a ferruginous tinge; the inner webs are blackish, paling on the margins; the tertiaries are broadly tipped ashy; all the tail feathers have a yellowish green tinge, being on the outer edges brighter towards the base; upper and lower tail coverts are ashy and somewhat olivaceous. The black spots are occasionally almost wanting on the middle of the breast. The male has the black on the throat purer, the chesnut of the head somewhat darker and the greenish yellow edgings of the wings tinged with more rufous; in other respects of colouring both sexes are identical. The young bird is above and below on the neck, back, breast, vent, upper and lower tail and the thigh-coverts uniformly light rufous brown, without any black spots; otherwise it is coloured like the old bird.

114. TROCHALOPTERON VARIEGATUM, *Vig.*, (II. 45), is common at all seasons in the higher regions of the N. W. Himalayas, and seldom descends lower than 5,000 feet. Females which I procured, in June 1865, in Lahul, have the outer webs of the wing coverts

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ashy grey, with a very slight tinge of yellow, but having distinct traces of this colour on the outer tail feathers. The male has a little more yellowish rufous colouring on the wings, and the black central spot somewhat smaller.

Other male specimens, shot near Kotegurh early in the spring, have the outer edgings of the wing feathers (except towards their terminations) bright rufous, as likewise the basal portions of the outer webs of the outer tail feathers. In the females from the same locality, the edgings of the wings and of the tail are more yellowish, and the central, black wing spot much smaller. All the specimens from Kotegurh have the upper plumage distinctly olivaceous, especially on the back, while the Lahul specimens are more ashy. The longer wing coverts are always more or less chestnut and all the tail feathers are broadly tipped white, or sometimes in the male a little rufous.

The voice of this species is a prolonged, monotonous whistle, being constantly repeated; during the winter it lives, I am told, partly on insects, searching carefully after them in the hollows of willow-trees, &c. partly on buds of different shrubs. This and the next species belong to the few* birds which remain in Lahul during the winter.

115. Trochalopteron lineatum, *Vig.*, (II. 50), is one of the most common species of birds all through the N. W. Himalayas. It is found from the low hills, near the plains, through the entire extent of the Sutlej valley up to Sungnum, and very probably farther eastwards. It is not usually a migratory bird, for it remains at Kotegurh, in Kulu, and even in Lahul, all the year round, feeding on insects or buds, like the previous species. The specimens, which I procured in Lahul, were somewhat more ashy on the head and breast, and the central edgings of the outer webs of the wing feathers were less yellowish rufous, while they are generally conspicuously so in specimens shot in the lower hills. There is scarcely any difference in the brightness of the colours between male and female.

116. Sibia capistrata, *Vig.*, (II. 54). The shorter wing-coverts of the quills are black; of the longer coverts the first are black, the next white for the basal half, the rest grey on the outer, and black on the inner webs; the last coverts are also white, with ashy and rufous tips.

* Only about a dozen species.

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The quills are distinctly insinuated towards the tips, which are mostly grey, the rest of the quills being black, but paling towards the margins of the inner webs; the secondaries are dull black, some of the last ones ashy on the outer webs, especially towards the tips, only the central margins of the outer webs being shining black; the tertiaries are rufous with pale quills, ashy on the outer, and blackish on the inner margins. The black feathers of the head are somewhat paler in front, and have the shafts white for the basal half.

Rare about Kotegurh between 5 and 7,000 feet, chiefly frequenting brushwood and low forests; generally feeding on insects.

117. Chatarrhæa caudata, *D u m.*, (II. 67), is often seen in the low hills to the north of Belaspoor, but does not go any considerable distance in the interior.

XIX. *Fam. BRACHIPODIDÆ.*

118. Hypsipetes psaroides, *V i g.*, (II. 77). Only the greater portion of the outer webs of the wing-feathers are ashy, the inner webs are brownish black, like the tail, the outermost feathers of which are externally and near the base also tinged with ashy. Common in the forests between Kotegurh and Nachar, ascending elevations ud to 9,000 feet, though generally to be seen between 6,000 and 7,000 feet.

Sibia is very closely allied to this genus, and the species very much resemble each other in their habits; it ought to be placed in this family.

119. Otocompsa leucogenys, *G r a y*, (II. 90) is found all through the lower forests of the Sutlej valley, and is occasionally seen as far east as Chini; but in the low hills it seems to be replaced by the next species, the common Bengal bulbul,

120. Pycnonotus pygæus, *H o d g s.*, (II. 93), which does not penetrate to the interior of the hills, and is rare even in the neighbourhood of Kotegurh.

Several other species of this family are also found near the plains, but very few extend to the interior of the hills. I may mention

121. Oriolus kundoo,* *S y k e s*, (II. 107) and

122. Oriolus melanocephalus, *L i n.*, (II. 110); both are occasionally seen between Kotegurh and Rampoor and in the Kulu valley,

* Ibis, 1867, p. 10, Blyth says it only differs from *O. galbula* by its larger and differently shaped bill, and in having some black feathers posterior to the eye. (Feb. 1868).

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but generally only between 4 and 5,000 feet; the former has been seen solitary at Gaora up to 9,000 feet, and is common in Kashmir. I also received a specimen of

123. Oriolus Traillii, *Vig.*, (II. 112), from near Kotegurh, but have not myself observed this species.

XX. *Fam. SYLVIIDÆ.*

124. Copsychus saularis, *Linn.*, (II. 114), is common in the lower hills about Belaspoor, also in Chamba and in Kulu, but is very rarely met in the Sutlej valley, even about Kotegurh, or farther to east of this station.

125. Thamnobia Cambaiensis, *Lath.*, (II. 122).

The *male* has the lower plumage shining bluish black, the tail is darker than the wings, being more brown, and the feathers of the former are obsoletely barred with dull cross lines; the edges of the outer webs of most of the tail and also of the wing-feathers have a metallic lustre.

Female; wings and tail are darker brown than the upper plumage, the lower being light brown, much paler on the throat and on the sides of the neck, the ear coverts being generally somewhat rufous.

This robin is also much more common in the more western portion of the hills and in Kulu than it is in the Sutlej valley, except in the autumn, when it descends to the lower hills near Belaspoor; it chiefly frequents bushes and low woods, feeding on insects, for which it generally searches on the ground in the neighbourhood of streams.

126. Patrincola caprata, *Linn.* (II. 123). The female is in summer plumage uniformly brown, paler or sooty brown below, albescent on the throat and on the lores, rufescent towards the vent; the lower tail coverts being almost white, the upper rufous; there are also usually some traces of white on the uppermost wing coverts, &c.

Common all through the Sutlej valley up to Nachar, but seldom farther to east above elevations of 8,000 feet.

127. Patrincola indica, *Blyth*, (II. 124); the winter plumage is much softer and is assumed about October, before the birds retire to the plains. The species occurs with the former, and generally agrees with it in habits. Young birds are extremely variable in colouring.

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128. PATRINCOLA FERREA, *Hodgs.* (II. 127).

Old male; the ashy above is sometimes quite uniform, without any black streaks; below the white is either pure or somewhat ashy on the breast, very rarely is there any rufescent tinge traceable.

In the *old female* all the brown plumage above is edged paler; there is scarcely a trace of a white wing spot; the tail feathers are on their outer webs mostly ferruginous; the lower plumage is albescent, with a slight rufous tint, pure white on the chin and the throat.

The *young male* has all the feathers above dark blackish brown, with pale brown or fulvous central streaks, the wing coverts and tertiaries broadly edged and tipped with the same colour, more ferruginous on the back and upper tail coverts; below whitish, dashed all over with dusky, purer white on the throat and towards the lower tail-coverts; tail black as in the old male, but the white on the outer webs passes towards the tips into pale rufescent.

The *young female* is like the young male, the general plumage is only somewhat more brown, and all the pale and white streaks or edgings are much more rufous and almost purely ferruginous on the upper tail coverts and on the tail; below whitish on the throat, the rest of the plumage with a distinct ferruginous tint.

The young birds appear to assume the plumage of the old ones before they retire to the plains, for I found them changing the same already towards the end of August.

Common with the previous species, and usually seen about Chini, where it also breeds.

The form of the beak of *Patrincola* is more like that of *Siphia* or *Erythrosterna* than that of any species of the SYLVIIDÆ, and in their habits they much more resemble the previous birds. The place assigned to *Patrincola* in this family does not, therefore, appear to be quite a natural one.

129. SAXICOLA LEUCUROIDES, *Guerin,* (II. 130), and

130. SAXICOLA PICATA, *Gould,* (*Blyth,* II. 131), have been observed towards the end of October in the lower hills about Belaspoor, Simla and Kotegurh.

131. SAXICOLA OENANTHE, *Linn,* (II. 132), generally retires also during the winter to the plains. The only species which occasionally, during the cold weather, remains in the Kulu valley and near Kotegurh is the next one,

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132. Saxicola deserti, *Rüpp.*, (II. 132). The middle portions of all the wing feathers, except the one or two last tertiaries, are white, becoming purer towards the secondaries; back and scapulars are more or less pale white, often with a rufous tinge; the longer feathers of the upper tail coverts are also somewhat rufous. All the black on the throat, sides, neck, the wings and the tail, is pure in summer, but rather brownish in winter.

In the *female* the head and the neck above are more uniform light brown, with a slight ashy tint; back less rufous, wings and tail of the same brown colour as has the male in winter; below uniform pale brown, albescent on the throat and vent, with no black whatever.

This species is one of the most common birds all through western Tibet; it migrates to the plains of Northern India in winter.

A large number of species of Ruticillinæ inhabits W. Tibet and Central Asia during the summer. I may mention *R. phœnicura, Linn.*, *R. rufiventris, Vieil.*, *R. erythrogastra, Güldenst*, and others. All these species migrate in winter to the plains, but their stay in the Sutlej valley must be a very short one. I defer any remarks on these species, as I hope to make farther additions to my materials on the Tibetan fauna, and publish the results separately. The only species which is found common in the eastern parts of the Sutlej valley, though generally only on the Tibetan side of the Central Himalayan range, is

133. Ruticilla cæruleocephala, *Vig.* (II. 141).

In *old males* the white edgings of the secondaries are soon worn off and disappear; a white wing patch is chiefly formed by a portion of the scapulars and the posterior wing coverts. The margins of the inner webs of all the wing feathers are pale, purer towards the tertiaries.

Dr. *Jerdon* supposes, that the *female** is coloured similarly to the male, which is not exactly the case, so far at least as the summer plumage is concerned. *Old females*, shot about the end of July 1866, are above uniformly light brown with a slight olivaceous tinge, the feathers on the head are centrally streaked dusky; the posterior part of the rump and especially the upper tail-coverts are ferruginous, wings and tail dusky brown, the feathers of the former externally edged pale, the outer tail-feathers margined rufous on their basal half; the wing coverts are edged and tipped whitish. Below

* See also Blyth in Ibis, 1867, p. 15.

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much paler brown, albescent towards the vent and lower tail coverts which are white with brownish quills; thigh coverts brown. Bill and legs black, the latter irid dark brown.

The *young bird* has the general brownish colour of the female, but is above and below spotted with whitish, each of the feathers being centrally on the terminal half white, the tip itself, however, blackish; upper tail coverts ferruginous, less in the male, a little more distinct in the young female. The young male has the wings and tail blackish brown, the wing coverts broadly tipped and the tertiaries, margined with pale white; towards the tips a little rufescent. In the young female, the wings and tail are rather sooty brown, and all the edgings have a distinct ferruginous tint. Bill and legs blackish brown in young males, and light brown in young females.

This species occurs plentifully, beyond Pangi and about Chini, generally on small streams, it also breeds here; it is also common in Spiti, Lahul and southern Karnag, wherever any brushwood exists.

134. Chæmorrornis (Ruticilla) fuliginosa, *Vig.* (I. 142). This species ought to be placed in *Chæmorrornis* and not in *Ruticilla*, the beak being towards the tip much stouter and more evenly curved in the previous genus, while in *Ruticilla* it is more straight and slender. In habits the present species also perfectly resembles the next one, both being generally found near the rapids or waterfalls of mountain streams. *Old males* are occasionally seen with a few feathers of pure white on the top of the head, and thus likewise recalling the characteristic colouring on the head of *Chæm. leucocephala, Vig.* In the *old female* only the tips of most of the wing coverts are usually white; the primaries are externally edged pale, round the bill the white has a distinct rufous tint; the outer tail feathers are white nearly up to the tip, it being grey, this colour gradually increasing until the central feathers become nearly wholly grey, except at the base which always remains white.

The *young bird* resembles the female in the general ashy colouring, the plumage is spotted, the white spots below being however larger, and the feathers centrally, towards the tips, streaked white; the tertiaries and most of the longer wing coverts are tipped with rufous, which is specially distinct on the external margins. In

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the *young male* all the edges on the outer webs of the wing feathers are bluish, the general colour is dark ashy brown; the tail often has the white on the base ferruginous, which is in the *young female* rather mixed with dusky, the general colouring of the plumage above being greyish brown, and the external edges of the wings slightly ferruginous, not bluish. *Young males*, shot in November, very closely resembled the old ones, except that the general dark cyaneous colouring and the ferruginous on the tail were not equally pure.

Very common all through the Sutlej valley from about 3,000 feet up to 13,000 feet; it is plentiful about Chini and can be seen almost in every ravine. I found it, as also *Rut. rufiventris*, breeding near Losar in the Spiti valley on an elevation of 13,000 feet. It lives here during the summer, but migrates to the lower hills about October, when the young birds are full grown.

135. Chæmorrornis leucocephala, *Vig.* (II. 143). The *female* is duller black, than the male, especially on the rump and belly, the black feathers only being tipped pale rufous; the posterior vent and the tail-coverts are pale ferruginous; tail itself chesnut; in all other respects of colouring, male and female are similar.

Common all through the N. W. Himalayas, extending from the lower wooded ranges far into Tibet and probably into Central Asia. When I crossed the Lanier pass (somewhat above 20,000 feet) in Rupshu, the only bird, besides *Otocornis penicillata*, which I have seen the next morning upon an elevation of about 17,500 feet, was this species. I have observed several specimens, but it is not likely, that they were breeding, for the temperature certainly must fall here to, or below the freezing point of water, every night all through the year. During the cold weather, the species migrates partially to the low Himalayan ranges, partially to the plains of Northern India.

136. Larvivora cyana, *Hodgs.* (II. 145), is a rare bird in the Sutlej valley and does not go eastwards beyond Nachar. It chiefly frequents low woods between 4 and 7,000 feet. The general colouring very much recalls that of *Sitta Himalayana.*

137. Janthia cyanura, *Pallas* (II. 146). The *female* has (in winter plumage) a narrow superciliar stripe; the external edges of all the wing feathers are of a similar pale greenish, or olive brown colour as is likewise the upper plumage of the head, the scapulars and the

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back. This species does not occur in summer to the west of Nachar and not below 8,000 feet. It breeds near Chini and even here almost only near the limit of trees at about 12,000 feet. It is often seen about 'Korzog in Rupshu, on an elevation of between 15 and 16,000 feet. During the cold weather, it is tolerably common about Kotegurh and occasionally also about Simla.

138. TARSIGER CHRYSÆUS, *Hodgs.* (II. 149). Only one specimen was procured in winter at Kotegurh, it is a female and somewhat smaller, than the measurement given by Dr. Jerdon, the wing being only 2⅜ inches and the tail hardly 2 inches; I have never met the species on my summer visits to the Sutlej valley, or in W. Tibet.

139. CALLIOPE PECTORALIS, *Gould* (II. 150). The *young bird* is above dark drown, the feathers being centrally streaked pale yellow; wings brown, wing coverts tipped and edged externally with slight rufescent, upper tail coverts with a ferruginous tint; tail brown, except on the four central feathers, being white at the base and tipped whitish or pale rufescent; superciliar stripe pale, scarcely traceable; below dull white, all the feathers on the chin, throat and the breast margined dusky.

Rare in the eastern parts of the valley, generally frequenting brushwoods; migrates to Tibet and Central Asia during the summer.

140. CYANECULA SUECICA, *Linn.* (II. 152), is not very rare about the end of October in the lower and western parts of the valley. I found it breeding in little Tibet, where it appears to be common during the hot season. The *young birds* are almost identical in colouring with those of *Calliope pectoralis*, except that the ferruginous on the base of the tail and the whitish tips of the last species are wanting.

As there are in the interior of the hills no extensive grassy places or swamps along the Sutlej, representatives of the sub-families CALAMOHERPINÆ and DRYMOICINÆ are consequently very rare, and only of the latter sub-family the next species,

141. SUYA CRINIGER, *Hodgs.* (II. 183), is rather a common bird, being found on grassy slopes all through the lower ranges of the hills, but it does not go very far into the interior.

The wide separation of *Eurycercus* (*Laticilla*, Blyth) from these birds appears almost a too forcible one. PHYLLOSCOPINÆ are comparatively very numerous, but their determinations are in many

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respects still deficient and very difficult. In West Tibet I have procured several peculiar and apparently new species which no doubt visit northern India during the cold weather, but as they have not been yet obtained here, I intend to give of them a more detailed account at some future occasion. At the present I shall only mention a few of the better known species.

142. NEORNIS FLAVOLIVACEA, *Hodgs.* (II. 188); rare about Nachar and Chini between 6 and 10,000 feet; at the latter locality I generally found it between apricot trees. *Jerdon* (III. 872) quotes *Blyth's* supposition as to the identity of this species with *Horornis fuliginiventer*,* *Hodgs.*

143. PHYLLOSCOPUS TROCHILUS, *Linn.* (II. 192), is common all through the Sutlej valley, between elevations of 5 and 11,000 feet; it breeds near Chini.

144. PHYLLOSCOPUS VIRIDANUS, *Blyth*, (II. 193) and

145. PHYLLOSCOPUS AFFINIS, *Tick.* (II. 194), are comparatively rare, but both of them are during the summer more common in W. and central Tibet. The latter species is exceedingly like the European *Ph. sibilatrix* and perhaps identical with it.

146. PHYLLOSCOPUS? sp. I procured one specimen of an apparently new species near Nachar; it is not in very good preservation, but the attention of any future traveller may be directed to it by the following short description.

Above uniform olivaceous brown with a slight rufous tint, especially on the back and on the outer webs of the wing feathers; wings and tail dusky; below albescent, purer on the chin and throat, towards the lower tail coverts with a gradually increasing rufous tinge; lores dusky, supercilium pale-whitish, front edges of wings and lower wing coverts white, with a slight yellow tint; wings 2¼ inch; tail 1⅞ inch. In general colouring, this species resembles *Phyllopneuste rama*,† *Sykes*, but it is decidedly smaller.

147. REGULOIDES OCCIPITALIS, *Jerd.*, (II. 196), rare about Chini.

148. REGUL. TROCHILOIDES, *Sund.*, (II. 196) is common all through the valley from Koteguth to Chini, where it breeds between 9,000 and 10,000 feet.

* Vide Ibis, 1867, pp. 21-22.
† See Ibis, 1867, p. 24.

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149. Regul. proregulus, *Pall.*, (II. 197); *Regul. chloronotus Hodgs.* (III. 873) is not very rare about Chini, where it breeds. I met with young birds in the beginning of August.

150. Culicipeta Burkii, *Burt.*, (II. 199), not common in the lower hills between Simla and Nachar, but I have not seen it further to east nor on elevations exceeding 8,000 feet.

151. Abrornis xanthoschistos, *Hodgs.*, (II. 202), is the only common species of this genus found on elevations between 3,000 and 9,000 feet; it also occurs in eastern Kashmir, especially near Kishtwar.

152. Regulus Himalayensis,* *Blyth*, (II. 206).

The black streak on either side of the crest is very distinct in winter. The lores, and a streak passing above the upper mandible and connecting both eyes is almost purely white; the tertiaries are tipped pale.

I procured this species only through my shikaries at Kotegurh, the specimens were shot early in the spring and in winter; I met with it, however, during the summer in the Indus valley of W. Tibet; it breeds no doubt here as well as in other parts of Central Asia.

The female has the top of the head uniform pale yellow without any flame colour.

153. Henicurus maculatus, *Vig.*, (II. 212). The young bird has the head, neck, back, scapulars, throat and breast sooty brown, the feathers on the throat and breast centrally streaked paler; abdomen, wings, belly and tail as in the old bird; the former does not assume its full plumage till the next spring or very late in the season; in some of the birds the white spots begin to shew themselves in October, but the feathers on the back want the pure black colour of the old bird. Common all through the valley on elevations from 5,000 to 12,000 feet, but does not go eastwards of the large forests, into the Tibetan climate proper.

154. Henicurus Scouleri,† *Vig.*, (II. 214), is more confined to the hills of the outer ranges, but not uncommonly seen up to 8,000 feet.

* Mr. v. *Poelzeln* of Vienna informs me, that he compared the Himalayan specimens with several European ones, and is unable to detect any sufficiently characteristic distinctions. Both may therefore be proved to be identical.

† *Hen. nigrifrons* is stated by *Blyth* to be a young specimen of this species Ibis, 1867, p. 29.

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I have already remarked, that *Hydrobata* would seem to be more correctly classed here, instead of in the family TURDIDÆ.

None of the true MOTACILLINÆ are, during the summer, very common in the Sutlej valley, for most of the species generally proceed further north and eastwards, into Tibet and Central Asia. I procured a few of them through my shikarees at Kotegurh in April and May, and others myself when travelling through the valley proceeding to or returning from Tibet. The most common species are :—

155. MOTACILLA MADERASPATANA, *Briss.*, (II. 217) being occasionally seen also in summer near Chini.

156. MOTACILLA PERSONATA, *Gould*, (III. 873, M. DUKHUNENSIS, *Sykes*, II. 218), is very rare in summer as likewise the two following ;—

157. COLABATES SULPHUREA, *Bechst.*, (II. 220) and

158. BUDYTES VIRIDIS, *Gmel.* (II. 222).

159. BUDYTES CITREOLOIDES, *Hodgs.*, (III. 873), is especially common beyond Chini, towards the Tibetan frontier, as also in Lahul and north of Kishtwar. *Budytes Rayi* of Europe occurs in Kashmir, but I have not met with it further eastwards.

160. NEMORICOLA INDICA, *Gmel.*, (II. 226), has been shot near Kotegurh in April, and I also obtained a specimen in August 1865 near Suroo in the Dras district, N. E. of Kashmir.*

The following species, including the so-called Pipits, do not seem to be naturally classed with the MOTACILLINÆ. The great differences which exists in the form of the bill, in the plumage, in their habits &c., would seem to justify the formation of a separate subfamily, being rather more allied to the ALAUDINÆ, than to the MOTACILLINÆ.

161. PIPASTES MACULATUS, *Hodgs.*, (III. 873,) I have only met with this species in the lower hills, but it breeds in W. Tibet. It was observed by me on one or two occasions in the Indus valley, W. of Lei, in company with the next one.

162. PIPASTES ARBOREUS, *Bech.*, (II. 229), not common in W. Tibet and Kashmir; about October it may be seen in the low hills near Kangra and Belaspoor. The following species,

163. CORYDALLA RICHARDI, *Vieill.*, (II. 231),

164. CORYDALLA RUFULA, *Vieill.*, (II. 232),

* Blyth (Ibis 1867, p. 31) says that it is also found near Pekin.

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165. Agrodoma sordida, *Rüp.*, (II. 236),

166. Anthus cervinus, *Pall.*, (II. 237),

167. Heterura sylvana, *Hodgs.*, (239) also occur during the summer months in the Sutlej valley, but they are generally confined to the lower western portions of it, and do not usually migrate further eastwards than Nachar. The elevations upon which they are found lie between 2,000 and 6,000 feet. In cases of the absence of grassy and shrubby slopes they are very seldom met with in the denser pine forests. The *Agrod. sordida* breeds at Kotegurh, and the *Het. sylvana* is occasionally seen near Chini, where it also breeds. It is the only species which is more common in the valley, and sometimes even remains during the winter in the neighbourhood of Kotegurh and Simla. All the other species migrate at the beginning of the cold weather to the plains of Northern India, or to the Dhoons of the Sub-Himalayan hills.

XXI. *Fam. AMPELLIDÆ.*

168. Pteruthius erythropterus, *Vig.*, (II. 245).

It almost appears to be a very unnatural separation to remove from each other the genera *Ptheruthius* and *Lanius*, under the last of which *P. erythropterus* has originally been described. The species seems to combine the characters of *Lanius* and *Tephrodornis*, possessing the shape of the bill of the former and the short tail of the latter.

Male ; some of the ashy feathers on the back are often tipped black; the primaries and secondaries and their coverts are shining black on the outer, dull black on the inner-webs; the quills, beginning at the third primary, are tipped white on the inner webs, the white increasing up to the sixth primary, then again decreasing, until it disappears on the last secondary; a white wing patch is formed by the basal half of the inner webs of all the secondaries and of the primaries, with the exception of the first primary. Below white, all the feathers dark slaty at their bases, abdomen of a light fleshy colour, under tail coverts pure white. The tips of the tail feathers are distinctly mucronate, and have sometimes traces of golden yellow.

The *female* has the tertiaries somewhat duller chesnut; only the two central tail feathers are wholly dingy green, the others mostly black, greenish on the outer webs and tipped yellow, which increases towards the outermost pair.

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This species is occasionally in the spring seen about Kotegurh, and as far east as Nachar, the highest elevations, at which I observed it near Serahan, lying between 9,000 and 10,000 feet; it is, however, always a rare bird in this portion of the hills.

169. ALLOTRIUS* SP., the following is a short description. Head slaty, rest of upper plumage greenish, wings dusky on the inner webs, coverts of the primaries black; lateral tail feathers pale on the outer webs, darker on the inner, tipped greenish white; chin, throat and breast greyish white, abdomen and vent light green, especially on the sides; length of wing 2½ inches; tail 2 inches.

The female seems only to differ by having the head above greenish grey, instead of pure slaty, and in having the coverts of the secondaries tipped pale yellow; the tail is greyish green, the outer feathers tipped dull whitish. Only three specimens were shot, in February 1867, in the southern part of Kulu.

170. SIVA STRIGULA, *Hodgs.* (II. 252). The yellow on the crest and below is paler in the female, than in the male; the back is somewhat ashy in the former, the black spot on the throat smaller and the central tail feathers more tipped yellow, while in the male the tail feathers are often nearly all black, being chesnut on the inner, basal half, *not outer* as stated by *Jerdon.*

The young bird scarcely differs from the old one, except that its plumage above, on the back, wings and on the tail is a little more ashy, the dusky spots on the throat being at the same time very small.

This species in summer frequents thick forests, between 6,000 to 9,000 feet, all along the elevated range from Simla to Nachar; it is in general rare and only in winter more common about Kotegurh.

171. PROPARUS (SIVA?) VINIPECTUS, *Hodgs.* (II. 257). The ear-coverts are darker brown than the head and nape; the white stripe, extending from the eye to the nape, is above bordered with some blackish feathers; lores black, back pale brown, rump and upper tail coverts lighter and rusty, longer wing coverts bright rusty. The upper mandible has a very small and shallow, but a traceable notch, the bill is, however, in every other respect exactly like in *Siva*, the

* This is *Allotrius xanthochlorus, Hodgs.* which *Jerdon* identifies with *A. melanotis*, the present species being, however, certainly a distinct bird. Gould's figure in "Birds of Asia" pt. VIII. is correct. *Allotrius* can only be considered as a subgeneric division of *Ptheruthius.*

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only difference from this genus probably consisting in the greater length of the hind claw, which is in reality almost a trifling distinction, when compared with other generic characters. The differences of *Proparus* from *Parus* are on the contrary much greater, because the bill is in the latter genus more distinctly conical and the nostrils covered, while in *Siva* or *Proparus* the bill is laterally rather compressed, lengthened, and the nostrils uncovered. With regard to this point as well as to the coloration of the wings, the habits, &c. there appears to be a marked relation of the species of *Siva* and *Proparus* to those of *Garrulax* and *Trochalopteron*. I only procured at the end of August 1866 two specimens of *Pro. vinipectus* at a height of 8,000 feet on the Matiana hill, beyond Simla; it appears to be very rare, and would seem chiefly to frequent in summer thick pine-forests, in company of *Siva strigula*.

172. Zosterops palpebrosus, *Temm.*, (II. 265) is very common all through the valley, as far as any rich arboreal vegetation exists; it ranges up to elevations of 12,000 feet, breeds about Chini, but retires to the plains in winter.

173. Sylviparus modestus, *Burt.* (II. 267). *Male* in summer above olive green, brighter on the abdomen, on the upper tail-coverts and on the forehead; the feathers on the head have black quills; an indistinct supercilium, round the eye and the ear-coverts are pale greenish yellow; on the lores and beneath the plumage is whitish, slightly tinged with greenish yellow, especially on the breast; wings and tail blackish, externally edged with yellowish green, which is brighter towards the tips of the secondaries, as also on all the coverts and on the front edges of the wings. Some of the last primaries and the secondaries are usually tipped white; the tail is emarginated in the middle and all the feathers are slightly mucronate.

The *female* has the forehead and the plumage below pale white.

The species is in summer common on the apricot trees about *Pangi* and *Chini*, but I have not noticed it any where else in the valley. It is said occasionally to remain at Kotegurh during the winter.

The bill of *Sylviparus* resembles in many respects that of *Carduelis*, and the feet are as stout as in *Munia*, the general coloration is that of *Zosterops*; thus the genus represents a remarkable transitional type.

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174. Cephalopyrus flammiceps, *Burt.*, (II. 267), is still rarer than the last species, and is to be found only between elevations of 3,000 and 7,000 feet; it does not go eastwards beyond Wangtu bridge.

Sub-family, PARINÆ.

175. Ægithaliscus erythrocephalus, *Vig.*, (II. 270).

176. Lophophanes melanolophus, *Vig.*, (II. 273).

177. Lohpophanes rufonuchalis, *Blyth*, (II. 274).

178. Parus monticulus, *Vig.*, (277).

179. Parus cinereus, *Vieil.*, (II. 278).

All these species, except the last one, are very common in the valley on elevations between 4,000 and 12,000 feet. The *Æ. erythrocephalus* is occasionally met with migrating from one elevated portion of the valley to a lower locality, and vice versa. I found the birds in large numbers moving about in the morning hours, generally associated with *Abrornis xanthoschistos*, *Muscicapula superciliaris*, *Sitta Himalayana*, and other species. The same observation I have made previously in Chamba and in other parts of the hills.

The species of *Lophophanes* prefer in summer higher situated pine and cedar-forests, while those of *Parus* are more commonly seen on the open places and on apricot trees in the gardens, &c. *P. cinereus* is by far not so common on this side of the snowy ranges, as it is in Kashmir and in little Tibet. It is the only species which goes farthest to north and extends into Tibet, although most of the others remain during the winter in the less frigid portions of the interior valleys, and only seldom migrate to the plains.

180. Machlolophus xanthogenys, *Vig.*, (II. 279), was only procured in winter at Kotegurh and appears to be even at this time of the year very rare. The yellow patches on the nape and the sides of the head are very pale in winter and there are occasionally even some whitish feathers on the top of the head. The coloration of this and the allied species is extremely like that of *P. monticulus*, and thus *Machlolophus* may properly be considered as a transitional form between *Lophophanes* and *Parus*.

Sub-family, ACCENTORINÆ.

181. Accentor altaicus, *Brandt*, (II. 287). The feathers on the head, nape and neck are centrally streaked dusky, those of the back and of the scapulars are centrally broadly tipped blackish brown,

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and of the same colour are the tertiaries, being margined with light rufous brown. A rather dark streak extends from the lores below the eye; the ear-coverts have a slight rufous tinge; the lower tail-coverts are dark brown, margined with pure white.

This species inhabits during the summer Tibet and Central Asia and comes in winter to the Sub-Himalayan ranges. The largest specimen, which was procured at Kotegurh last year in winter, measures 3⅞ inches on the wings, tail 2⅜ and the total length could not have been much under 7 inches, the specimen having thus fully the size of *A. nipalensis*, *Hodgs.*

182. ACCENTOR STROPHIATUS, *Hodgs.*, (II. 287). The general colour above is rather olivaceous brown, with a slight rufous tint on the back, wings and tail are dusky brown; the white tips on the wing coverts are sometimes scarcely traceable.

This species is likewise an inhabitant of Central Asia; I do not remember it even from W. Tibet, although it is probably to be found there, for it occasionally comes in winter to Kotegurh and to other Cis-Himalayan parts of the Sutlej valley.

183. ACCENTOR HUTTONI, *Moore*, (II. 288). The pale line extending downwards from the base of the lower mandible is sometimes very indistinct; the black on the throat is below occasionally margined with a whitish, pale line.

Only a winter visitant to the lower ranges of the N. W. Himalayas, and common at that season about Simla and Kotegurh.

184. ACCENTOR RUBECULOIDES, *Hodgs.* (II. 288). The general brown hue above is much paler in summer than in winter, but the ferruginous on the breast is brighter in summer.

This species is common in W. Tibet, of which it generally is a permanent inhabitant. It seems very rarely to visit the plains of Northern India, and even the lesser ranges of the N. W. Himalayas; only one specimen was shot near Rampoor during the winter of 1865-1866.

I have also procured in W. Tibet one apparently new species of *Accentor* and another probably belonging to the type of *Acc. modularis* which has been called *Tharrhaleus*, but I have not yet succeeded in obtaining them on this side of the Himalayas; they may, therefore, better be treated subsequently with the Tibetan fauna.

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XXII. *Family CORVIDÆ.*

185. CORVUS TIBETANUS, *Hodgs.*, (II. 294). This, so called, species is common in summer all through W. Tibet and only very few birds come down in winter to Kulu and the Sutlej valley, near Kotegurh, but it is said to be abundant at that season in the neighbourhood of Chini. Although generally supposed to be a good species* Dr. *Jerdon* includes it, and I believe very properly, in the list of the doubtful ones. The only difference, from the European *Cor. corax*, is its occasional somewhat larger size, but this is far from constant. I obtained in Spiti several specimens which evidently appear to belong to the same species, and they are by no means larger than true *C. corax*. Some do not even appear to equal the largest measurements of *C. corax*, but as these had been taken only from dried specimens, I will not absolutely rely upon them, especially as I hope to settle that point more carefully on my next visit to Tibet.

186. CORVUS CULMINATUS, *Sykes*, (II. 295), is only to be found in the lower hills and generally retires to the plains for the winter.

187. CORVUS INTERMEDIUS, *Adams*, (II. 29), is most common all through the N. W. Himalayas; in W. Tibet it was found by me only W. of Lei, about Kargil, Dras and towards Skardo. During the summer it is the only species met with about Chini and in the eastern portions of the Sutlej valley.

The usual measurements are; total length 18—20 inches, length of wing 12-13 inches, tail 8-8½ inches, length of bill 2¼-2½ inches, height of the same about ⅞ inches.

188. CORVUS SPLENDENS, *Vieill.*, (II. 298), is very seldom seen to the east of Kotegurh, and only near the villages.

189. NUCIFRAGA HEMISPILA,† *Vig.* (II. 304), is very common all through the forests of the valley, from low elevations to the limit of trees, and from Simla to Chini.

190. NUCIFRAGA MULTIMACULATA, *Gould*, (II. 304). I procured

* Ibis 1867, p. 34. Mr. *Blyth* still considers the species as distinct from *C. corax*. When lately in London he shewed me a large specimen of this species, sent from the Himalayas, but I confess that I have seen in the Museums at Münich, Berlin and Vienna quite as large specimens of the European *C. corax*. I do not think that they are distinct species, (Feb. 1868.)

† The plumage of this species is very variable. I obtained specimens which have very few and almost not traceable white spots. The *N. immaculata*, which *Blyth* (Ibis, 1867, p. 36) calls an unspotted species from Nepal appears to me rather doubtful (Feb. 1868.)

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a specimen of this species in October 1865 on an elevated point beyond Belaspoor, and found it tolerably common in the pine and cedar forests near Kistwar and Budrawar. The species very much resembles the European *N. cariocatacthes*, only that the white blotches are somewhat larger and perhaps more numerous, the quills and the two central tail feathers are usually tipped white; the plumage above also appears to be darker, than it is in European specimens.

191. Garulus bispecularis, *Vig.* (II. 307), and

192. Garrulus lanceolatus, *Vig.* (II. 308), are both common, but the latter is more confined to the lower ranges about Simla while the former occurs much further to North, and in the interior of the hills, it is occasionally seen about Chini; both species are also common at Koteguгh in winter.

193. Urocissa occypitalis, *Blyth*, (II. 309, *U. sinensis*, and III. 873). This is the only common species of *Urocissa* occurring in the Sutlej valley, I never have observed the *U. cucullata*, *Gould*, noticed by Dr. *Jerdon* (III. 873) as distinct from *U. flavirostris* of Sikkim.

194. Dendrocitta rufa, *Scop.* (II. 314), and

195. Dend. Himalayana, *Blyth*, (III. 316, No. 676, and III. 874), are both only found in the lower hills between 2 and 5,000 feet, the last one ocasionally occurs up to 7,000 feet; but very seldom in the interior of the hills; both are also met with in Southern Kashmir.

196. Fregilus Himalayanus,* *Gould*, (II. 319), is rare during the summer in the neighbourhood of Chini and only on elevations of and above 11,000 feet; it is, however, more common in these parts during the cold weather; most of the birds live in summer in the Spiti valley, Tibet, and probably all through Central Asia, extending into Siberia, but I have nowhere in western Tibet seen them in large numbers; in Spiti, I have generally observed them at elevations from 13,000 to 15,000 feet. They live in pairs or three or four together, and at some distance from villages, being apparently very shy.

* I do not think that this is distinct from *Freg. graculus. L.* *Gould* says that the Himalayan species has a larger beak, but when lately in Vienna I have compared my specimens with the European ones and found, a specimen from Savoy had a longer and stronger bill, than either of my Himalayan ones; size and colour do not offer any distinctions. I strongly believe that the Himalayan bird is *not specifically* distinct from the European (Feb. 1868.)

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197. PYRRHOCORAX ALPINUS,* *Vieill.* (II. 319), is in summer spread all over western Tibet, including the Spiti valley, the eastern districts of Kunawar, &c., but migrates in winter to the lower ranges and valleys of the Himalaya, being in the cold weather specially common in Kulu. In its habits it is altogether the reverse from the last species, being very social and generally the first, and often the only, visitor to the camp of the traveller in Spiti or Ladak; it is here quite as familiar and quite as noisy in the neighbourhood of villages and camping grounds as the *Corvus splendens* throughout India.

Both this and the former species breed in holes of rocks.

XXIII. *Fam. STURNIDÆ.*

198-199. STURNUS VULGARIS, *Linn.*, (II. 321), and ST. UNICOLOR (II. 322), have been both procured on the Sutlej to the north of Belaspoor, they were most probably migrating from Kashmir, where they are very abundant, especially near the Wollar lake.

200. ACRIDOTHERES TRISTIS, *Linn.* (II. 325) is common in the lower hills and valleys, but never approaches the northern regions bordering on the Tibetan frontiers. In the Sutlej valley, it is not seen much farther beyond Rampoor, or above elevations of 5,500 feet, the last and highest limit of growth of the *Ficus religiosa;* it is also very common in Kulu and all through the western hills extending into Kashmir.

201. TEMENUCHUS PAGODARUM, *Gmel.* (II. 329); common in the lower hills in the autumn; I found it also abundant in May about Suket and other places, where it breeds in holes of trees. It was associated on the pasture-grounds with the previous and the next species.

202. PASTOR ROSEUS, *Linn.*, (II. 333). It is very probable that this species breeds in the lower hills of the Himalayas.

XXIV. *Fam. FRINGILLIDÆ.*

203. MUNIA MALABARICA, *Linn.*, (II. 357); common in the lower hills and not ascending elevations above 5,000 feet, very seldom extending into the interior.

204. MUNIA SIMILARIS, N. SP.

There is another plain coloured species to be found on the lower

* Lieut. *Beavan* (Ibis 1867, pp. 137 and 142) has much doubt as to the legs of *Pyr. alpinus* being red. I believe, that I have distinctly told him the bill is yellow, and the legs are red, there cannot exist any doubt on this point. Col. *Gott* is certainly mistaken in taking the colour of the legs for yellow.

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ranges of the N. W. Himalaya. It is almost of the same size as the MUNIA MALABARICA, or perhaps a trifle larger, of a uniform rufescent brown colour, paler below and dusky on the inner webs of the quills. The feet are plumbeous and the claws proportionally somewhat longer than in the last species. It has a distinctly more rufescent tinge in all its plumage, than the true *M. Malabarica.* The only specimen which I possess is in a good state of preservation and belongs, I believe, to a new species.

205. PASSER INDICUS, *Jard. and Selb.* (II. 362,) is common all through the N. W. Himalayas, but only near villages or cultivated spots. It is during the summer most abundant in the Indus valley about Lei, though not a single bird remains here during the winter, all migrating either down the valley to the Punjab, or to the lower ranges of the Himalayas.

206. PASSER CINNAMOMEUS, *Gould*, (II. 365), is plentiful all through the valley, but usually found above elevations of 6,000 feet, it is mostly confined to the jungly districts,* though generally not far from villages; it breeds in holes of trees.

207. PASSER MONTANUS, *Linn.* (II. 366), is only rarely seen in the eastern parts of the valley, near Chini and towards the Chinese frontier.

208. EMBERIZA CIA, *Linn.* (II. 371, *Emb. Stracheyi*, *Moore*, 372). The general rufescent colour above increases from the back towards the tail; the longer upper tail coverts are centrally streaked black, the two central tail feathers broadly margined with rufescent, this colour being much paler in the female; the two outer tail feathers are for nearly the total terminal half white, more so on the inner, than on the outer webs; the breast is uniform ashy in old males, with dusky spots in the females and young birds; the three black streaks on the sides of the head are very distinct, the central one becoming much narrower towards the nape, while the grey streak is at the same time much wider.

This European species is very common in summer all through the N. W. Himalayas on both the Indian and the Tibetan side; in winter it mostly remains on the lower southern ranges.

* Ibis, 1867, p. 42, *Blyth* is correct in supposing that it is a tree- and not a house-sparrow.

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209. EMBERIZA PITHYORNIS, *Pall.*, (II. 370) is occasionally shot in winter at Kotegurh, but I have not observed it during the summer anywhere in the Sutlej valley.

210. EMBERIZA STEWARTI, *Blyth* (II. 374). In the *old male* all the under parts extending from the chest nearly to the lower tail coverts are chesnut, mingled with white on the vent, on which some of the feathers often have besides a central brown streak; the outer web of the first pair of the outer tail feathers is mostly white.

In the *old female* each feather above is centrally and below only terminally brown, the rest is light ashy or sometimes fulvous brown, internally the feathers are slaty; chin and throat are whitish, vent and edgings of the wing coverts somewhat deeper fulvous; the edgings of the tertiaries are broad with a rufous tinge, upper tail-coverts almost purely chesnut. There are generally also some traces of brown or chesnut on the sides of the breast and on the scapulars. The two central tail feathers are broadly margined with rufous, the others only slightly so on the outer webs, and besides somewhat paler; the two outer tail feathers on each side are near the base black, the rest being white except on the black shafts; of these two outermost tail feathers the first one is less black at the base, than the one next to it.

Young females differ from the old ones in having all the fulvous brown colour much paler, and whitish. The *young males* are also very like the old ones, only that the brown central streaks on the breast and on the head are much narrower, the central tail feathers less margined with rufous and more black; the chesnut on the scapulars and on the sides of the breast is also somewhat less developed. This species occurs in summer in the interior portions of the N. W. Himalaya; in the Sutlej valley it is scarcely seen west of the Wangtu bridge, but it is very common about Chini and farther to east, making a nest of coarse grass near the ground in low bushes. I found young birds about the middle of June. It is only partially a migratory bird and remains in the wooded parts of the valley generally all the year, but apparently not in Tibet.

211. EMBERIZA FUCATA, *Pall.* (II. 375). The grey on the head is rather variable, sometimes it is very conspicuous, in other cases scarcely traceable; occasionally some of the feathers on the head are

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rufous. When I passed through the Sutlej valley at Kotegurh, Rampoor and Nachar in June 1866, I have not observed a single specimen of this species, but on my return through the same parts in August I found the males most abundant, but not a single female. I cannot at the present account for the solitary appearance of the former.

212. EMBERIZA PUSILLA, *P a l l.* (II. 376), is very rare at Kotegurh, and only to be seen in winter; I have not noticed it during the summer in W. Tibet, it must travel further northwards.

213. EUSPIZA MELANOCEPHALA, *G m e l.* (II 378), is common in the low hills about Belaspoor and Kangra.

214. MELOPHUS MELANICTERUS, *G m e l.* (II. 381), is generally found, on bare slopes of hills or open places, all along the southern ranges of the N. W. Himalayas, but it never approaches the Tibetan climate; it does not go even as far east as Chini, and it is very improbable that it inhabits the western parts of Central Asia, although it may be identical with the species occurring in China. At Kotegurh it breeds in summer during the months of May and June, but it does not remain here in winter.

FRINGILLINÆ are especially numerous on the lower ranges during the cold weather, while in summer they are mostly to be found at greater elevations, in western Tibet and in Central Asia. Some of the species appear to be, however, permanent inhabitants of the outer ranges.

215. HESPERIPHONA ICTERIOIDES, *V i g.* (II. 384). The yellow on the back is in the old bird often mingled with some black feathers. The *young female* is like the old one, but the *young male* has in the first winter the whole head with the sides, nape, chin and throat ashy; the rest of the plumage is yellowish green, brighter below; the primaries, secondaries and the tail feathers are black, the tertiaries green on the outer webs, black on the inner, all the coverts being greenish. Common about Kotegurh and N. of Simla, in summer and winter, at elevations of 5,000 to 9,000 feet; the species does not go far in the interior, at least not beyond the limit of the large forests.

216. PYRRHULA ERYTHROCEPHALA, *V i g.* (II. 389); the shining blue black feathers on the wings and on the tail are narrowly barred across with dull black lines; the species breeds about Kotegurh between 6,000 and 8,000 feet, but it is found all through the valley up to the limit of the pine and cedar forests; it is also common in Lahul and

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probably migrates much farther to north into Central Asia and Siberia, for very large numbers come down each winter to Kulu and the lower ranges.

217. Loxia Himalayana, *Hodgs.* (II. 393), is only to be found in the forests about Chini and towards the east; it is rare at Kotegurh even in winter, but common in Lahul during the summer.

218. Carpodacus erythrinus, *Pallas*, (II. 398); very common, on elevations from 7,000 to 14,000 feet, all through the N. W. Himalayas and in Tibet during the summer; it remains at Kotegurh in winter. The different variations of the plumage quite agree with *Jerdon's* description.

219. Propasser rhodochlamys, *Brandt*, (II. 401) is not very rarely met with near Kotegurh, though more common about Chini; it breeds in Tibet.

220. Propasser rhodochrous, *Vig.* (II. 402).

The rose colour of the male is in winter on the forehead and on the superciliar stripe paler, than on the rump; the feathers covering the nostrils are vinaceous; the shorter upper tail coverts are bright rosy, the longer more dull; the edges of the outer webs of the wing and tail feathers are generally rufous, while in the female they are much paler.

The young male very much resembles the old female, except that there are always some rosy feathers on the throat, sides of the neck and the front of the head. The species is very rare in summer on the lesser ranges and is scarcely seen below 7,000 feet, it is, however, more common to the east of Chini, in Spiti and in Lahul, as likewise during the winter near Kotegurh and Simla.

A large apparently new species of Propasser occurs in W. Tibet; the length of the wing of the female is 4¼ inches; it is similarly coloured as the female of *P. rhodochlamys*, but the brown longitudinal streaks below are comparatively much smaller; I have not been able to procure as yet a male specimen of this species, but it is possible that it is not different from the last named one.

221. Pyrrhospiza punicea, *Hodgs.* (II. 406), comes only occasionally in winter to Kotegurh and Simla, but is more common eastwards; in summer it is found in Spiti and Ladak on elevations of 13,000 to 17,000 feet, searching after food at the camping grounds. I found the

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nest, made of coarse grass, in Rupshu near the Thsomoriri (lake), on the ground, in a little bush of the Tibetan furze; eggs dirty white or greenish with some dark brown spots.

222. CALLACANTHIS BURTONI, *Gould*, (II. 407). The entire lower plumage is in winter reddish brown, and only the tips of the feathers are crimson; wings and tail are black, the tips of all the wing-coverts, all wing-and tail-feathers are white, those on the tertiaries slightly tinted with crimson; the three pairs of outer tail feathers are terminally white on the inner webs, the white decreasing from the outermost, until it becomes reduced on the fourth pair and all the following feathers to white tip. This rare species is found occasionally in winter on the lesser ranges, about Kotegurh and Simla between 4,000 and 7,000 feet; in summer it lives in the highest cedar forests on the central range of the N. W. Himalayas. I do not remember it from Tibet, but it very likely migrates farther to the north of the Indus valley in W. Tibet.

223. CARDUELIS CANICEPS, *Vig.* (II. 408), common in summer all through W. Tibet, wherever any thistles are to be found; in its habits, flight, song and nidification it does not differ at all from the European *Card. elegans.* During the cold weather, it is very plentifully met with at Kotegurh, near Simla, and all along the hill stations of the lesser ranges.

224. CHRYSOMITRIS SPINOIDES, *Vig.* (II. 409,) prefers the more wooded districts and is in the lower hills not uncommon even during the summer months between 5 and 9,000 feet; it is, however, found with the former species also in Spiti and in Lahul.

225. METOPONIA PUSILLA, *Pall.*, (II. 410). The female has the head and ear coverts brown; there are usually some traces of golden yellow on the forehead, specially in very old females; the throat is pale, breast black, but the nape is rather ashy; in other respects it resembles the male.

This finch comes only in winter to the lesser ranges of the N. W. Himalayas; it breeds east of Chini on elevations of 10,000 feet and above, as likewise in Spiti, Lahul and Ladak. I found old nests made of thin twigs, laid out with grass and wool, on shrubs or low trees of *Juniperus excelsa.*

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226. Linota pygmæa, *n. sp.** There is another small finch found in Ladak and in Bissahir. It is considerably smaller than *Metop. pusilla*, the wings being only $2\frac{1}{2}$; the head and nape are blackish brown, ear-coverts rufous brown, general plumage above dark brown, the feathers being centrally streaked with that colour and broadly margined pale fulvous brown; wings and tail blackish brown; edges of outer webs of the primaries and partly also of the secondaries yellow, the entire margins of the tertiaries and the tips of the former, as well as the tips and outer edges of all the wing coverts are pale rufous brown; tail deeply emarginated in the middle, the external edges for two-thirds length from the base yellow, the rest pale rufous; throat slightly tinged with yellow, rest of lower plumage light fulvous brown, centrally streaked dusky on the breast and upper vent. The bill is very small, dusky above, culmen distinctly angular, ridged.

I procured two specimens of this species, one at about 13,000 feet near the snows above Chini (August, 1866), and one near Padam in S. W. Tibet at about 12,000 feet, (September, 1865). I cannot identify this species at present with any described by Pallas from North Asia, for which reason I think it advisable to introduce a new specific name.

227. Linota brevirostris, *Gould*, (Proc. Zool. Soc. Lond. 1855, p. 216), is exactly of the same size as the European *Lin. montium*, apparently only differing from it by its paler plumage; rare in Ladak and visiting Kulu and the Sutlej valley in winter; it is also in winter caught near Chini and sometimes caged.

228. Montifringilla hæmatopygia, *Gould*, (II. 413, Birds of Asia, pt. III. pl. 15).

229. Montifringilla Adamsi, *Moore*, (Proc. Zool. Soc. Lond. 1858, p. 482, pl. 156). The longer upper tail-coverts are grey; the secondaries are black on their basal half.

Both these species are inhabitants of Ladak during the summer, but they have been procured in winter through my shikaries in the Sutlej valley as well as in Kulu. They also visit Northern India in the cold weather. There is a third, apparently new species of *Montifringilla* to

* Dr. *Jerdon* informs me that he also procured in the Punjab a very small finch which he supposes to be a second species of *Metoponia*; my specimens though very small appear to be more allied to *Linota* (April 1868).

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be found in the Himalayas, but as far as at present known, only occurring in Ladak, I shall give the description of it at some future occasion, as I am at present in possession of a single specimen.

230. FRINGILLAUDA NEMORICOLA, *Hodgs.* (II. 414), is likewise only a winter visitant to the lesser ranges; I observed it often during the summer in the south-western parts of Tibet and to the north of Kashmir.

231. FRINGILLAUDA SORDIDA, *n. sp.* Another species apparently belonging to the genus *Fringillauda* has been procured by me near the Baralatse-pass in north Lahul and near Padam in 1868; last winter I got several specimens of the same species from Kotegurh. The following description is taken from these specimens.

Male in winter; forehead dusky brown, all the feathers margined pale; top of head and ear-coverts uniform rufous brown, nape and neck ashy brown, back dark brown, the feathers margined pale rufous; rump pure ashy; upper tail-coverts blackish, tipped and margined white; wings and tail dusky, the secondaries being narrowly, the tertiaries more broadly edged pale brown and tipped whitish; wing coverts brownish, dusky in the centre, tipped whitish and forming two conspicuous bands; all the tail feathers are margined pale; below uniform dull ashy, albescent on the vent; lower tail coverts dusky, broadly margined and tipped with pure white. The *female* has the entire top of the head light brown, the feathers being dusky centrally, the ear coverts are pale; otherwise it is coloured like the male.

The specimens which I procured in summer, are more uniform dusky brown above, having all the pale edgings of the feathers much less distinct and the whitish bands on the wing coverts scarcely conspicuous.

Length of wing 3⅞ inches; tail 2⅞ inches; bill dusky brown above, pale on the base and below; legs greyish brown, irides fleshy brown.

The form of the bill is scarcely different from that of a typical *Montifringilla*, but the hind claw is remarkably longer and like all the other claws very slender, and more similar to those of *Fringillauda* than to those of the former genus.

I have not succeeded in identifying this species nor have I seen specimens of it in any of the European Museums, though it is comparatively a common bird.

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232. Mirafra cantilans, *Jerd.* (II. 420), is the only species of this genus which has been observed on the lesser ranges along the Sutlej valley; it usually frequents grassy slopes of hills.

233. Calandrella brachydactyla, *Temm.*, (II. 426) is common in the eastern portions of the valley, beyond Chini, and in winter also in the low hills.

234. Alaudula raytal, *Buch Ham.*, (II. 428); the typical smaller species was by me occasionally observed during the summer in Ladak, but it probably migrates farther to north; in winter it arrives in Kulu and the north of India in larger numbers and is often caged.

235. Alaudula pispoletta, *Pallas*, (II. 429), will stand as a distinct species; it was procured by me near Korzog in Rupshu, but appears to be much rarer than the last species; it most probably also migrates in winter to the lower hills and to the plains of North India.

In general colouring, it is very like *Al. raytal*, except that the ear-coverts are more whitish, and the feathers on the head and nape very narrowly streaked dusky brown, while they are more distinctly streaked in the former species; in size it is decidedly larger, the bill being in proportion rather long and slender, horny above, pale yellow below at the base, the upper mandible at the tip a little less curved; legs fleshy brown; length of wing 3⅝ inches; tail 2½ inches.

236. Otocoris longirostris, *Gould*, (II. 431), is common all through W. Tibet, where it usually remains all the year round, only few birds migrating to the lower hills or to the North of India. I found this species near the highest passes on the N. W. Himalayas, following the tracks of merchants on the snow and searching after grain. It has not been obtained by my shikarees at Koteguih, but I am told that it is common in winter in eastern Bissahir, and Gould described it from a specimen, which is said to have been procured at Agra. Its song is remarkably like that of a true lark, for which it may very easily be mistaken from its voice only.

237. Alauda leucoptera, *Pallas*, occurs in eastern Bissahir near the extreme frontier of the Chinese territory. I have nowhere observed *Alauda triborhyncha*, *Hodgs.*, which ought to be considerably larger than the next species.

238. Alauda gulgula, *Frankl.* (II. 434), is common all over W. Tibet and during the summer also in eastern Bissahir, migrating to the plains in winter.

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239. GALERIDA CRISTATA, *Linn.* (II. 436), is often seen with the last; it is not rare in the Indus valley about Lei. Both this and the former species often remain at Kotegurh during the winter.

XXV. *Fam. TRERONIDÆ.*

240. SPHENOCERCUS SPHENURUS, *Vig.* (III. 453), is the only species which represents the family in the eastern portions of the Sutlej valley. It is found about Serahan in small flocks, and sometimes proceeds even as far as Chini, being particularly fond of mulberry fruits, groves of those trees not being rare in any of the branch valleys; elder and elm-trees equally are their places of retreat. *Jerdon* says that the third primary is not insinuated in *Sphenocercus*, although it is unmistakeably so in the present species.

XXVI. *Fam. COLUMBIDÆ.*

241. ALSOCOMUS HODGSONII, *Vig.* (III. 463). The first and fourth quills are very nearly equal, the latter being a trifle longer, but both are shorter than the second and third, of which again the last one is somewhat longer than the previous; the second, third and fourth quills are insinuated on the outer webs, the last one somewhat less than the two others.

The plumage is rather variable in different specimens and at different seasons. The male has in winter the head and throat more whitish, the vinaceous colour above more brown, the posterior part of the back, the wings and the tail greyish brown, and the white specks on the abdomen and the breast are large. In summer the head and throat are greyish, the vinaceous colour above purer and reddish, the white specks are at the same time less numerous; the abdomen, upper tail-coverts and tail are dark brown.

The females have the head and body much paler than the males, especially in winter, and the vinaceous colour is a good deal tinged with dull brown.

This species is tolerably common near Chini and somewhat farther to east; it feeds on berries and on different seeds on or near the ground. During a whole fortnight I observed a small flock returning every evening to the same tree (a *Pavia indica*), but the birds are very shy and difficult to approach, as also stated by *Jerdon*. Many of them remain at Kotegurh even in winter, at which time they probably partially live on seeds, partially on knops of trees, &c.

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242. PALUMBUS CASIOTIS,* *Bonap.* (III. 464), is very rare about Simla and Kotegurh; it has been procured at the last place only in winter, and probably lives during the summer in the more eastern provinces of the valley and in Central Asia.

243. COLUMBA INTERMEDIA, *Strickl.* (III. 469). This is of all pigeons the most common species and occurs all through the Sutlej valley, in Bissahir, Spiti and all through W. Tibet. In Tibet it remains even during the winter, unless very large quantities of snow force it to search after food in the lower and western parts of the valley. It is generally found near camping grounds and villages, occasionally ascending elevations up to 17,000 feet, but this only in cases, where it follows the grain-merchants towards the passes.

I have not observed in the Sutlej valley *Col. rupestris*, but have seen it repeatedly on the Indus; it is, however, by no means so common as the former species.

244. COLUMBA LEUCONOTA, *Vig.* (III. 471), only occurs near the snows, on both sides of the principal range of the north-west Himalayas, (the Baralatse-range); it is often seen feeding with *Col. intermedia*, *Pyrhocorax alpinus* and *Fregilus* (*Himalayanus*) some distance from villages, being always very shy and not usually migrating in winter, except within small limits of elevation. Wherever this and the previous species are seen together, the proportion of *Col. leuconata* to *C. intermedia* is about one to ten.

245. TURTUR RUPICOLA, *Pall.* (III. 476). This is in general colouring extremely like the European *Tur. aurita*, and I rather doubt their being specifically distinct; it is very common all through the N. W. Himalayas, in summer preferring elevations between 6,000 and 9,000 feet. In W. Tibet,† it is only found, where any shrubby vegetation exists, and not usually above 12,000 feet.

246. TURTUR MEENA, *Sykes*, (III. 477), is only found in summer on the lesser ranges and does not go far in the interior; I have not seen it beyond Kotegurh.

247. TURTUR CAMBAYENSIS, *Gmel.* (III. 478). I shot a specimen

* See Ibis, 1867, p. 149. *Blyth* says the figure of *Bonaparte* represents a much darker coloured bird (Feb. 1868).

† Ibis, 1867, p. 150. I do not remember of having seen any other dove in Tibet, than the *T. rupicola* (or *aurita*) and it is probable that Dr. *Adams' T. orientalis, Lath.*, only refers to this species, (Feb. 1868).

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on the 26th August 1866, near Kotegurh, and I was informed that this species breeds here, though it is very rare.

248. Turtur suratensis, *G m e l.* (III. 479), was met with in June, breeding near Gaora (beyond Rampoor) at an elevation of 7,000 feet; I have not observed it, however, beyond Wangtu bridge and it certainly does not go eastwards beyond the limit of the arboreal vegetation.

249. Turtur risoria, *L i n n.*, (III. 481), is only found in the low hills, although occasionally ascending elevations of 6,000 feet, as for instance near Kotegurh, being, however, rather rare.

250. Turtur humilis, *T e m m.* (III. 482), was shot near Belaspoor on an elevation of about 2,000 feet, but I have never observed it in the interior of the hills.

I also have not been successful in observing personally any species of the Sand-grouse, though *Pterocles fasciatus* is said to occur in the low hills along the Sutlej. I only obtained a few birds which were stated to have been shot in the Dhoon, south of Kangra.

XXVII. *Fam. PHASIANIDÆ.*

251. Pavo cristatus, *L i n n.* (III. 506), is commonly seen on elevations of 1,000 and 2,000 feet, occasionally ascending up to 5,000 feet, but only in the Sub-Himalayan hills about Belaspoor.

252. Lophophorus Impeyanus, *L a t h.*, (III. 510). The Monal is now rather scarce during the summer under elevations of 8,000 feet, generally it is only to be found near the snows, or near the limit of the arboreal vegetation; it occurs at those higher elevations throughout the valley extending from Simla as far east as Sungnum, where the last cedar forests are found, but it does not enter Tibet proper. In winter it descends lower in the valley down to 7,000, and in southern Kulu probably to 3,000 feet, for it is said to be common near the villages about Bijaura and Plash.

253. Ceriornis melanocephala, *G r a y*, (III. 517). The numbers of this beautiful pheasant are fast declining, and although it is said to have been formerly common near Simla at elevations of 5,000 and 6,000 feet, it is now only found in the less visited and well wooded districts above 8,000 feet, and even here it is comparatively rare. Most of the birds sold in Simla are procured in winter, either on the Chur-mountain or in Kulu, where it is still tolerably common. Further

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to east its geographical range is about the same as that of the Monal.

254. PUCRASIA MACROLOPHA, *Less.* (III. 524), is not very common about Simla and Kotegurh, but oftener seen a little more eastwards, generally occurring on elevations between 5,000 and 10,000 feet. I could not receive any information, whether the species is found in the neighbourhood of Chini. It certainly does not occur in W. Tibet or even beyond the large forest.

255. PHASIANUS WALLICHII, *Hardw.* (III. 527), is by no means a common bird and generally only met with at the same elevations or even lower down than the last species; it does not usually go beyond the Nachar forests towards east and is said to be very rare near Chini.

256. GALLOPHASIS ALBOCRISTATUS, *Vig.* (III. 532); common at elevations between 5,000 and 6,000 feet and often descending to 3,000 and 2,000 feet; it occurs at Chini (9,000 to 10,000 feet), though I have not been able to procure a specimen, and old skins which I saw had the black part of the plumage rather deep brown.

257. TETRAOGALLUS HIMALAYENSIS, *Gray* (III. 549), occurs all along the southern side of the Baralatse range; it is rare at the head of the Wangur valley and above Chini, but more common eastwards, above Sungum and towards the Manirang pass, as also in North Kulu. In Spiti and Tibet it is usually met with during the summer at elevations of 14,000 to 15,000 feet, and is here much more frequently seen, than on the Indian side of that range.

258. TETRAOGALLUS TIBETANUS, *Gould* (III. 554), is readily distinguished from the former by its smaller size and longer tail; it occurs at the head of the Spiti valley and its smaller tributaries. The species must therefore be added to the Indian fauna proper.

259. LERWA NIVICOLA, *Hodgs.* (III. 555), is not uncommon along the Baralatse range of the N. W. Himalayas; it occurs in Spiti, but I have not observed it farther north, in Rupshu. It is numerous in the north-western parts of Kulu during the winter, when it descends from the snowy range somewhat lower down, though it very rarely migrates as far south as Kotegurh.

260. FRANCOLINUS VULGARIS, *Steph.* (III. 558), is common from the plains all along the lower ranges, ascending elevations up to about 9,000 feet; it is not rare about Serahan, but I have not observed it beyond the Wangtu bridge.

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261. CACCABIS CHUKOR, *Gray*, (III. 564); common all over the N. W. Himalayas and W. Tibet, where it ascends elevations up to 14,000 feet, but in Tibet it generally prefers cultivated districts to the elevated and bare plateaus.

The Tibetan specimens are usually much paler in colouring, than those generally seen on the Indian side, and thus very closely resemble the European type *Cac. græca*, of which in reality it can hardly be called more than a local variety.

262. ARBORICOLA TORQUEOLA, *Val.* (III. 577), is very solitary in its habits and during the summer generally met with only near the limit of trees or near the snows; it comes down to Kotegurh, Simla and other places merely in winter; as soon as the snow begins to melt on the higher ranges, it immediately retires to the interior.

263. COTURNIX COMMUNIS, *Bonat.* (III. 586); not rare on cultivated grounds all along the lesser ranges, it ascends elevations up to about 5,000 feet, but very rarely extends into the interior of the hills. I observed it below Kotegurh, and it is occasionally also obtained in the Kulu valley between 4,000 to 5,000 feet.

One or two other species of quails occur in the low hills and in the Dhoons, but they do not enter the interior to any considerable distance.

264—270. *GRALLATORES* and *NATATORES*.

Of these two orders scarcely any species permanently inhabit the Sutlej valley, their absence being due to the scarcity of marshy grounds, with the exception of a few small places in the lower hills, where rice is cultivated. I may mention a few of the more common species, though there cannot be a doubt that a large number of others which migrate from the plains to Kashmir, Tibet or to northern Asia make at various times a short stay in different portions of the valley. The following species have been observed by myself, either in the spring or in the autumn; *Aegialitis pyrrhothorax, Numenius arquata, Limosa ægocephala, Chettusia gregaria, Totanus calidris, Actitis glareola,* and *A. hypoleucos, Fulica atra, Gallinula chloropus* (*an G. Burnesi !*),* *Hydrophasianus chirurgus, Podiceps cristatus, Sterna hirundo, Sterna javanica,* (all common in Kashmir and Tibet), *Xemma brunnicephala* (common on the Thsomoriri in Rupshu), *Querquedula glocitans* and *Q. crecca, Mareca Penelope, Anas leucopthalma* (common in Kashmir).

* Not likely a different species.

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271. Vanellus cristatus, *Meyer* (III. 643), has been observed in the neighbourhood of Suket, it breeds at the beginning of May; it is also not uncommon in the Indus valley about Lei, in W. Tibet.

272. Lobivanellus goensis, *Gmel.* (III. 648), is common on marshy rice fields all through the lower hills, especially about Belaspoor, extending in the Sutlej valley as far east as Rampoor, or up to elevations of about 4,000 feet. It does not go into Tibet.

273. Scolopax rusticola, *Linn.* (III. 670), is rather common in the forests of the lesser ranges between 4,000 and 10,000 feet; it breeds about and beyond Chini, and is occasionally seen also in W. Tibet, it is common in winter in Kulu and along rivers in other valleys of the southern Himalayas.

274. Gallinago solitaria, *Hodgs.* (III. 673), and

275. Gallinago scolopacinus, *Bonap.* (III. 674), have both been procured in the southern part of Kulu and near Kotegurh during the winter, though I never met the species here in summer.

276. Rhynchæa bengalensis, *Linn.* (III. 677,) is rarely seen in the hills; I procured a specimen on a marsh above Belaspoor (in October) and another one on the Wollar lake in Kashmir (in September).

277. Actitis ochropus, *Linn.* (III. 698). Solitary specimens are always met with along the Sutlej river; the species is very common all through W. Tibet.

278. Totanus stagnalis, *Bechst.* (III. 701), is still more common than the last species, and at certain times of the year to be met with wherever there is a pool of water along the banks of rivers.

279. Anser indicus, *Gmel.* (III. 782), and

280. Casarca rutilla, *Pall.* (III. 791); solitary specimens of both these species are occasionally seen in the neighbourhood of Chini on the Sutlej river; they breed in very large numbers on the lakes of W. Tibet and Central Asia.

Many specimens of *Casarca*, *Anas* and *Anser* remain even in winter in Tibet, on places where the water of the lakes does not freeze on account of subterranean hot springs.

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On the intimate Structure of Muscular Fibre.

By Dr. C. Macnamara.

[Received 29th March, 1867.]

I have this evening the honor to lay before the Society the results of some investigations I have recently been making regarding the minute anatomy of muscle.

The muscular system, as is known, has commonly been divided into two classes, the striped or voluntary and the unstriped or involuntary muscle, but I can hardly consent to this division of the subject, because it appears to me that there is really no such thing in nature as a striped muscle, the muscular tissue as it is called, whether voluntary or involuntary, being composed of an homogeneous substance, the characteristic features of which are, that it contracts in obedience to the nervous force, its elements under every conceivable circumstance being arranged in such a manner as best to fulfil the mechanical purposes for which it is intended. Whether we examine it in the lens, in the walls of the blood vessels, intestines, or the heart we find in each instance such modifications in the dispositions of the contractile tissue as are best suited to the work it has to perform.

It is, however, to the circumstances of voluntary muscle that I am now desirous of drawing your attention. This system forms the bulk of the limbs, and is the medium through which the movements of the skeleton and of the organs of sense are effected.

Every muscle, whatever its dimensions, is composed of the external case of fibrous tissue from the inner surface of which numerous interlacing fibrous bands are given off, and in this fibrous matrix, the larger branches of the vessels and nerves ramify. These structures, however, are to be found in every part of the body, and are by no means characteristic of muscle, the fibrous tissue allowing of motion among parts of the body which it also binds together; the vascular being the channels through which nutrint fluid is supplied and effete substances are removed from the organism, and the nerves in the case of the voluntary muscle are the medium through which the mandates of the will are conveyed to the contractile tissue. It is therefore, to the substance contained within the sheath and filling the spaces between the fibrous matrix of muscle that I would direct your special attention.

The prevalent ideas which histologists hold on this subject appear to be mainly derived from the investigations of Bowman and are well defined in the following remark of Busk and Huxley, in their translation of Kölliker's Histology. They observe "in a homogeneous transparent matrix definite particles are imbedded, the sarcous elements, which are arranged, side by side, in transverse rows. In some cases, the sarcous elements are all of one size, in others they are alternately larger and smaller. The reason of this does not at present appear, but it is possibly connected with the nutrition of the muscle. The matrix usually tends to break up in longitudinal bands,—the fibrils—which have the diameter either of a single sarcous element or of some multiple thereof. It likewise tends to break up in the transverse direction giving way between the pairs of rows of sarcous elements; but these cleaving lines are no indications of the existence of discs or fibrils as such in the unaltered muscle." The more one endeavours to comprehend the meaning of this passage the more perplexed one becomes, and in fact I have long since arrived at the conclusion that the authors themselves did not comprehend the nature of the appearances which they attempted to describe; at any rate when they come to apply their anatomical description to the facts observed in the contraction of a muscle, they are absolutely in fault, and plainly state they are ignorant of the process which takes place in the fibrils during contraction.

It was the consideration of these difficulties which led me to investigate the subject for myself with a fiftieth of an inch lens. The magnifying power of this glass can be best comprehended when I state that a particle having a definite outline the $\frac{1}{100000}$ of an inch in size could be distinctly defined, and that an object three feet long would appear as high as Mount Blanc if it were possible to examine it under this lens.

I have already noticed the relation of the fibrous sheaths and matrix to the contractile tissue; if we carefully examine the latter, we shall find it to consist of bundles of contractile fibres, each fibre being composed of two longitudinal bands running continuously from one end of the muscle to the other end, and connected throughout their length by spiral transverse bands, the whole being encased in a sheath

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of homogeneous tissue. I believe therefore that a voluntary muscle consists of a matrix of fibrous tissue the interstices of which are filled up with contractile fibres such as I have just described, the larger vessels and nerves ramifying in the fibrous matrix, but giving off numerous branches which spread themselves over the case of homogeneous tissue which encloses each individual contracting fibre, so that the capillaries and ultimate branches of the nerves are brought into immediate contact with the contractile tissue.

If this be the solution of the vexed question as to the minute anatomy of muscle, it certainly appears like many other things to be remarkably simple, when once we understand them, and to be another instance of the wonderful adaptation of means to an end, which is displayed in every part of the body. Evidently bands of simply elastic tissue could not perform the functions required of a muscle, the increase in breadth of the muscles of a limb in contracting would, under these circumstances, exercise an injurious amount of pressure on the nerves and vessels of surrounding parts, and as the elastic bands became elongated, spaces would necessarily be left between them, which had previously been occupied by the bulk of the contracting muscle. All such anomalies are obviated by the beautiful arrangement I have now demonstrated, for in contraction the longitudinal bands must shorten on themselves drawing the transverse bands into close approximation, and these at the same time uncoil, each fibre therefore would increase in breadth exactly to the same amount which it lost in length. That such is the case with regard to the muscles of a limb as a whole, has been proved by repeated measurements. Mr. Bowman remarks " a muscle in the act of contracting becomes shorter and thicker, the changes being accurately proportioned to one another, the whole organ neither gaining nor losing in bulk." But the means by which these changes are effected have never been explained satisfactorily before, so far as I am aware. One can hardly be certain as to the active part taken by the transverse bands during muscular contraction. It is evident as the longitudinal bands are attached to fixed points at either extremity, that the tension or relaxation of the transverse bands would be sufficient of themselves by acting on the longitudinal bands to cause contraction or relaxation of the muscle; and I am disposed to favour this idea, because we can thus easily conceive the means by which the remarkably

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rapid actions which muscle is capable of effecting are accomplished, it being kept in a state of perpetual tension depending on the action of its spiral transverse bands. The most casual observer moreover will at once perceive that through the mechanism I have endeavoured to describe, no puckering or pinching of any of these delicate structures can possibly occur, the parts being all admirably poised and adapted to one another.

Time will not permit me to extend this principle to the case of the crystalline lens, but I am convinced that the lens is simply a mass of contractile bands arranged in such a manner that in contracting and dilating, the curve of its surfaces are capable of alteration, and its refractive powers thus modified, so as to enable it to bring both parallel and divergent rays of light to a focus on the retina. I cannot, however, close this paper without alluding to the fact that the minute anatomy of muscle I have delineated, evidently displays a source from whence animal heat may be derived. I need hardly say that much of Liebig's theory of the combustion of the hydrocarbons as being the chief if not only source of animal heat is fast falling to the ground under the assaults of modern chemistry. But in the action of a muscle, we have evidence of the existence of forces as capable of engendering heat as combustion, viz friction, compression, tension, and expansion,—they all necessarily giving rise to molecular motion and an equivalent amount of heat,—quite capable of keeping up the temperature of the blood to a healthy standard, and this, by constantly circulating throughout the body, would tend to equalize the temperature in all parts of the system.

Many distinguished physiologists have supposed that the nervous force is analogous, if not identical, with electricity, and have pointed with triumph to the evidence of the excitation of electricity during muscular contraction; it appears to me, however, that we may easily explain the presence of electricity by the play of the forces above enumerated during muscular contraction: they must, in fact, induce electrical phenomena, and that independently of the nervous system which is simply the medium through which the mind acts. If therefore the consideration of the minute anatomy of muscle is attended with no other practical result, it serves to explain much that was before a mystery in the animal economy. It has not advanced our knowledge as to the influence which volition has over muscle, nor do I think

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we can expect this. We have not the remotest conception of the nature of the active principle which maintains gravity or any other force in operation, though we may with advantage study the laws which govern these forces. All beyond this must at present be theory and speculation. And so with the voluntary muscles; we have advanced a step in knowledge if we have gained a notion of their mechanical construction, but I have no more expectation of determining the nature of the subtle agency which sets the system at work through the nerves than I have of seeing the changes which occur in the molecules of an iron wire during the transit of an electric current through it.

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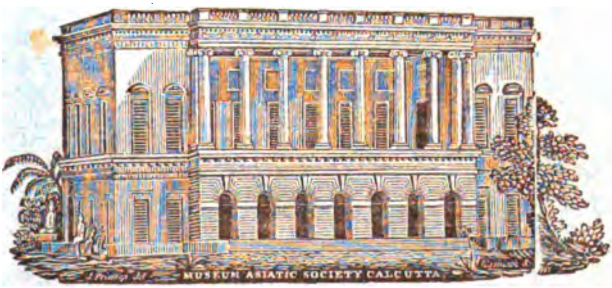

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Contributions to Indian Malacology, No. IX.—Descriptions of new Diplommatinæ *from* Darjiling *and the* Khasi Hills.—*By* William T. Blanford, *F. G. S., C. M. Z. S. &c.; to accompany Captain Godwin-Austen's figures; see p.* 83.

[Received 12th January, 1868.]

Amongst a very large and interesting collection of land shells made by Captain Godwin Austen in the Khasi and Garo Hills are several undescribed forms, and of these no less than 6 belong to the genus *Diplommatina*, two forms of which, from the same neighbourhood, were described by Mr. Benson some years ago, from the collections made by Mr. Theobald in 1856. I hope to describe some of the other novelties shortly, but as Captain Godwin-Austen has figured the species of *Diplommatina*, not only of the Khasi Hills but also of the Himalayas, both Eastern and Western, and of Burma, from typical specimens in his own and my collections, I describe the new species thus figured at once.

Most unfortunately, one of the most remarkable of Captain Godwin-Austen's discoveries, the very interesting sinistrorse species figured in Pl. III. fig. 3. has been lost, the only specimen obtained having been crushed during transmission by post. I therefore refrain from giving the species a name, for, although there can be no reasonable question

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of its distinctness, and although, from the excellence of the drawings made of it, it is improbable that there would be any difficulty in recognising it again, still the practice of describing shells from drawings is so objectionable, and has led to so much confusion, that I do not think it should be permitted, except where the draughtsman himself is the describer.*

This unnamed form and the remaining sinistrorse kind which I have called *D. gibbosa*, are the first reversed species yet found in the Eastern portion of the British possessions in India. From the Western Himalayas, *D. Huttoni* has been known for many years, and it is curious and interesting to find that both dextrorse and sinistrorse *Diplommatinæ* occur in the Khasi Hills, as well as at the North-Western extremity of the known range of the genus. Captain Godwin-Austen's extensive researches have raised the number of forms from the Khasi Hills to 8, viz., 6 dextrorse and 2 sinistrorse, or one more than all the species hitherto collected in both the Eastern and Western Himalayas, even when the new form from Darjiling is included.

This new form, now first described, was found by myself in 1856, but the few individuals procured, remained unnoticed amongst my numerous specimens of *D. pachycheilus*, Bens., until lately. I now give a description of it, in order to complete, so far as possible, the list of Indian and Burmese *Diplommatinæ*.

1. Diplommatina semisculpta, n. sp. Pl. I. fig. 6.

Testa dextrorsa non rimata, ovato-conica, solidiuscula, albida vel succinea. Spira conica, subattenuata, apice acutiusculo, sutura superne mediocriter impressa, subtus profunda. Anfr. 7 convexi,

* One instance of the confusion to which this practice is likely to lead may suffice; it is one to which I have before adverted. The first species of *Pterocyclos* ever described from Ceylon was *Pt. Troscheli*, Benson, the description of which was taken from a drawing. Amongst the numerous specimens of the genus hitherto brought from that island, this species has never again been recognised, though there can be but little doubt that the specimen from which the original drawing was taken, belonged to one of the species since instituted. Yet the drawing was carefully made, and the describer a naturalist as careful and conscientious as Mr. Benson. What errors may be committed by less careful naturalists may be understood by studying the history of *Artamus cucullatus* in Jerdon's Birds of India, Vol. II. pp. 56, 872. Of course there are parts and important parts of animals, such as the soft portions of minute mollusca, which are either unpreservable, or so difficult of examination when preserved, that drawings must often be had recourse to, and in such cases every thing depends upon the accuracy of the draughtsman.

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primi costulati, postremi lævigati, antepenultimus major, ventricosus, penultimus juxta aperturam leviter constrictus, ultimus antice ascendens, subtus rotundatus. Apertura verticalis late auricularis, peristoma incrassato-expansum, subduplex vel duplex, margine dextro subrecto, columellari sinuato, angulo saliente subtus desinente basali juxta angulum fere concavo, dente columellari valida, callo parietali mediocriter expanso, tenui, appresso.

Long. 4, diam. 2 mill.; Ap. cum peristomate 1½ mill. longa, intus 1 lata.

This shell is easily distinguished from its congener *D. pachycheilus*, Bens., by the greater tenuity of the antepenultimate whorl,* the absence of sculpture on the lower whorls and the more prominent angle at the left lower corner of the peristome. This last character in *D. semisculpta* is rather stronger than appears in the figure. The present species is much more closely allied to *D. diplocheilus*, Bens., which it resembles greatly in sculpture and form. The principal distinction is in the peristome which is much less developed in *D. semisculpta*, the parietal callus being quite thin and appressed instead of standing out from the last whorl as in that species. The mouth also is larger in proportion, the angle at the base of the columellar margin more salient, and the spire more acuminate. It would not, however, be surprising if intermediate varieties should be found to connect these two forms.

2. D. SCALARIA, n. sp. Pl. II. fig. 2.

Testa dextrorsa, non rimata, ovato-acuminata, subfusiformis, costulis validis verticalibus distantibus ornata, pallide succinea. Spira conica, sub-turrita, apice subacuto, sutura valde impressa. Anfr. 7 rotundati, duo primi lævigati, tertius confertim-, cæteri distanter-costulati, antepenultimus major, tumidus, ultimus versus aperturam ascendens, basi rotundatus. Apertura subverticalis, leviter sursum spectans, late auricularis, plica columellari mediocri intus munita: perist. duplex, internum continuum, expansum, externum expansum, fere retro-relictum, margine dextro juxta anfractum penultimum sinuato, tunc angulatim antice porrecto, subtus unâ cum basali recto, columellari verticali, subtus angulo obtuso desinenti, callo parietali expanso, superne suturam fere attingente.

* In Pfeiffer the length of *D. pachycheilus* is given as 4 mill., diam. 2½. The length should be 5 mill.

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Long. $3\frac{1}{2}$., diam. 2 mill. Apertura c. peristomate vix $1\frac{1}{2}$ mill. longa, diam. intus circa $\frac{3}{8}$.

Hab. rarissime ad Habiang in montibus Garo dictis, ad latus occidentale montium Khasi. (H. Godwin-Austen.)

In shape this form approaches the Darjiling *D. Blanfordiana*, Bens., but may easily be distinguished by the distant and prominent sculpture. But two specimens were found.

3. D. LABIOSA, n. sp. Pl. II., fig. 3.

Testa dextrorsa, non rimata, ovato-acuminata, pallide succinea, solidula. Spira attenuato-conica, subturrita, apice acutiusculo, sutura impressa. Anfr. $7\frac{1}{2}$-8 convexi, primi confertim costulati, 3 ultimi lævigati, nitiduli, antepenultimus major, ultimus versus aperturam interdum subdistanter costulatus, antice ascendens. Apertura verticalis, late auricularis, subcircularis, plicâ columellari validâ munita; peristoma rectum, incrassatum, subtriplex, externum valde expansum, internum expansum, sulcatum, subduplex, margine columellari brevi, subsinuato, subtus angulo vix saliente desinente; callo parietali, tenui, mediocriter expanso.

Long. $3\frac{3}{4}$., diam. vix 2 mill. Ap. c. peristomate $1\frac{1}{2}$ mill. longa, diam. intus circa $\frac{3}{4}$.

Hab. Mayong et Habiang in montibus Khasi et Garo dictis. (H. Godwin-Austen.)

This shell is, in some respects, intermediate between *D. pachycheilus*, Bens., and *D. diplocheilus*, Bens. It has the general form of the first, but resembles the last in its smooth lower whorls. The peristome is largely developed and peculiar, the inner portion being flatly expanded and almost divided into two portions by a groove, so that the whole lip is almost triple.

4. D. GIBBOSA, n. sp. Pl. II. fig. 4.

Testa sinistrorsa, vix subrimata, gibboso-ovata, tumida, succinea, lævigata, parum nitida, tenuiuscula. Spira supra conoidea, sutura valde impressa, apice obtusiusculo. Anfr 5. antepenultimus major, ventricosus, ultimus subtus rotundatus, alte ascendens. Apertura obliqua subelliptica, plicâ columellari validâ obliquâ munita, infra plicâm excavata; peristoma leviter sinuatum, expansum, duplex, externum retro relictum, internum continuum, patens, callo parietali lato, suturam fere attingente. Long. 3, diam. $1\frac{1}{2}$mill. Ap. c. perist. $1\frac{1}{2}$ mill. longa, intus vix 1 lata.

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Hab. Habiang in montibus Garo (H. Godwin-Austen).

This very interesting species differs widely in form from the only previously described sinistrorse *Diplommatina* inhabiting India, *D. Huttoni*, Pfr., more widely than it does from some of the reversed forms met with in the Oceanic region. It shews a considerable resemblance in form to *D. Martensi*, H. Ad., of unknown locality, figured in the Proc. Zool. Soc. for 1866, but which is said by its describer to belong to the section *Diancta** of Martens, characterised by a constriction at the back of the penultimate whorl. In *D. gibbosa* as in most Indian *Diplommatinæ*, there is a slight tendency to constriction in front of the penultimate whorl, to which an internal rib appears to correspond, but which is covered and concealed to a great extent, by the parietal callus of the peristome.

5. D. Austeni, n. sp. Pl. III. fig. 2.

Testa dextrorsa non rimata, conico-ovata albida vel succinea. Spira superne conica, non attenuata, sutura impressa, apice obtusiusculo. Anfr. 6, primi 3 gradatim crescentes, confertim minute costulati, ultimi lævigati vel costulis subobsoletis signati, antepenultimus major, ultimus aliquando lineis subdistantibus versus aperturam signatus, antice ascendens, subtus rotundatus. Apertura verticalis oblique subovalis; perist. incrassatum, mediocriter expansum, duplex, margine columellari verticali, angulo aperto subtus desinente, basali rotundato, plicâ columellari mediocri, callo parietali expanso.

Long. $2\frac{1}{3}$, diam. $1\frac{1}{3}$, mill. Apertura c. perist. 1 mill. longa, intus $\frac{2}{3}$ lata.

Hab. Cherra Poonji et Maotherichan in montibus Khasi (W. Theobald et H. Godwin-Austen).

I, some years ago, received a specimen of this species from Mr. Theobald as *D. polypleuris*, Bens. On comparing the series of *Diplommatinæ* collected by Captain Godwin-Austen with Mr. Benson's description, it is evident that the type of that species belonged to a different form, found abundantly by Captain Godwin-Austen with the present species on the Maotherichan ridge, part of the Northern scarp of the Khasi hills, and distinguished from the present form by

* From the description however of *D. constricta*, Martens, the type of *Diancta*, that species would appear to possess peculiarities not shared by Mr. Adams' species.

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its much stronger sculpture, less conical spire, deeper suture and rounder mouth. It is also a smaller form. Mr. Theobald's type specimens of *D. polypleuris* were from Nanclai, also on the northern portion of the Khasi plateau. *D. Austeni* varies considerably in the sculpture of the lower whorls, which are in most specimens, quite smooth. One individual sent is considerably more tumid than the type, but presents no other difference of importance.

6. D. OLIGOPLEURIS, n. sp. Pl. III. fig. 4.

Testa dextrorsa, non .rimata, conico-ovata, costis distantibus obliquis ornata, fulvescenti-albida. Spira conica, apice obtuso, sutura impressa. Anfr. 6, rotundati, antepenultimus major, tumidiusculus, ultimus antice ascendens, subtus rotundatus. Apertura verticalis, late auricularis, plicâ columellari validâ munita; perist. rectum, duplex, internum antice porrectum, expansulum, externum late expansum, margine columellari verticali, callo parietali mediocri. Long. 2, diam. vix 1¼ mill. Ap. c. perist. ⅝ mill. longa.

Hab. Teria Ghat ad latus meridionale montium Khasi. (H. Godwin-Austen).

This is evidently a peculiar type. In some specimens the sculpture on the lower whorls appears to be more or less obsolete. The form is not unlike that of *polypleuris* and *Austeni* but it is easily recognised by its strong distinct costulation. In this character it resembles *D. scalaria.*

The smooth or spirally lirate *Diplommatinæ* of Southern India I have proposed to distinguish as a subgenus under the name *Nicida.* This will include,

Diplommatina (*Nicida*) *Nilgirica,* W. and H. Blanf. Nilghiris. (Type.)

D. (*Nicida*) *Kingiana,* W. and H. Blanf., Kolamullay; and the following additional species.

D. (*Nicida*) *Pulneyana,* n. sp. a less tumid form than *D. Kingiana* with more convex whorls, deeper sutures, oblique aperture and a non-ascending last whorl. It has no basal keel. Common on the Pulney hills where Mr. Fairbank obtained it.

D. (*Nicida*) *nitidula,* n. sp., a tumid species, more so than any other met with, and with flattened whorls. Found in the Wynaad by Capt. Beddome.

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D. (Nicida,) Fairbanki, the largest form yet found in Southern India 3¾ millimetres in length. It has 7½ whorls and resembles a lengthened specimen of *D. Nilgirica*. The last whorl rises to an unusual extent and there is a basal keel. From the Pulney hills (Rev. S. Fairbank).

D. (Nicida) liricincta, a conoidly ovate shell with marked spiral ribbing, being the only species so far as I am aware yet found belonging to the *Diplommatinidæ* which possesses spiral sculpture. Found abundantly at Khandalla with *Cyathopoma Deccanense*.

The new species are described in a paper recently sent to the Journal de Conchyliologie.

Figures of the species of DIPLOMMATINA, Benson, *hitherto described as inhabiting the* HIMALAYAS, KHASI HILLS *and* BURMA, *with some additional forms from Darjiling and the Khasi Hills.—By Captain* H. H. GODWIN-AUSTEN, *F. G. S. &c.*

Pl. I. Himalayan species.

Fig. 1, *Diplommatina folliculus*, Pfr. typical form, Masúri.
„ 2, *Do.* *Do.* var.—Kalunga, Deyra Doon.
„ 3, *D. Huttoni*, Pfr.—Masúri.
„ 4, *D. costulata*, Hutton,—ditto.
„ 5, *D. pachycheilus*, Bens.—Darjiling.
„ 6, *D. semisculpta*, W. Blanford, n. sp.—ditto.
„ 7, *D. pullula*, Bens.—ditto.
„ 8, 8*a*, *D. Blanfordiana*, Bens.—ditto.

Pl. II. Khasi Hill species.

Fig. 1, 1*a*, *D. diplocheilus*, Bens.—Teria Ghat.
„ 2, 2*a*, *D. scalaria*, W. Blanford, n. sp.—Habiang.
„ 3, 3*a*, *D. labiosa*, W. Blanford, n. sp.—Northern portion of plateau.
„ 4, 4*a*, 4*b*, *D. gibbosa*, W. Blanf. n. sp. Habiang.

Pl. III. Khasi Hill species, continued.

Fig. 1, *D. polypleuris*, Bens.—Northern portion of plateau.
„ 2, 2*a*, *D. Austeni*, W. Blanf. n. sp. Cherra Poonjee, &c.

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Fig. 3, 3*a*, 3*b*, *D.*—— *n. sp.*—Nongsingriang.

„ 4, 4*a*, 4*b*, *D. oligopleuris*, W. Blanf. n. sp.—Teria Ghat.

„ 5, 5*a*, animal of *D. folliculus*, Pfr. Deyra Doon variety.

Pl. IV. Burmese species.

Fig. 1, 1*a*, *D. sperata*, W. Blanford, Arakan Hills, west of Prome.

„ 2, 2*a*, *D. Puppensis*, W. Blanford, Puppa Hill, Upper Burma.

„ 3, 3*a*, *D. exilis*, W. Blanford, Mya Leit Doung, near Ava.

„ 4, 4*a*, *D. nana*, W. Blanford, Akoutoung, Pegu.

(For descriptions of new species, see last paper.)

Notes on the Pangong lake *district of* Ladakh, *from journal made in* 1863.—*By Captain* H. H. Godwin-Austen, *F. R. G. S., Topographical Surveyor.*

[Received 16th June, 1866.]

To the north of the Indus, from its junction with the Dras river, lies a high range of mountains which separate the Indus drainage from that of the Shayok or Núbra river. The axis and great mass of this range is granitic; on the west this extends to within a very short distance of the river, while at Pitùk below Leh, the granite hill on which that large and well-known monastery stands abuts on the Indus itself, and thence towards the east for a considerable distance it holds the same position. The great mass of coarse sandstones, red clays, grits, and conglomerates seen on the right bank of the Indus, west of Pitùk, are now seen on the left or south bank, thence to the east in the direction of Stock and Himis. On the above granite range are several passes leading into the Shayok valley, all of great elevation, and on the direct road from Leh to the Pangong lake are two, viz., the "Chang La," and the "Kay La," both high, being respectively 17,470 and 18,250 feet above the level of the sea.

The ascent to the first is gradual from the village of Tagar in the Chimray valley, which there divides into two large ravines,

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the western branch leading to the Wuri La, while the eastern runs up to the two passes above-mentioned. On the 15th July, when our party crossed the Chang La, the snow that had fallen in the early part of the month still lay covering about three miles of the road, and being fresh, it was glaringly white in the sun and much affected the eyes of our servants and the coolies, while all suffered more or less from the effects of the rarified air; curious to say, on the return journey *viâ* the Kay La, 800 feet higher, scarcely a man suffered from this cause; we had then been living for some time at a high altitude, which very probably had not a little to say to our immunity from the fatigue and headache engendered at high elevations. The mountains on the northern side are perfectly bare, a little grass growing only along the bottom of the valley which had a steady easy slope the whole way to Durgo; a small tarn lies near the encamping ground below the pass, and another somewhat larger is passed about a mile further down the valley, and the scenery is not remarkable save for its huge scale and bleakness. Before reaching the village of Durgo, one emerges out of the narrow valley upon the level surface of one of those large accumulations of alluvial sands and shingles that are seen along the large valleys of these mountains; the powerful force that accumulated the materials that form them is now extinct, and the circumstances attending their formation, and more wonderful subsequent denudation, are as yet but little understood. At this spot the vast scouring process was well exemplified, the level of the plateau on which I stood could be traced across the valley in and out of its numerous ravines in a perfectly horizontal line of a different colour, where very small portions of the alluvium still adhered to the slopes and precipices; and I do not think I am exaggerating when I state that its thickness at the junction of the streams below Dùrgo was over 1,500 to 2,000 feet. Traversing the level surface of this plateau for about a mile its edge is reached, and Dùrgo with the valley up to Tanksè is then clearly seen, a narrow green belt near the river with barren easy slopes thence to the foot of the hills.

The whole valley is very open,—low cliffs of alluvial sands and clays can be traced the whole distance on both sides,—and it is self-evident that at no very distant period this presented a long reach of water. An after sojourn on the Pangong fully confirmed this; it was in fact

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a drained portion of that line of lake; perhaps caused by some local alteration in the levels of the country.

From Dùrgo to Tanksè is a distance of eight miles and the road quite level. The stream is considerable and contains a small kind of fish of which I saw numbers at the Dúrgo bridge. The road follows the right bank for nearly the whole distance, mountains rise to a great height on either side, and at the southern end of the valley, towering above Tanksé, is the fine snowy peak called in the survey Tanksè No. 1. The village of this name is large and a very fair area is under cultivation—lucerne grass grows luxuriously. Many of the houses are built close under a large mass of conglomerate, the stones firmly cemented in it, and to this cause it must owe its present existence at the mouth of the narrow gorge towards the Pangong, out of which the soft beds have been washed away. The remains of an old fortified post still cover the upper portion of this conglomerate bed. The main stream comes from the southward, and drains the Lúng Yùghma valley and the mountains on the north of the Indus river. It is joined at Tanksè by the small stream that drains the valley up which the road to the Pangong runs; this is at first rather shut in and confined by the mountains that rise in cliffs on either hand, but where it takes the more direct easterly direction it opens out considerably; high cliffs of the alluvial shingly deposits again occur, forming a belt at foot of the mountains of the northern side about 300 feet high and some 400 yards distant from the stream. Mùglib, where I halted, about 11 miles from Tanksè, is a very small place. At this point a broad belt of green pasture land extends along the valley, and through it the little clear stream finds its way in a very tortuous course, but above Mùglib this green belt becomes very swampy and on it several Brahmini duck were seen. The stream above flowed over a stony dèbris from the hills, with occasional patches of grassy and watery ground, and at about three miles the road passes two little tarns; these had been evidently larger at that season of the year when the snows are melting, or after an extra amount of rain has fallen. The physical appearance of the whole length of this valley showed unmistakable signs of its having at one period been the bed of a lake, and I am induced to think for a portion of that time continuous with the portion below Tanksè and that the mass of alluvial above Dùrgo

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was contemporary with that above Mùglib. Above the two lakes, Tragùmè Bur Tso, there is no longer any water in the bed of the stream save at intervals here and there, where it breaks out in a small rill to lose itself in the loose gravel a few yards lower down. Over distances of more than a mile it is deep white sand, the collection of which is a good deal due to the wind. Down to this sand the talus from the mountains extends tending every year to increase the height of level. At the low pass of Surtokh, whence one obtains the first view of the Pangong lake, this action is nowhere so well seen; this ridge of Surtokh forms the watershed across the natural exit for the waters of the great lake and is entirely formed by the loose shingle brought down a somewhat large lateral ravine from the snowy peaks to the south : this bed of talus actually divides, part to the eastward, part to the west, as exemplified in the sketch annexed (Fig. 1), so that the waters may in some years flow one way, in others another. If the supply of water to the Pangong lake were equal to what it must formerly have been when the glaciers were double their present size, the continual flow of water would soon carry off these talus accumulations from the mountains above Surtokh; there being now no force in action for this purpose, the snows of winter and the waters of the side ravines tend to raise the main valley level every year. The Pangong Tso (lake) is about two and a half miles distant from the low ridge of the Surtokh La, or more properly speaking, its natural bar or bund, but the level of the old lake bed extends up to within a very short distance of the pass. A rise of 150 feet in the waters of the present lake would find them again an exit down the valley to Tanksè. A Trigonometrical station lies close to the water's edge, it bears east-south-east from a rock, a quarter mile distant out in the lake, and is marked with a stone having the usual dot and circle cut on it; its height has been determined trigonometrically to be 13,931 feet above the sea. From this mark-stone, a fine view of the first long reach of this elevated and interesting piece of water is obtained. Its colour is of an intense blue, the water as clear as crystal, but far too saline to be drinkable; there was quite a true salt water feel in the air as the wind blew off it. This was a good site from which to form a commencement of my survey work, as knobs and peaks were seen for many a mile along the spurs that descended from

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the ranges bounding the northern shores. From the height at which one stood these all appeared comparatively low; only on the highest lay a few small patches of snow, thence to their bases was one succession of shades of yellows, purples, reds and browns, the invariable colouring of Tibet—not a scrap of green. My intention was to proceed along the northern shore as far as it was possible, and eventually to turn north, and work round into Chang Chùngmo. But it being necessary first to see something of the south side also, I left the supplies and sepoys at the spot where we had first struck the lake; and taking one small tent, I marched on, skirting the southern shore towards a low point that runs down to and overlooks the whole of the western end, and forms the termination of the longest spur from the lofty snow-bound range, which forms the southern watershed of this basin.

Late in the afternoon we reached a very small patch of cultivation, with some two or three wretched huts called Spang Mik, and the next morning, by 9 A. M., reached the foot of the low point, named by the Survey Pankong (*b*) Hill Station. For so high an elevation, a considerable amount of green grass, Tibetan furze, and cultivation occurs on the west side of the hill, having a few houses scattered about it, forming the village of "Mun," the largest in the Pangong district. I ascended from it to the station by a short easy pull of some 1,000 feet above the lake, obtaining a most commanding view, up and down it, across to the spurs of north bank and high up among the snowy peaks to the south, where small glaciers just show their noses above the masses of the old moraines, which extend down to the ancient level of the lake. Little streams flow down these steep inclines like silver threads from the ends of these glaciers, to finally lose themselves in the silt and sands that skirt the edge of the lake, for only the most considerable of these streams find an exit in its waters. Such is the one that flows through the little oasis of Mun; it owes its size to the streams from three glaciers uniting some distance above the village. The silt brought down by these, has formed a miniature delta, or arm of shallow water, running out into the lake. In the course of a conversation with the coolies and men of Mun, I learnt that some three or four marches further on, the lake narrowed to a mere stream which was fordable, and that it was not necessary to follow the northern shore, where ran besides the worst road. I

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changed my route, sent back for the supplies and camp at Spang Mik, and late in the evening, they had all arrived. Other advantages accrued by following the south shore, *viz.*, that I saw more of my ground without having to ascend to very high peaks, there was plenty of water and wood as far as the Chushal river, and the villages extended further. On the other hand, the northern shore is very bare, and water is only obtainable by digging holes close to the edge of the lake, into these water percolates, but only slightly less saline. On the 22nd July, my march lay over the sandy, stony plain, skirting the shore of the Pangong, crossing two or three ravines, where sections are well displayed of former and higher levels of its waters in sands, interstratified with an angular rubble like that distributed over the present surface. At about eight miles from Mun, the straggling village of Mèruk is passed on the right hand, and the last on the lake Karkpèt is three miles further. The level ground between the shores and the foot of the mountains increases much in breadth as one proceeds east, and the stream from Chushal gives, from a distance, no signs of its proximity, and I was rather surprised on coming suddenly upon a fine body of water, flowing with a quiet current through a narrow belt of green grass some 10 feet below the surface of the plain. Finding plenty of wood and a nice green sheltered spot under the bank, I pitched camp by the side of it.

The extent of level ground here is considerable, quite ten square miles, dotted over in the vicinity of the stream with a few low bushes, and over the rest grows a scanty coarse grass in tufts. Towards the shore of the lake rise two very conspicuous isolated low rocky knobs a mile apart, and between these is the confluence of the Chushal stream and the Pangong Tso. The next morning I walked across and ascended the most eastern eminence, having the strange sounding name of Tuggù Nuggù. This had formerly been a fortified post, the level space at the top was enclosed by a low stone wall, while a detached out-work had been built on the low spur that ran out on the east side; none of my coolies, who were all from this district of Pangong, could give any account of it, as to when or by whom it had been built; it must be comparatively an ancient work, still considering how soon events are forgotten by such men, its age may be only 150 to 200 years. It was a lowering morning; and before I had finished

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my survey work from this position, it came on to rain hard, which we sat out on the top; the shower passed off up the lake, and it had a fine effect on the view in that direction, with the lines of falling rain over the expanse of water, and the misty mountains bounding its sides. The state of the plain which, when dry, is covered with a hard incrustation of lime and a salt, that crackles under the feet, had now by the wet been turned into a sticky loam that adhered to the boots in huge lumps, and remained like a cement upon every thing it came in contact with. One and a half miles beyond Tuggù Nuggù low spurs abut upon the lake in cliffs of 150 to 200 feet high, and the way leads along the narrow shore at their foot, with very deep water washing the bank. Passing one large bay we rounded a low narrow point of beach only to find the existence of another bay, called Phùrsook: this forms the boundary between the Kashmir Rajah's territory and the Chinese district of Rudokh. Phùrsook formed a circular sheltered little lake in itself, a narrow strait only connects it with the water outside. It was evidently of great depth in places where the hills came down in cliffs upon it, a narrow beach ran along the foot of these formed of talus cemented by lime. The bay formed a perfect harbour, in which a line of battle-ship might have floated, and sailed in and out of. Were this lake in a less elevated region, or on a line of trade, how useful would the water communication prove up and down the extent of its two long portions. The first or lower lake is 40 miles in length; the second 33, giving a total of 73 miles, exclusive of the upper long portion beyond Tso Nyak, which is quite 18 miles.

I shall not detail each day's march, winding in and out of the bays of this long length of water, but will attempt to give a general description of it, connected with which are several points, both curious and interesting.

The first that must strike any one of observation is the evidence of this lake having been formerly fresh for its entire length. Myriads of dead fresh-water shells now strew the shore: these, thrown up by the waves in a long white ridge, lie so thick in some of the bays they can be taken up in handsfull. They are principally of *Lymnæa* and *Planorbis;* but though I searched diligently, I never found a large bivalve, only one very tiny *Pisidium* that I found inside one of the

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specimens of *Lymnæa;* nor did I ever find a living specimen, which I had hoped to do in the upper lakes, where the water was very slightly brackish. When these shells existed, the former lake must have had quite a different aspect from its present one, and in it must have grown for the sustenance of these molluscs beds of water plants, while its banks would have been fringed probably with grass and rushes. In the lower lake there is not a vestige of any sort or kind of plant, the beautifully blue clear water washes a bank of sand and pebbles, the latter perfectly free even of algæ. This is not the case beyond Ote, where the water is much less salt, there the stones under water are extremely slippery and covered with vegetable growth. At this part also, patches of a coarse water weed are also seen here and there along the shore, but not growing luxuriantly, and evidently making a struggle for existence. The waters of the western end are far more salt than those of that near Ote, noticeable even to the taste, but it is not until the stream that connects the two portions is fairly entered that it is by any means drinkable; thence for the whole distance eastward, we used the lake waters save when we had the luck to find a spring of really fresh. By looking out carefully, we discovered springs in three places flowing out from under the bank; and in one spot, these springs were bubbling up for some distance out into the lake, rendering the water quite fresh around. It was quite a pleasure to see the poor yâks who carried our baggage take their fill of it, when for three days they had drank nothing but salt water. A curious feature of the Pangong is the almost entire absence of streams, whose waters find an exit in it, considering the great area that some of them drain; for, with the exception of the few glacial rills and the Chushal stream on its south shore, and the stream at the extreme west end, from the Marse Mik La, there are none. The northern shore is particularly dry, not a single rill joins it for its entire distance, until arriving at "Pal," on the upper lake; and the same may be said of the southern shore, from the Chushal river to Ote, and for many miles beyond. Many of the ravines have their sources at a considerable distance, but near the lake have broad dry beds from 2 to 3, and up to 500 yards in breadth of rubble and sands. I may instance the very large lateral ravine at Ote, the longest branch of which runs back into the snowy mountains of Chang Chùngmo, for

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a distance of 40 miles, draining altogether an area of nearly 400 square miles. The silt which in former times has been carried down from the above area has formed the plain of Ote, the broad barrier to what would otherwise be a continuous long reach of water. This was no doubt the old configuration of the lake, for a rise of some 12 feet would cover the greater part of the Ote plain even now. In nearly all the higher ravines, water is plentiful, and glaciers of the second order are seen, but the streams are all sopped up in the broad bed of the main valley which acts like a perfect sponge; the stream breaks out occasionally here and there only to hide itself a few hundred yards down, the last water seen being above the fort of "Lanakh-khur," but it nowhere is seen to flow into the lake, being lost in the sands of the plain.

Another point in the history of this lake, on which may be based a good deal of theory as to its older aspect, is the former size and extent of its waters. On every side unmistakeable traces that the level was much above the present one, are seen in the lines of old beaches and in the beds of sand, containing the fossil remains of fresh-water shells,* interstratified with beds of angular dèbris, which I mentioned before, are to be seen in the little dry ravines that cut through the plain, over which the road from Mun to the Chushal stream runs. Fig. 2. is a rough section of these beds, in which No. 1 represents the present plain of surface dèbris, the scattered talus of rocks brought down from the mountains of the south bank, when the small glaciers, at present only two to four miles long, extended nearly down to the lake, as proved by their old moraines still to be seen. Winter snow and the water action of time have spread their materials far out, nearly down to the water's edge. No. 2 are fine sands and arenaceous clay, such as would be now in the process of formation near the dèbouchement of the Chushal stream, perhaps a little coarser, which a moister climate would entail. It contains shells and stems of plants. No. 3 is a bed of angular débris, the same in every respect as the upper bed, No 1, but much thicker. No. 4 again are sands, like No. 2, containing the same shells. No. 5, débris as beds 1 and 3.

* These fresh-water shells are the same as those now found on the edge of the lake, while the stems of plants are plainly discerned; where these last are seen, the sandy clay is generally tinged with an iron colour.

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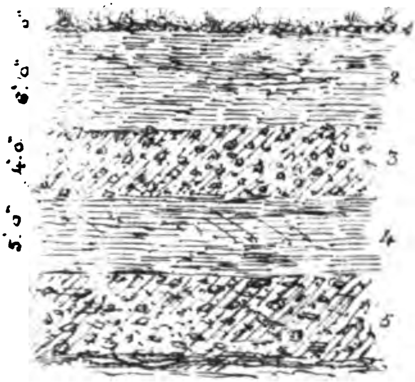
Fig. 2.



This section proves great changes, and also, I think, that the lake existed prior to, certainly during the latter part of, the great glacial period in the Himalayas. Whether the scooping out of the depression in which its waters lie, is due to glacial action in the first instance, when this high region was (as is most probable) deeply overlaid by ice and snow, is a hazardous question, and one rather problematical. From the alternation of the beds of débris and finer deposits, we can infer that there have been changes from milder and moister seasons than at present exist, back to colder and drier; during the first, beds like No. 3 would have been deposited by the increased transporting power that would have carried the materials further out into the lake; while, at the same time, the level of the waters would naturally have been much higher. Its waters must then have generally held much silt and mud in suspension to form the shell beds of above section. At the present day, no deposit of any kind is taking place, save perhaps near the debouchements of the Chushal, and the extreme western tributaries. A closer inspection with some levelling would, I think, somewhat clear up the mystery attached to the huge masses of alluvial deposits seen in the valleys of all the great rivers of the western Himalayas, from the Chang Chúngmo and Leh, to Skardo in the valley of Kurgyl and valley of Dras, and on both the Jhelum

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and Chandra-bagha (Chenab) rivers. Give a greater rain-fall to the Pangong district, and a lower snow line (now above 20,000 feet), the ravines would be seen with fine running streams in them, and, allowing time, would cut through the barrier at the Surtokh La;* and eventually down through the whole length of the alluvial deposits in this lake basin, the large valley and its tributaries then drained would resemble most closely on either side the sand, shingle, and conglomerate deposits now seen at Tanksè and on the above-named rivers. These deposits at Ote would be somewhat higher, and would cover a greater area from the junction of the great tributary there. The height of the waters of the Pangong have much diminished, and are diminishing at the present day: the first travellers who visited it, now some years ago, would I think find a marked difference on its shores. The coolies of the district assured me that formerly, say 30 years ago, it was not practicable to proceed along the southern shore, following close to the edge of the lake from Phûrsook to Ote, which at present is quite easy—even yâks can be taken. Only in one or two spots was there any difficulty, where the cliffs approached close down to the water's edge. A rise of 15 feet would bring the water close to them, and even 10 feet would render such placees quite impracticable for animals and nearly so for man. From other information I could collect, the fall must now be from 1 to 1½ feet per annum. The difficult spots mentioned above have only been practicable for yâks for the last four years (1863); before that time the track lay over a rough ridge a short distance back from the shore. The men of the district also said that it is only for the last 20 years or so, that the waters have fallen at this rapid rate. The rock that lies out in the lake at its western end, distant 1¼ mile from the shore, is about 5 feet high. It has only been noticed for the past four years, so this would again give a fall of about one foot a year. Again the numerous lines of the beach marks,—and at some points as many as five and six can be counted,—denote falls of level of about a foot.

* The rock bounding the north side of this pass is a hard crystalline limestone, nearly on edge, up to the plane surface of which the ridge of detritus extends. The depth to which the rocks *in situ* have been eroded prior to the talus that has since been precipitated against them, is in all probability sufficient to drain the whole extent of the Pangong and valley towards Tanksè, if these present accumulations were removed.

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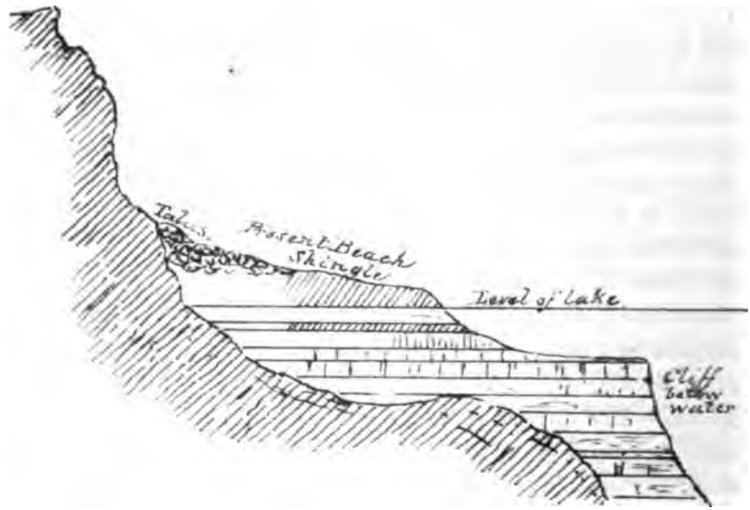
These all lying close to the water's edge are very recent, as evidenced by being so well defined. But as a proof that the waters of the Pangong lake in former times have fallen below its present level, I may state that on a long point of land in the little bay of Phûrsook in deep very clear water, I looked down upon a terrace 10 feet below the surface which terminated in a cliff, where the stratification of the sand and clays could be well seen, the bottom was not visible beyond this, and it was too far out to sound the depth. This would be the section,

Fig. 3.



The only deduction to make from such comparatively recent changes is, that the level of its waters has been alternating with moist and dry periods of time, the slow process of which may be even now going on almost imperceptible to man: the water of the Pangong depending as it does mainly on the winter snow, (query, may not the snow-fall in this part of the Himalayas be much less now than formerly?) and the country passing through a period of diminishing falls. Slow as such changes may be, they are by no means improbable or impossible. The western end of the Pangong Tso lies as nearly as possible in latitude 34° and longitude 78° 30′, thence its direction is due south-east to latitude 34° 40′, it then takes a bend easterly

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and follows that latitude as far as Noh, in longitude 79° 50′. The mountains to the north-west of the first long reach are of no great apparent elevation; in July there was very little snow to be seen, and only on the very highest portion, or the main range, which nevertheless is from 18,000 to 19,500 feet high; the highest peaks being 20,000; but the level of the lake being 13,931 feet above the sea, detracts considerably from their great altitude. The terminal knobs of the spurs from the above range lie close on the edge of the lake, rising to the height of 600 to 1,500 feet, generally terminating precipitously, and the lake I should imagine is excessively deep at such places. It would be a most interesting scientific enquiry to sound with some portable kind of boat the depth of this lake. To the south-west a high range runs parallel to the lake, some of the peaks on which attain an altitude of 21,500 feet; this range terminates in a peak above and to the east-south-east of Tanksè, which is 20,003. The above fine line of mountains, covered as they are with perpetual snow, and their ravines terminating above in small glaciers, form a fine boundary to this valley on the south. The southern watershed follows the lake very closely as far as Ote. It there extends further south, and between that place and Pal, several very large lateral ravines descend into it, all with the usual broad, dry, gravelly beds, the largest of these are the Algrong, Tengun, Kiam-Surpo Loombas, or valleys. On the northern shore, beyond the very large valley of Chang Burmah, which finds its exit at the Ote plain, there is another, the Dal-Loomba, that drains the considerable tract of 150 square miles; the silt carried down from this has narrowed the lake very much, forming a low point jutting out into it, and has contracted the waters to a quarter of a mile in breadth. Altogether the mean breadth of the second lake, "Tso Nyak," or "middle lake" is much less than the first or true "Pangong."

Wherever a tributary ravine joins the shore, there is grass, scanty as a rule, and of a very coarse kind. At Ote it is much richer, especially in the vicinity of the stream that unites the two lakes. On both banks of the second lake, wood is found in plenty, growing luxuriantly in places; at Algrong and Numkum it formed a scrubby jungle, but on the northern shore, at Silùng, it was met with no more, and the only fuel was a stunted plant which throws out a good

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deal of woody root, and is found all over this country; and I never found a scarcity of it even up to 18,000 feet in the Chang Chùngmo, save where the ravines were very rocky. Descending from the small ridge between Paljùng and Pal, the extensive plain near the latter comes in view, bounded by low spurs on every side save the east, where a conspicuous peak rears its head. A small stream winds its way through the eastern side of the "maidan," and joins the lake being the only one on the northern shore that does so. Three and a half miles beyond Pal, the second lake ends, and a small stream is found flowing into it through half a mile of sandy flat ground, beyond which is another lake, called Tso Rum, having a length of about four miles. After crossing again some flat ground, Lake Tso Nyak, (the second,) is reached connected as before described with Tso Rum below. Near the northern shore of this last is situated the small village of Noh, a short distance up a tributary from the north. This place I much wished to visit, but as will be shown further on, I could not manage to accomplish it. On the northern shore of Tso Nyak, the effects of a very peculiar natural force may be seen; at intervals a ridge of sand and earth runs parallel to the line of beach, at first I attributed this to the action of waves, but observing the large proportions of these banks in some situations, and at last seeing the ridge quite 6 feet high; and, moreover, that the bank had been fairly turned up, as if with a gigantic plough, I was fairly puzzled to account for such an appearance, and on questioning the guides then learnt, that during winter, when the lake is frozen over hard, the water naturally accumulates under the ice and flowing westward can find no exit. When the pressure becomes too great it tears up the frozen earth on the shore and being liberated flows over the surface of the ice. I give a slight sketch (Fig. 4.) of a section through one of these banks, showing the old surface grass still growing on the perpendicular face of the upheaved ground, which of course is on the inland side. On measuring this, I found it an inch or two over 6 feet.

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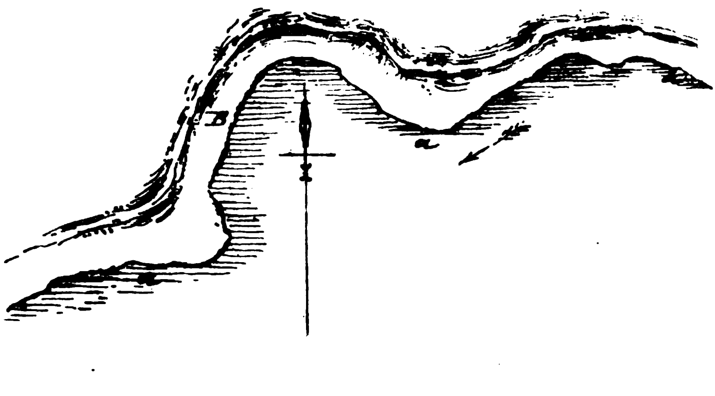
Fig. 4.

I noticed also that the banks were higher and better developed on the western curves of the bays. One reason for this may be seen by a glance at the accompanying diagram, (Fig. 5.) where *a, a, a,*

Fig. 5.



represent the shore of the lake, the waters of which have a tendency to flow west, in direction of the arrows. These waters (?) suddenly increased by springs in bed of lake, and subjected to the upper pressure of a frozen surface meet with another resisting force in the curve of the bay at B. That line where the ice, united to the frozen ground, meets the dry soil into which water does not percolate, and is consequently comparatively dry, would be the

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line of least resistance; and upon that line the disruption would take place and the pent up waters find an exit. Where the bank is sandy or clayey and covered with grass, it would be turned up in the manner as shown in Fig. 4. In spots where the shore is gravelly, the water seems to drive in the sand and stones before it from the bottom of the lake out upon the shore, and this being a continuous annual action it has in some bays formed a bank quite 3 feet high. Whether this phenomenon has been observed before on other lakes I do not know; it could not take place even here, did not this lake Pangong receive a large amount of water from the east, with a determination to flow towards its old natural exit near Lûkoong. During summer, evaporation no doubt carries off a great amount of the surplus water that drains into it, but in the winter this must cease, and with its upper casing of ice the water to free itself thus tears and roots up the bank in the curious manner above detailed.

During the whole time I spent on the shores of the Pangong, the only animal I saw was the Kyang, or wild ass of Tibet, a few couple of these were grazing on the grassy maidans of the northern shore. Of the birds, geese were plentiful in the stream between the first and second lakes, and I saw many young broods. The Brahmini goose, teal, a red-headed diver with white body, and a very black plumaged duck, made up the water birds. There was a great scarcity of the smaller birds, a sandpiper and wagtail were occasionally seen on the shore. The large fish-eagle was plentiful at Ote, attracted there by the fish which are seen for the first time in the slightly brackish water flowing out of the upper lake; this lake is full of them, they much resemble the tench in shape and colour, only somewhat longer in the body, and are covered with slime like those fish. I had fortunately brought a rod, and all its etcæteras, and had near Numkum, in deep water under the rocks, a very good afternoon's sport, catching some five and twenty; they ran about a pound in weight, the largest I caught being about 4 fbs. They would rise at a fly when the surface was much rippled, and seeing them rising at gnats, I managed to catch two with a small midge fly, the first artificial I fancy ever thrown on these waters; but their extreme clearness is much against fly-fishing. The most paying bait after all was dough; this they took readily enough, and I might have

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caught double the number in another hour, but had to move on to camp. These fish formed a welcome addition to our food as long as we remained on the lake, I supplied my old Bhut Moonshie and some of the guard with hooks and lines, they became fierce fishermen, and brought in good bags. It is a fine sight to see the lake during a storm, when a good strong wind is blowing down a long extent of its surface, and dashing the waves, which rise to a considerable height, against the hard rocky shore: I had the fortune to see its surface in this state one morning, and sitting down watched the waves rolling in; it was a minature sea, and Pangong waves brought up thoughts of beaches in old England. Though the country is so barren, the lake has its beauties in the varied tints of surrounding hills and mountains, and the rich deep blue of its waters, becoming quite of an emerald green colour as they shallow near the shore. During the summer months the lake is quite deserted, and we did not fall in with a soul the whole distance up to Pal, or we might not have got so far. At that time of the year, the flocks of shawl-wool goats, sheep and yâks, are grazed in the higher valleys on the young rich grass that springs up in some places after the snow has left the ground. During winter they are brought down to the level "maidans" near the lake, and Ote, I was told, becomes dotted with black "Champa"* encampments. Snow, they said, never lies long at Ote, though the lake freezes all over very thick, and the degree of cold must be very considerable;—what a glorious expanse for skating the lake must then present! The Champas or Changpas, who spend the winter on the lake at Ote, come from both Noh and Rudok. The said plain is a disputed piece of ground; the men of the Pangong district claim it, though judging by the site of an old fort standing on a low rock on the north-western side of the plain, I should say it undoubtedly belongs to the Lhassan authorities, by whom it was built years ago: proximity of Leh and greater power of the Thanadar there, places it in the Kashmir Rajah's territory. Walls of stone and earth are built up as a portection for the tents against the wind; and to render them still snugger, I observed that the interior floor had been dug down to a depth of 3 feet, which must make them warmer abodes. I found the summer winds of this country cold

* "Champa," the nomadic trides of this country.

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enough, what the winter are like I can well imagine: the amount of comfort, in a tent on the edge of a frozen sheet of water stretching for miles, must be a very minus quantity. During the whole period of my sojourn there in August 1863, the weather, with a few solitary fine days, was miserably cold, nothing but cloud, sleet, and rain. I may have seen it under disadvantageous circumstances, and I trust at times it does enjoy a little warmth and brightness.

On the 1st of August we reached Paljung, and in the afternoon of that day came in sight of the first natives we had seen, viz., three men driving some yâks in our direction, they saw us at the same time, and turned and bolted; we followed, but failed to overtake them, —it being about two miles to the point they had rounded,—they had disappeared up some lateral ravine out of sight: our approach was, therefore, known to the Rudok men. It rained in torrents during the night, camp was pitched at Paljung, where a long broad nulla bed came down to the lake, and a low long promontory ran from the hills on the north out into it. Our road next day on towards Pal lay over this, it being a very long round to follow the shore under the cliffs. From the low pass the broad dull green plain of Pal was seen, and on its eastern side we discovered the black tents of a small Tartar camp. As our approach was now certainly known to these people, we bent our steps towards them. Three men came out to meet us, and turned out very mild individuals, one being a Lhama or priest. Their dogs, of the large Tibetan breed, were much more noisy and furious at the intrusion of strangers, and were not to be reconciled until long after the tents were up. These Champahs informed me that one of their number was about to ride into Noh at once to give the news of our arrival, and have it thence sent on to Rudok, I at once sat my Bhut Moonshi down to write a letter to the Governor of the place, requesting that he would raise no difficulty to my paying the place a visit, and see its monasteries, &c.

The next two days I remained at Pal, for the hills were buried in dense cloud and a good deal of rain fell, so that I was unable to proceed with any survey work in an eastern direction; on the third day, the Zimskang of Rudok rode in with some twenty followers, and pitched his tents on the other bank of the little stream, and came over at once to see me. He was a native of Lhassa, a short, stout, jovial

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fellow, and brought a letter from the Governor of Rudok, and a white scarf, together with a present of two damuns (bricks) of tea, and some sheep and goats for my men. The letter was then read by the Moonshie, and was to the effect that it was not in his power to give me leave to visit Rudok, as he had strict orders from his superiors in Lhassa to prevent foreigners crossing the frontier, and that it would eventually be known if he permitted it. He added that he could not use force to prevent my further progress, but he trusted I would not lose him his appointment by so doing, and that I would accept the presents as a sign of friendship. Having received orders not to bring on any collision with the Chinese officials, I had to give up the idea of seeing Rudok, but I held out for one more march towards the place and gained my point, but not before showing some anger at their absurd wishes. The Zimskang again came over after my dinner about 9 o'clock at night, to beg I would not proceed any further; but I said they must abide by their first agreement. The afternoon of that day I was enabled to ascend the limestone mountain east of camp and fix my true position, the range around Rudok and the eastern end of lake were also again visible, and I was enabled to get intersections with other rays. The 5th broke fortunately clear and bright, so I started early along the shore of the lake in direction of Noh, my friend the Zimskang, stuck to me like a leech the whole day with a few of his men, and a curiously dressed rabble they were, with their enormous flat mushroom-shaped hats, and all mounted on little scraggy but sturdy ponies, they were all very jolly and amiable, I made no secret of my work, and showed and explained the map of the lake to him, which he thoroughly understood. I have found the people of Tibet far in advance of Hindustan as regards drawings, and what they are intended to represent. At a small hill called Tobo Nokpo, whence I had promised to return the previous day, I fulfilled my agreement evidently to the great pleasure of the Zimskang, who was now more pleasant than ever and thanked me with many salaams. On the 6th August my tents were struck to leave Pal, and the Rudok men did the same, I was invited over to their tents, previous to starting, to partake of a parting-cup of salted tea churned with butter, which is always kept simmering on the fire; it is by no means a bad beverage

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when made with good fresh butter. I gave him a few presents and we parted.

At the eastern end of the Pangong the hills somewhat decrease in altitude, the highest lying to the north of Noh. Looking in a direction due east from the higher points I ascended, the country appeared flat but undulating, and I observed in the far distance two or three pieces of water, these may turn out to be connected with Pangong Tso, probably bounded by steep sides which were not discernable at twenty miles, they may extend for some distance; the breadth of this high region was considerable, and extended up to a snowy range that rose suddenly on the south. The more level surface was not bounded by any mountains, and was seen stretching to the horizon.

The morning we left Pal was raw, cold, and cloudy; the road lay north-westerly for some distance over the dead level plain, that showed distinctly it had once been covered by water, for dead fresh-water shells are seen for some way; we then rose from it over a long very gradual slope of some three miles which at last contracted into a ravine, bounded with very low and easy scarped hills. A portion of this ravine was well wooded with the same kind of shrub as grew along the shores of the Pangong. The little camp of Champas continued their march with us; and had we been one day later coming into Pal, we should have missed them altogether and gone straight into Noh without meeting a soul. Nearly all their worldly goods were carried on sheep, only a few articles on the ponies which they rode. The women drove the former, and, in fact, did more in the packing, unpacking, and pitching of the tents, than their lords and masters; after which they were sent out on the hill side to collect the roots of a low shrub having a scent like lavender. One of the girls was very nice looking, and wore a peculiar head-dress which is not seen on the Ladakh side. The usually narrow fillet of cloth worn by the Ladaki women was treble the usual width, and covered with torquoise and silver ornaments; near the attachment at the forehead was a bar of silver set with small torquoise, pendant from which so as to lay on the forehead were a number of silver coins attached by short strings of coral beads, the effect was very good. I had the young lady brought over to my tent, where she sat for her portrait, and was delighted at the drawing made of her. The encamping ground was called Tobo

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Ruberu, and was a level piece of green grass, with several good streams of water flowing across it, for curious enough the higher ravines of the country have plenty of water, but they are all absorbed a few miles down in the sand and gravel of the broad water ways. The valley was here high, broad, and nearly level, the mountains were of no great elevation above it, not more than 3,000 feet; the lower slopes falling gradually from them into the valley, which was patched with furze of stunted growth, and plenty of good grass. The morning of the 7th broke clear, sunny, and bright, with a fresh breeze, we started early and gradually ascended the valley to the pass in our front, called the Dingo La (16,270 feet). On the top the ground was nearly level, expanding into wide open ground to the north; on the left rose a hill about 1,000 feet, which I determined to ascend to obtain a view over the hills and country around. Walking a short distance up this, a small tarn was seen in the centre of the level ground north of the pass, which had once evidently extended over the greater part of its area. Scattered plants of rhubarb are here seen but very tough and acid. The rocks were all of limestone formation, with a strike nearly east and west. I found no fossils, but it resembled in appearance the palæozoic rocks of Dras, &c. I obtained from the peak a fine view, but could see no more of the eastern end of the Pangong near Noh, on account of a dense haze in that direction. I was much disappointed and could only fix a peak or two looming up through the mist. My own camp and the Tartars had gone on, and I quickly followed them down the valley. This was very characteristic of these regions, spreading out into a broad gravelly plain, on the left side of which was a sharply defined scarp showing its general level had been uniform; this plain forms the head of one of the branches of the Dal Loomba. We parted with our Champa friends at a place called Chuchan, where they encamped to graze their goats and sheep for a few days, while we proceeded on along the side of the hills of the right bank rising gradually to a low pass called Sa Lam, and descending on the other side to another broad tributary of the Dal Loomba, which at this spot branched into three broad arms that penetrated into the mountains on the north for some eight miles. The longest of these valleys had a direction north-west, and up this our road to the Chang Chùngmo ran; no water was here to be found, and it was not until we

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had proceeded another two miles that water was found in the bed of the ravine. Where we halted fuel grew in plenty—the yellow flowered Tibetan furze, differing slightly from the European in not being quite so thorny. The valley was still broad, but the hill sides descended into it with steeper slope, it was here called Drukker. When on the Sa Lam a horseman was seen riding down the valley from the north, who joined us. He had come from an encampment up the valley, and said he was sent to escort us on to the pass ahead. Our movements were, therefore, well known, though we should not have supposed a human being to have been within miles, but the Champas were evidently on the watch, and espied us the moment we topped the pass of Sa Lam. Between camp and the Demjor La, the valley bore the same character, save that the broad gravelly bed was covered with a luxuriant growth of furze, this swarmed with hares, which got up in all directions, and I had some good shooting. The Demjor La was reached about 10 o'clock, I found it by boiling point thermometer to be 17,465. The rise was gentle the whole way, and it fell in like manner into the valley on the north. As I came up to the usual pile of stones on the crest, two fine *Ovis ammon* came round a spur to the right, at about 200 yards distance. I managed to get a little nearer, but missed them. A fine mass of hill rose to the south appearing easy and near, I sent the camp on to the stream below and commenced its ascent. This was a good deal steeper and further than I had anticipated, proving to be 20,240 feet high, but the labour was rewarded, for from the summit I obtained a splendid view, and did a large amount of work; massive snow beds still covered the top, and the wind was bitterly cold. The mountains to the south of the Pangong were well seen, with the great snowy range near the Indus beyond Rudok; and I still longed to go on in that direction. Of the mountains to the south and west, there was a fine view of a country bleak, naked, stony, and inhospitable; only in a tributary of the great Chang Burma Loomba, whence was a way to Ote, was anything green, a little grass and furze there skirted the stream. Work being finished, we were soon down again upon the level ground of the valley; and on a piece of very wet ground, I was surprised to flush a snipe. It was a bitter cold evening, but the camp was in as sheltered a spot as we could find, and there was some good grass here for the yâks. Our Champa guide

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took leave of us on the Dimjor La, so that we proceeded on the next day alone. The valley below camp took the usual configuration and ran towards the north-west, with a bed about one fourth of a mile broad. At about three miles we reached the confluence of a large valley from the north, and up this I determined to proceed, and thence ascend to Kiepsang, trigonometrical station. Several Kiangs were here seen, and up the valley numerous Tibetan antelope. After marching up the gravelly wide bed for five miles, whose main tributary turned to the east, and ended in an extensive elevated plain on the surface of which lay some large snow beds, we were rather at a loss to find water. I took the eastern branch, while the yâks and servants proceeded up the western (the Nertsè Loomba), towards a patch of green grass where I thought water would be found, and this proved to be the case. From this the staff on the top of Kiepsang was visible, and a very delightful little pull-up it looked. I followed the eastern branch to a low pass, which overlooked a narrow gorge that terminated a short way down on another high level plain. There was no track of any kind to be seen here, and my guides told me that the country on beyond was grazed over by a nomad tribe, called Kirghis, who did not own allegiance to the Rudok authorities; that they were great thieves and robbers, and occasionally came into Tanksè to exchange their wool for grain, of which they had none. These are the people who wander over the plains, thence to Ilchi and into a *terra incognita* on the east. It was not until late that I got back to camp, going to bed with the prospect of a stiff ascent next day. I was up and off very early, taking some breakfast with me; at this hour it was very cold, and the water of the little stream was frozen hard, and the backs of the yâks were quite white with frost. I took the line of a ravine which led up to the ridge east of the Kiepsang staff, the ascent was most fatiguing, over the loose angular débris that filled the steep bed of this ravine, whose waters were frozen into water-falls of ice. In this ravine we put up from under a rock a hare so benumbed with cold, it could not run, and it was knocked over with a stick by one of my coolies, to his great delight. On reaching the ridge, there was still a long pull up to the pole, but the view recompensed all the labor to legs and lungs; the ascent was 3,200 feet, the peak being 20,035, while the camp below was about 16,800. Bleak wastes of hill and wide dry drainage

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courses met the eye to the north-east, backed by some high mountains, whose loftier peaks were covered with snow, and threw down some small glaciers. To the south the great tributary of the Pangong, the Mipal valley could be followed for many miles, high rugged angular mountains bounding it on every side. It was very, very cold, and I could scarcely do my work, or hold the pencil, the clouds were gathering up fast; and before I left the peak it had begun to sleet, I got under the lea of the ridge for breakfast and made a brew of tea in the boiling point thermometer pot, of which I gave a tot all round to the Bhuts, and then descended on the western side into the valley below; by skirting the hill sides down into the ravines and over spurs, we reached by evening the Kiüng Gang La, 17,259 feet, on the boundary of the Kashmir and Rudok territory. At this pass are stationed throughout the summer months a guard of a few Rudok men,—these we now met,—and who got a dose of chaff from my Tanksé coolies, for thus being taken in rear, but they were very good humoured, and said that they were now off for their homes, and left that day with their ponies, black tent, tea churn, &c. We saw a good many antelope during the day. Near the pass was a great thickness of the conglomerates, sandstones, and coarse shales, seen in the Indus valley, which formation it is most curious to find having so wide an extension in this direction. This opens out a wide field for geological speculation. The south-west wind was bitterly cold all the afternoon, and in the tents, though they were in a somewhat sheltered ravine, it was very cold all night. The next morning we proceeded down the ravine to the north, which was grassy for some way. The coolies who had gone on with the breakfast things came upon seven wild yâks, who went off down the valley and were not seen again; they are, I believe, very wary; great numbers are to be seen here later in the season, when they are driven out of their higher haunts by snow into these lower grazing grounds, which were covered with their traces. They occupy this part of the country from about the end of October until March, the larger number roaming away into the high plains on the north, though some remain throughout the year in the neighbourhood of the Pangong, but I do not think are met with south of it. About half way down, the ravine narrows very considerably, and a mass of rock quite detached rises in the centre of the valley, a narrow gorge to the west being the direct road

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to Kyam; by this the coolies proceeded, while I took the east side, crossing a low connecting ridge. Numbers of hares were seen, and I bagged a couple for the pot. I fell in near this, with a Mr. Turnor, a traveller from England; and when I told him the beat I was going, he said he would accompany me. He had been searching for the pass by which M. Schlagintweit had gone towards Ilchi; but by the natives with him (for he could not speak Hindustani) had been taken off in this direction, quite a contrary point of the compass. We marched on together, reaching at last the main stream of the Chang Chŭngmo, called Kyamgo Traggar; this was broad, and a great thickness of alluvial deposits were exposed on its sides. It was an alluvial plain in its transition state before the river had cut its way down to the solid rocks. Its former levels were beautifully shewn in a series of steps and terraces, of which as many as five could be counted.

At the point where we descended from the alluvial terrace into the bed of the Kyamgo Traggar, there was a small rill of water, but this disappeared about half a mile on, where the valley narrowed considerably, and the hills rose on either hand in high cliffs of limestone, forming a regular gorge, through this the wind blew with great violence from the eastward, and dark angry clouds hid the mountain tops: it was evidently setting in for a stormy afternoon. We pushed on, struggling against the strong gusts of wind, and the gorge widening as we proceeded at last brought us to a broad valley spread over with detrital matter. The mountains still towered in cliffs to the south, but rose very gradually from about 1½ miles to the north, towards the high ridge of Samkang and Chamkang. It now began to snow hard, and we got under the lea of a low cliff, and sat there until our coolies came up, when we pitched the tents with great difficulty for the tent pegs would not hold in the gravelly bed of the stream; but by means of large boulder stones, this was accomplished. It was a miserable evening, snow falling until sunset, and lying on the top of the tents and in dry high spots. When the clouds broke at that hour, beautiful appeared the surrounding mountains with their white covering, the fleecy clouds, drifting up against the sides, added greatly to their height: the whole suffused with a lovely rose hue, and the sun shining upon the wet surface of the many tinted rocks, brought out their colours brighter than ever. Fires were soon blazing away, and we got on

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dinners as if nothing uncomfortable had happened. One must give the Indian cooks immense credit for the manner in which they work under the discomfort and difficulties that must from time to time happen on the march.

The valley ahead of us appeared to end at about six miles distance, and thus it had been sketched in on the rough reconnoissance I had, so the next morning it was determined to leave the camp where it stood, and go on ourselves to the main ridge of the valley, and return by evening. After breakfasting we walked up the soft gravelly bed of the river for about four miles, it then narrowed considerably, and took a bend to the east-south-east and at three miles further on divided into two large branches: we followed that having a nearly due east course. From the mountain spurs having approached so close to the broad bed of the Kyamgo Traggar, the absence of water, and it having also taken a bend, we had been led to imagine its course here ended, but this we were both of us much surprised to find was not the case, for we now beheld ahead of us an enormous broad gravel covered valley, stretching away to the foot of mountains at least 18 miles further to the eastward. It was quite impossible to reach the main ridge that day, so I sent a coolie back to bring on the tents. This open valley had the most peculiar aspect of any I had yet seen, but partook in its dry gravelly bed a good deal of the nature of those valleys I have seen between Pal and the Kiúng Gang La; its elevation was about 16,400 feet, and its breadth in widest part about two miles; the ridge of hills, bounding it to the north, lay about four to five miles off, but were only 3,000 feet above it, and the spurs came with a very gradual fall towards the valley. On the south a very low ridge of about 500 feet, in places not more than 300, separated this valley plain from another broad one of a like character, the ravines of which ran up into the hills in wide beds, from 2 to 300 yards in breadth. Several broad lateral drainage plains also formed a junction with the one we were in from the northern line of hills that ran parallel with it. Directly ahead a low broad pass was visible, the mountains rising to the south of it in snowy peaks 21,000 feet high; but from the great altitude we stood at, and their distance 15 miles off, they gave no idea of so great an altitude. Plenty of the woody rooted wild lavender, or rather a stunted plant with the like scent, grew around, but grass was very scanty, only in two or

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three spots was there found barely sufficient for the yâks; a few large patches of snow still lay on the plain, these (for the hill sides were now quite bare of it) were the remains of deep drifts formed by the winter winds. Water was also very scarce, and we could obtain none that day until we reached the spot chosen for camp in the evening. The distances on this plain seemed interminable, the ends of low projecting spurs appeared in the clear atmosphere quite close at hand; and had not the position of the pass ahead been fixed tolerably correctly on my plane table, we should, in all probability, have made our plans to reach it that evening; and my fellow traveller would not believe that it lay so far to the east as it did. The "mirage" on the flat gravelly plain had at times the appearance of beautiful blue still lakes; antelopes were very numerous; and running across the plain in vicinity of this appearance, looked double their natural size. We found the sun very hot in the middle of the day; but while waiting for our tents in the afternoon, found a blazing fire very comfortable; and the night, with the usual great alternation of temperature, was very cold. We were on our way up the valley early on the 13th August, but did not reach the foot of the low hill until the afternoon. Antelope still very plentiful, and the males magnificent creatures, with beautiful long thin horns. The summit of the pass (17,960 feet) was quite 1,500 feet above the level of the valley at camp, but the ascent very gradual. The snowy mountains on the south could now be well seen, their valleys filled with ice, and from the pass in easterly direction lay another valley which also widened out into another of the same type as that we had marched up; the hills seemed to fall on both sides, and the country generally to take a more open plateau like character. I could not spare time to proceed any further, I had much work to finish in the rear, and some high points to ascend, which the early snow-falls would shut up for the season. I much longed to explore, but could not do so. Mr. Turnor went on beyond for two days, and gave me afterwards a sketch of the ground. It appeared that some ten miles further, the open valley turned sharp south, and disclosed a long piece of water like the Pangong, but the mountains shut out the end of it, nor did he even get so far as the edge to tell me whether it was fresh or salt; so that this may be, for all we know, another rival to the great Pangong Tso. Turnor saw six or seven miles of its waters, which he described as

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having a breadth nearly equal to that of the above lake. I retraced my steps therefore down the valley finishing the sketch of it. Some fine agates and cornelian are to be found in a small ravine at the spot, where the long southern spur from Chamkang H. S. abuts on the Kyamgo Traggar. I made a short ascent here, in order to look over into the country to the south-east. This presented the appearance of large broad level valleys that might almost come under the designation of plains, the undulating ridges that divided them being of so little elevation. On the 15th August I had returned to the junction of the road from Pal, with that running down the valley towards the direction of Leh, and encamped close to the hot springs of Kyam. These rise at foot of the hills on the left bank ; the alluvial plateau, on the edge of which they are situated, extends for about half a mile to the river, and ends in a low cliff. The water rises in several spots, covering a distance of about 150 yards long. The spring on the extreme west side is the largest, and temperature the highest : this I give below. The ground about is wet and swampy, and consequently beautifully green with grass and weeds; an incrustation of lime had formed about the springs, but very sparingly.

Western spring, ...	103.5	degrees.
Centre,...	102.0	"
Eastern, ...	98.0	"

From the north-west a large tributary here joined the Chang Chùngmo river, adding so much to the depth of its waters, that it was a matter of difficulty crossing at the two fords below Kyam. The valley now lessened much in breadth, but the alluvial deposits were still well developed, and were cut into a series of steps by the gradual falling of the lake, or the diminished waters of the river on a drier climate commencing. At Pamzal the valley was still narrower, but these accumulations had disappeared. Here the Chang Chùngmo is left, and the road leads up the Rimdi Loomba to the Marsè Mik La, (18,452) and thence descends towards the Pangong basin, with a gradual fall down a broad valley passing Phobrang, Yùrgo, Tùblang to Lùkùng. At Chuggra, about three miles short of Phobrang, I turned to the north-west to the Kepting Kiptung La, 17,642. In the Gedmure Loomba was a green expanse of grass, with a rather severe ascent to a grazing spot called Boomzi, from this a high broad plateau

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extended to the pass; the line of watershed being so broad, that it was difficult to assign its exact position. This high wide valley parted north and south, in the first direction to the Ororotze La, 18,050 feet, only used by shepherds when taking flocks to graze in the lower courses of the Chang Chùngmo river.

The scenery here was grand and very striking from its novel nature. On the broad high plateau are three small lakes, from which flows away a stream bordered with bright green grass, running parallel to slopes of talus backed by mountains over 20,000, culminating in peak Shayok (No. 2) 21,000 feet. These mountains rise very abruptly and send down a row of glaciers that end in moraines upon the plain of the Koh Loomba. The sides of this mountain mass are rugged in the extreme, and topped with perpetual snow. Shayok (No. 2) throws down a mass of ice covered with moraine débris, which abuts upon the river itself. From the foot of this glacier, I hardly ever saw a grander sight than the steep falls of rock and ice of 3,500 feet in a horizontal distance of only three miles to the highest point. This portion of the Pangong mountains is well worth the visit of a traveller. At the time of my visit the increasing cold had driven the shepherds with their flocks and herds from the higher grounds, and we found some families at Montol, from which place there is a path over the mountains to Mùglib. I followed the Koh Loomba valley down towards the lake, where it ends in a narrow gorge opening out into a considerable broad expanse of open ground, on which are scattered some small hamlets containing only three or four families each, *viz.*, Phobrang, Yùrgo, Tùblang, and last of all, where the stream dèbouches into the plain of the Pangong itself, is Lookoong. Coming down the defile upon Yùrgo, is a very peculiar and striking peak overhanging the road. Its high rounded point is called by the natives "Chomo Kong Go," or the "Woman's Head," it having some resemblance to the shock head of a Tibetan belle.

Lookoong is situated about two miles from the spot where the waters of the Koh Loomba join the lake; this distance is covered with sand, white and glaring to the eyes, and the sides of the ravine are cut down about 12 feet, forming a cliff of that height on either side. I did not see any fish here, the body of water in the stream, though much reduced from the quantity that rises at its sources,

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is still very considerable, though not equal to that of the Chushal stream. I had now finished the whole of my work, and went on that day as far as Mùglib, thence to Tangsè, where I paid up my coolies and for yâks, &c. The men had behaved very well, never had I any occasion to be put out with them. From Tanksè I returned to the Indus valley over the mountains by way of the Kay La, 18,256 feet. The Kay Loomba river is fringed with grass and bushes for a considerable distance up, and at a height of 16,300 feet flows out of a lake about 400 to 500 yards long, of very deep clear water. It owes its origin to a large landslip from the left side of the ravine, by which cause a very considerable portion of the hill side has moved forward and been disrupted. The rock is granitoid, the same as the Chang La, and forms the main axis of this mountain chain between the Indus and Shayok. From the lake to the pass, the scenery was wild as wild could be; near its source the ravine turned south and was nearly level for some distance, finally ending amid a mass of scattered rocks, débris, and snow; large beds of which still filled the ravines and lay in patches on the summit of the ridge. The wind blew with great violence from the west-south-west on reaching the pass, with that cutting, piercing, unsparing manner it does at these elevations; behind the shelter of some rocks I boiled the thermometers, and then descended into the valley below. All my followers now on the return journey walked their best; and by the evening we were well into the cultivation of the valley above Chimray. The next day I reached Leh, and was glad to meet some brother Surveyors, also on their return from their respective surveys.

In the foregoing pages, reference has often been made to the great accumulations of boulders, gravels more or less angular, clays and sands, near Tanksè and in the Chang Chùngmo; it is necessary to add a few words in conclusion regarding the cause I assign for their formation. This is, I think, clearly glacial. Proofs are not wanting that, in ages past, the valleys of the Himalaya contained glaciers of enormous length and thickness, the only prototypes of which are to be seen in those now filling the valleys of the Karakoram, far north in Baltistan. About half way between the villages of Kungun and

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Gond lying on the Sind river a tributary of the Jhelum, Kashmir, and at the village of Gond itself, marks of glacial action are unmistakeable in the deep grooves or striæ-marks cut in the hard metamorphic slates, at a height of about 150 or 200 feet above the present level of the river. This point is 20 miles in a direct line from the head of the valley, where at present some very small glaciers exist. How much further this glacier extended towards the plain of the Kashmir valley, it is impossible to say; but at the dèbouchement 10 miles below, thick beds of débris are to be seen; the Sind river is still of very considerable size, and glacial accumulations are very soon swept away, as may be seen in now existing large glaciers below their terminal cliffs.

Taking 5,500 feet as the lowest limit of its extension, every valley in the vicinity of a range equal in mean altitude to the mountains north of Kashmir, must have once been the bed of these moving rivers of ice. The indications of glacier extension are also seen on the north of the Zogi La, between the present glacier of Muchoi and Pundras, at 10 miles from the pass. It is my belief that the Dras plain was once buried in ice, and that this region presented much the same appearance that the neighbourhood of the Mustakh does now. The imagination can hardly conceive the enormous magnitude that glaciers, like those in the Karakoram, must have once attained;* and that they extended into the Skardo valley on the Indus, 70 to 80 miles, is by no means improbable. Smaller ones from the ridge to the south we know did, for near Kepchùn, a fine mass of moraine protrudes into the plain nearly a quarter of a mile, having very large angular blocks on its surface. Moreover, this moraine must have been formed after the valley around Skardo had assumed somewhat its present configuration, for this basin has at some period been filled up with beds of lacustrine deposit, gravels, and conglomerates, to a height that overtops the present isolated rock rising above the town, the coarser beds being the highest in the series; but it is quite natural to suppose that, on a milder climate succeeding, these larger alluvial deposits would be the first to be removed by the extinction of glaciers further down the valley,

* The existing glacier of Baltoro is 36 miles long in direct horizontal distance.

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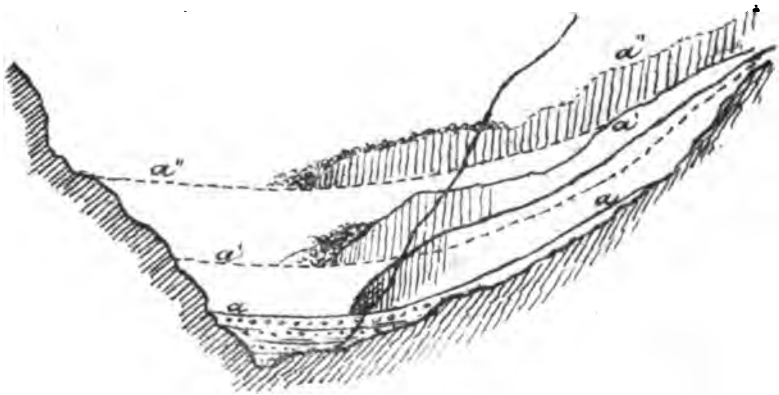
while the cold was yet intense enough to preserve those around and above Skardo. Though the vast accumulations of detritus in the Skardo basin were, I conceive, due to the glaciers from the high ranges, both to the north and south of the Indus near Basho,—which glaciers must have extended close down to and dammed up the river, —it does not follow as some might be led to suppose that the whole mass of such a mighty barrier should be formed of ice. It was the débris of moraines that would have composed this, from its continued accumulation in so narrow a gorge as the Indus there presents. These exuviæ there piled up, would have raised the bed of the gorge, and the bed of the lateral valley as well, also elevating the active cause, *viz.*, the glacier itself; and in course of time the whole valley level would have been brought up to the height of the great deposits around Skardo. The section below (Fig. 6.) will, I hope, explain my meaning, in which *a*, *a′*, *a″* represent the successive levels of the gorge and corresponding lateral glaciers.

Fig. 6.



Innumerable other instances can be seen of ice action throughout the Kashmir territory; I will instance near the Fotu La, on the road to Leh, a spot now far removed from such causes in action. Even in the valley of the Jhelum, below Bara Múla, the effects of a glacial period can be seen. That glaciers filling lateral ravines have extended across the main valleys at some periods of their existence is most probable; and in nearly every case where gravel deposits are seen, some side ravine below, having its sources high up, can be pointed out, whose glacier has formed a temporary stoppage to the main river into which it ran: and such effects are still in progress in the highest ranges of the mighty Himalayas. When glaciers extended down to 5,000 feet, what must have been the appearance of the upper Shayok, Indus and Chang Chùngmo, where 12 to 13,000 is the lowest level of the country; contemplation of such a scene in the mind's eye renders the formation of lakes and the accumulations of detrital matter a natural sequence very easy to imagine. Further, when such powerful forces of ice and water were in action, their results would have extended far down the main drainage lines, and are to be sought for at the dèbouchements of such rivers as the Indus, the Sutlej, Ganges, &c.; and I believe that the more recent accumulations of immense boulder beds composed of rocks from the inner ranges, such as may be seen in the Noon Nuddee, Deyrah Dhoon, and other places along the base of the Himalayas, may owe their existence to a glacial period in those mountains.

Notes on Geological features of the country near foot of hills in the Western Bhootan Dooars.—By Captain H. H. Godwin-Austen, *F. R. G. S., Topographical Survey.*

[Received, 26th March, 1867.]

In the report 'On the coal of Assam, with Geological notes on the adjoining districts to the south,' &c. by H. B. Medlicott, Esq., Deputy Superintendent of the Geological Survey, published in the Memoirs of that Survey,* allusion has been made to certain geological features of the hills bounding the Western Bhootan Dooars.†

A few more explanatory notes on the formations to be seen there may prove of interest in connection with the above paper, and lead others who may have the opportunity to observe them more closely. The base of the Himalayas is there so densely wooded that much

* Mem. Geol. Survey of India, Vol. IV. p. 387. See pages 392 and 435, 436.

† See the map of "Bhootan and country adjacent" on the scale of 4 miles to the inch for all places mentioned in this paper.

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89°
28°
27°
PART OF THE
BHOOTAN DOOARS.
REFERENCES.
Clay and Conglomerates
Teritary Sandstones
Limestone ? Nummulitic
Schists
Gneiss
SCALE 32 MILES TO AN INCH
32 16 8 4 0 32 MILES
Chomien
Mengya lung benbroch
Domkiah
Tanga
Touna
23944
Chumala Rhi
28156
Kanchunjinga
Tunkra
Siola
Phak Rhi or Phari
Tagum
Punakha
Panilum
Gnaream
Chumbi
Domgieg Zong
Baro
Kirsomkirm
Tumlong
Gumochi
Durbee
Tendong
Dumsong Fort
Tsanghe
Jantsa
Paga La H.S.
Goika
7167
DARJEELING
Pucheem
D.B.
Daling Fort
Chamoorchi
Bullabari
Kursiong
D.B.
4500
Pankabaree
Baporbatta
Buxa Deva
Ramshai Haut
Mautteegurh
D.B
Nakasurba
Ronyali Bunna
Thakoorgunj
Sunnasekatta
Minagoree
Dhopgori
Falakata
Chichacota
Facheelakoar
Titalyah
Jilpigoree
Kulliagunj
Bheturguch
Beebeegunj
Patgram
Dhobgoore
Dhubulkooree
COOCHBEHAR

is necessarily often hidden, and interesting and important beds are easily overlooked on a hurried scramble through the country. The point where I first noticed the absence of the usual sandstone formation, corresponding to the lowest Siwalik formations, so similar in every way to that in a like position in the Deyrah Dhoon, was near Dalingkote, where the Tsel river leaves the hills; here I only observed a low terrace of clay and boulders, quite a fluviatile deposit on the river bank, the bounding spurs from the main hills being of stratified gneiss. A short distance towards the Teesta on the west, these sandstones make their appearance and continue up to that river rising to a considerable height and thickness. The remains of a much larger accumulation of clays and conglomerates is seen some three miles up the Tsel towards the fort of Dalingkote forming a narrow flat terrace overhanging the river. The lowest terrace of clays and gravels extends away towards the plains, covered with a dense forest for eight miles, blending gradually with them into a clay country clothed with high grass. Proceeding from the Tsel river to the Tsakamchu, and thence towards Sipchu, the beds of two large streams are crossed, *viz.* the Nurchu and Mochu. Between these drainage lines, the road passes over a sub-angular debris from the adjacent hills of the gneiss rocks and clays, the terminal cliff being of considerable height and becoming much higher as one proceeds east. The lowest levels of the courses of streams which are below those south of Dalingkote, gradually increase as the longitudinal depression of the Jholdaka is approached, so that on and about the Mochu, the conglomerate cliffs rise in fine proportions, the upper level surface of the terrraces being constant. But I must remark here that this is far below the highest level of like beds on the west of the Jholdaka or Dèchu, shewing that these last have suffered the effects of denudation to a less extent, unless, in the instance of conglomerates on the Nurchu and Mochu, we are to suppose them to be later fluviatile deposits of those rivers. A very characteristic feature of the country in this part of the Dooars is the very sudden termination of these gravels and clays at about six miles from the base of the hills in a more or less abrupt scarp running east and west; this outer boundary rises higher than most of the intervening ground between it and the hills (which is deeply cut into by ravines and covered with dense jungle and forest)

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forming at Tsulcha Pahar and Rungamutti isolated high points of ground. The watershed between the Dholla and Jholdaka is thrown off from Tsulcha and running due south towards Ramsahai Hath, terminates there in a marked low scarp of sand and gravel about 20 feet high, beyond this a more clayey level begins and blends into the dead level of the plains. Looking due east from Tsulcha over the Jholdaka, the conglomerate deposits are seen abutting on the river, and terminate at Tondoo in a high cliff about 120 feet high irregularly but horizontally stratified, some of the boulders being of large dimensions, one remarkably large, about 10 feet high, lay at the foot of the cliff. About half a mile below this in the bed of the Jholdaka the masses of gneissose rock were of very large dimensions, their size and position so far from the hills requiring the existence of more than the ordinary transporting power of moving water. This cliff follows the left bank of the Jholdaka and the road to Sipchu runs at the base of it as far as the trijunction of the Jiti and Sipchu with the Jholdaka. Looking up the first named river, the masses of conglomerate beds with clays, are seen to rise into very considerable proportions, and towards the east form low hills running up to the main mass of the mountains. I was unable to proceed far up the Jiti nulla, but it is far from unlikely that the sandstone formation may be found there, the look of the gorge gave somewhat the appearance of being cut through these rocks. The greater elevation of the newer deposits on this side of the Jholdaka also favours this idea, as they may have been raised by the upthrow of the sandstone on which they are seen to rest when both are present, and I may say generally unconformably. At the Jiti nuddee the road to Sipchu rises to the top of the high terrace that overlooks the left bank of the Jholdaka for the rest of the distance. No one, as they proceed, can fail to remark the succeeding sudden rises on to higher levels sharply and straightly defined. This with a slight slope to the main surface causes the mass of this formation at Sipchu to be of very great thickness; it is there seen abutting against the gneiss rocks quite 500 feet above the bed of the Dechu, and no trace of the tertiary sandstones are here to be seen. Close beyond this the conglomerates have been removed, and the gneiss extends low down to the bed of the river Déchu, but between

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Sipchu and Jangtsa a remnant comes in as a valley deposit in a narrow high ledge overhanging the Déchu, and at Jangtsa the highest level must be quite 800 to 1,000 feet above it. This level ledge can be traced in a greater or less degree up the valley, being most conspicuously marked at the junctions of the main lateral valleys. Looking over the face of the country just described, at the abrupt termination of the conglomerate and clay beds at Tsulcha, &c. and the successive and regular high cut terraces on the east of the Jholdaka, no part of the outer hills that I have seen, gave more the appearance of denudation due to the action of the sea than this: all seemed in accordance with a slow but intermittent last elevation of the land.

The large mass of conglomerates, north of Tondoo, disappear before reaching Chamoorchi: there in the gorge of the Pyim Chu, only a low terrace of transported water-worn materials brought down evidently by that river is seen sloping gradually out into the plain towards Ambari. The hill on which the fort of Chamoorchi stands is of the metamorphic rocks, some of the beds being of a more shaly nature, but all micaceous. Neither here, nor on the right bank of the Pyim Chu was any trace of the tertiary sandstone formation, nor did I see it any where the whole distance to Buxa, not even in the re-entering angle of the large river, the Boro Torsa. In the Chamoorchi Dooar, between the rivers Dahina and Raiti, is a dry flat plain, more or less stony on the surface, open and only covered with grass. It extends as far south as Garkunta and Huldabari Hath: the termination of higher level is very regularly marked also by the sudden rise of numerous small streams that flow due south, through a country where the surface beds are clay and free of pebbles. The distance that the gravel beds extend from the base of the hills, and these streams take their rise, is very regular, and conforms very closely with their contour at 8 to 10 miles. I also noticed that the bouldery character of the beds of the larger streams ceased at the same distance, the Jholdaka, the largest of them becoming at once sluggish, broad, and with a sandy bed at Ramsahai Hath, and the stony bed of the Raiti and Demdema are dry for a long distance; these outer gravels are evidently the most superficial recent deposits that have spread away from the several hill streams. East of the Raiti a long slope of gravel and boulders extends from the foot of the hills some 8 to 10

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miles, these end at Rangali Bujna in abrupt but low scarps much intersected with ravines. This scarp is seen on the left hand on the road following the right bank of the Boro Torsa that leads to Balla; its materials appear to have been carried out this distance by the above river, and are of very recent origin. About four miles from Tazigong, the site of the Bhutea stockade, the spurs from the mountains abut on the river, and a new and isolated feature in the geology of this part occurs. The rock is a hard compact limestone very similar to beds in the limestone of Masuri. The mass is of no great extent and dips at a very high angle to N. W; the lower beds being shaly and thin bedded. I found no fossils, so that its age can only be conjectured; certainly older than the middle tertiary, it may be nummulitic. The Balla hill in the immediate continuation of this limestone on the opposite side of the Torsa is a micaceous schistose rock, and in the bed of a small ravine near the foot of the ascent to Tazigong, I found several pieces of very pure soft steatite, which I was told the Bhuteas cut into small cups. I was unable to examine the foot of the hills to the east of Balla, having much ground to survey to the south, but looking in that direction the termination of the mountain spurs appeared somewhat detached from the mass, as if due to newer beds lying at the base of them; they may either be a continuation of the sandstone at Buxa, or the higher conglomerate beds.

To the east of the Boro Torsa, no marked feature denotes where the gravels end, the level of the country is very equable, the beds of the streams being very sandy, bouldery and dry for a distance of 10 miles. The Basera river, one of the largest, is dry nearly as far down as Nathabari in the month of February; but, although no scarp marks the commencement of a lower level in the country, this line coincides with what I have before said respecting the Balla and Chamoorchi Dooars. The larger streams have generally a narrow strip of kader land bounded with a low scarp marking their former, higher and lateral extension.

At Buxa the sandstones suddenly come in with the accompanying higher and unconformable conglomerate beds, the former with the prevailing high dip towards the main hills. I have already noticed the occurrence of this formation in a short paper in this Journal

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(1865), I have now an addition of some interest, *viz.* that in the bed of Deemah nuddee a short distance west of Buxa, which flows through the sandstones and conglomerates, Assistant Surgeon J. Richardson has since informed me he found the fossil molar of an elephant, probably washed out of the upper beds.

The absence of the tertiary sandstones at the base of the Himalayas for a distance of over 50 miles is, as remarked by Mr. Medlicott, an anomalous case, and if any remnant be found hereafter, it must be small. In the deeper gorges of the main rivers such as the Jholdaka, Dahina, and Boro Torsa, they would be the more likely to shew, as they do on the Teesta, if nowhere else, but we only find stratified rocks of the most recent formations with the single exception of a small mass of limestone thrust up at a high angle at Balla. The question arises where are these usual formations, they suddenly disappear east of the Teesta, and as suddenly reappear east of the Torsa in equal force. Are they still below the surface over this area, or have they never existed, one of the suppositions brought forward by Mr. Medlicott. If they have ever found a place here, to what forces are we to attribute this single instance of total widespread denudation in so long a line of formations. Taking great physical features into consideration, it may be worthy of remark that the country and its rocks under consideration is to the south and east on the edge of a great natural basin of depression that must have been receiving for ages the drainage of the whole of the Eastern Himalayas, and considering its distance from the sea, the neighbourhood of Kooch Behar is yet one of the lowest in Bengal on the north and east. From Balla there runs in a north-westerly direction a high ridge, 8 to 10,000 feet, given off from the great Himalayan mass of Gyepmochi, and this narrow but high feature runs parallel to the deep transverse valley of the Am Mochu, following in all probability a great fault, and the existence of which is, in a measure, proved by the sudden termination of the limestone in the direction of its strike at Balla, for in the Dootia nulla on the left bank of the Torsa, I was unable to find any, but metamorphic rocks in its bed; and if the limestone be continuous, this ravine would cut through the whole of it. I am, therefore, more of opinion that the elevatory force that has raised the tertiary sandstones into the position they are found along the whole base of the Himalayas, often to a height of nearly 3,000 feet above the sea, has here been exerted in a less degree, and that they are to be sought for yet below the upper conglomerates more or less deeply seated at a short distance from the base of the hills, as I have shewn by the dotted line in map (Plate V). Should further exploration shew more clearly how these sandstones near the Teesta disappear eastwards, how they commence again near and to the west of Buxa, and that they lie deeply seated in the intervening space, it will not a little form a connecting link geologically, though not orographically, with the hill mass south of the Brahmaputra; it is curious to find the last low eminences of gneiss in the Assam valley, *viz.* at Dhoobrie and Mateabug as noticed by Mr. Medlicott, to be upon a line in the direction of this great gneiss mass of the Himalayahs at Gyepmochi, the area so devoid of the tertiary deposits lying between them.

Oct. 1866.

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ON DWELLINGS, WORKS OF ART, LAWS, &c. OF THE KARENS; *embracing Query* 50 *to Query* 76;—*by* REV. F. MASON, *D. D. Missionary to the Karen people.**

[Received 7th January, 1865].

The following pages contain the answers to "Queries respecting the human race, addressed to travellers, by a Committee of the British Association for the advancement of science," from query 50 to query 76 inclusive, furnished at the request of Col. Phayre, and with the previous sheets, complete the replies.

No answer is given to query 73, for obvious reasons. It asks the results of missionary labours on the people, and for a scientific association, the answer should be furnished by one who is not a Missionary.

Dwellings.

50. The character of the houses the Karens inhabit, varies with the character of the cultivation pursued. Among the Red Karens and Toungthus, where the cultivation is permanent, the same ground being cultivated for a succession of years, the houses are comparatively permanent. But most of the Karen tribes change their fields annually, and move every two or three years to be near their cultivation; and there build temporary houses of bamboos, leaves and ratan. They clear a few acres of land, burn them over near the close of the dry

* This paper is a continuation of the answers to queries 1—50, on the same subject, published in Journal As. Society, Bengal, 1866, vol. xxxv. pt. ii. p. 1 &c.

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season, the ashes serving as manure; and when the first showers fall, they plant their paddy. They do not scatter it over the ground, as in the cultivation of lowland paddy, but one walks over the field in front with a pointed bamboo, with which he makes holes in the ground, a foot or more apart, and another follows dropping a few grains into the holes; and there they leave them for the showers to fill in the earth. After the harvest has been gathered, the field lies fallow for several years; while crops are raised in like manner in other localities.

Each village has its own lands; and if they are large, in comparison with the inhabitants, they are able to cultivate new fields for six or seven years; but if their lands are small, they are compelled to come back to their former cultivation in three or four years; but after so short a period, the jungle on it is too small to produce any good amount of ashes, and the crops are poor. In this way the Karens move around their scant domains, like the moon in her orbit, so as to present the same phases, after intervals of very few years.

While each village has its own lands and boundaries, as one, and which they call a country, the lands of each village are divided among many owners, as in other countries. Land is often bought and sold, and in the instances that have fallen under my own observation, the price paid has been from two to three rupees per acre. Like other communities, there are some too poor to own land, and these are allowed, by the landowners, to cultivate at a fixed rate of one rupee for every hundred baskets harvested.

In the north, where wars have been prevalent, the people have been necessitated to live close together for mutual protection. The Bghais, Mopghas and some other tribes, have usually but one building for a whole village. It is built like a bazar, with a square in the middle. There is a walk all around the building, with rooms opening into it on each side. Every married couple has a room and a fire-place of their own for domestic purposes, while the hall is common property, to which women often take their weaving, and men their mats and basket-making.

All around the hall is a raised platform, on which the young men of the village sleep, and where strangers are lodged. The building is of bamboo, usually raised some eight or ten feet above the ground, with rows of pig-sties ranged under the rows of rooms, while the

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fowls often roost on the beams over the rooms, but sometimes below in connection with the pigs.

Among the southern tribes, each family has commonly a separate house, though sometimes several families of relatives occupy the same building. These houses are built on one plan. The front is at one end, where the ladder, by which they are entered, leads into the hall; which is a verandah, where visitors are received, and where both men and women work. The main body of the building consists of one room, with a fire-place in the middle that serves to divide it into two apartments; in which different members of the family, when large, sleep.

The Pwos of the Tenasserim Provinces have the singular custom of always building their houses so as to face to the east, but they can give no account of its origin; and it is not observed by the other tribes.

The size of Karen villages varies from ten to one hundred houses or families; and in some of the Red Karen villages there are two or three hundred families.

Monuments.

51—52. No monuments of any kind are raised by the Karens, or have ever been known to be raised. They prefer that their localities should be unknown, and wish to ignore their existence to all the outside world.

Works of Art.

The Karens are singularly deficient in works of art. In the Tenasserim Provinces, the only works they can exhibit are baskets and mats, which are very neat. The mats have various forms woven in them, to which they attribute a divine origin. When god was about to die, as the legend runs, he called all nations to him to receive his dying legacies; but the Karens being tardy in coming, they arrived only in time to see his mats burning, and to note the figures on the ashes which had been woven into them; and they have made their mats, they say, after these patterns ever since.

Among the Bghais, we find a few that can work in iron, so as to forge their own axes and bills, hoes and spears. On proceeding to the Red Karens, silversmiths are met with who make all the common female ornaments, as rings, bangles, ear-knobs, and the like. The

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Tarus, further north, make matchlocks, some of which that I have seen, are very well done, and sell for thirty rupees each. They display no ingenuity, however, in these works. They are mere imitations of Shan articles. While the Karens originate nothing, they show as great a capability to imitate, as the Chinese. They can learn anything. Boys who never saw a chisel or plane or saw, will readily learn to use them, as well as a Chinaman. Men who were called Loo-yaing, "wild men," by the Burmese a few years ago, can now do all the work of a printing office, as well and as readily as Europeans with the same amount of training. Others can use the chain and the prismatic compass in the field, and the plotting scale and protractor, and paint-box in the house, and produce unaided a very creditable plan of a piece of land, while still others can use the sextant, measure heights and distances, take the sun's meridional altitude, and calculate the latitude.

Karen women can generally weave, and embroider very prettily; but there is a tribe or clan in the valley of the Salween, the We-was, in which there was not a single woman of the whole tribe, when the missionaries went first among them, that knew how to weave. They buy all their clothes from the neighbouring tribes, and have no peculiar dress of their own.

The Karens have a few musical instruments of their own manufacture, but they are quite rude. They make pipes or whistles out of bamboos; and bugles out of buffaloes' horns, or the horns of the antelope. They have also harps, guitars, jews'-harps, and a kind of dulcimer.

They are remarkably fond of the sounds of gongs, and kyee-zees, a taste they have in common with the Shans and Chinese. The Kyee-zee is little known, but it may be described as a large gong, with a cylinder a little less than its own circumference attached to one side; or it may be viewed as a bell-metal drum, with one end open. It is struck like a gong, and gives forth a sound like a gong, but not so shrill. They are manufactured by the Shans, and have ornamental circles and bands with representations of birds and fish; and on the outer circle are four raised frogs, as the figure of the cat sometimes surmounted the ancient sistrum. Whether the sound of the instrument is intended to emulate the voice of the frog or not, must be left to conjecture, for no one can give any reason for the frog being there.

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The Karens attach a fabulous value to these instruments, and often pay absurd prices for those that have good tones. They have distinctive names for ten different kinds, which they pretend to distinguish by the sound, the poorest of which sells for one hundred rupees, and the best for a thousand. Besides these, there are several inferior kinds with prices varying from thirty to one hundred rupees. When a good kyee-zee is struck, the Karens say the music softens the heart, and the women weep for the friends they have lost, or from whom they are separated.

The possession of kyee-zees is what constitutes a rich Karen. No one is considered rich without them, whatever may be his other possessions. Every one who has money, endeavours to turn it into kyee-zees, and a village that has many of them is the envy of other villages, and is often the cause of wars to obtain possession of them.

Domestic Animals.

54. The only quadrupeds, entitled to be considered domestic animals among the Karens, are hogs and dogs. The hog is the small Chinese variety, and is very extensively raised, both for food and for sale. It is used in all their offerings as most acceptable to the unseen spirits; and no idea of uncleanness is attached to it, any more than to the ox, the buffalo, or the goat. They are exclusively in charge of the women, and each hog distinguishes the voice of his mistress, though a dozen be calling at the same time, with unerring accuracy, and runs to her with greatest alacrity for the food he expects at her hands.

A few solitary oxen and buffaloes are occasionally seen, purchased from the Shans or Burmese, but they cannot be regarded as Karen domestic animals, any more than the elephant which is met with here and there. The Pakus and Mannepghas raise a few goats, and the Red Karens ponies, as well as oxen quite extensively; but these are local and exceptinal.

Dogs are found everywhere, and are eaten by the Bghais as readily as by the Chinese, but not by the southern Karen tribes. The pariah is the most common variety, but the Karens raise also a small dog allied to the smooth-haired terrier, which they use for hunting. It is not abundant, but is highly valued, the price of a good one being equal to that of an ordinary pony or buffalo. Deer, it is said, are so afraid of them, that they lose strength when they find one of these

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dogs after them, and become an easy prey to the hunter. When they start anything, they go yelping after it all day, so that a Karen has only to follow on, and he is sure of his game in the end. They will follow a large snake that the Karens eat, as readily as a deer, but they will not attack it. Tiger cats, palm cats, and civet cats they attack and kill. They fear nothing, excepting tigers and leopards. If they come on a tiger's track, they run back.

Cats are not domesticated by the Karens, for they say, "We cannot eat them, while they devour the rats we wish to eat ourselves."

Fowls are raised almost universally. Most of them appear to be the common domestic fowl, but a few are the Burmese domestic race of the wild jungle fowl; and a few are met, in the southern districts, with the membrane that covers the bones black, or nearly so, *Gallus Morio*, Temm. It is not found among the northern Karens.

Government.

55—56. The government of the Karens may be compared to that of the American Indians at present, or to that of the Scottish clans in the days of Rob Roy. As a whole, they are ungoverned and ungovernable. The Pakus are the hereditary enemies of the Pwos, the Bghais of the Pakus, the Gaikhos of the Bghais, and the Red Karens of all. Then there is not a village, perhaps, without an unsettled feud with some other village. Their districts are ill-defined, and they quarrel and fight, like civilized people, over a few roods of land.

If a man is devoured by a tiger, while on a journey, the price of his life is demanded by his relatives of his companion who invited him to take the journey, and they constitute themselves both judge, jury, and executive. Should any one innocently introduce small-pox, or cholera, or be supposed to introduce it, or any other disease into a village, all the deaths are charged to him; and if he has not property to pay, the debt remains for his children or grandchildren to liquidate.

Each village, with its scant domain, is an independent state, and every chief a prince; but now and then, a little Napoleon arises, who subdues a kingdom to himself, and builds up an empire. The dynasties, however, last only with the controlling mind.

Before the country was occupied by the English, Lai-quai, a Bghai chief, ruled all the Bghais, and Gaikhos north of Toungoo. He waged war at will with his subjects on the neighbouring tribes; and by

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furnishing the zenanas of the Burmese governors with comely Karen girls, whom he kidnapped, the chieftainship of the Burmese district on the plains was given him, and he reigned a king. He died, and his empire died with him.

Twenty-five years ago, I found some ten thousand Karens in the valley of the Yuneselon, under the rule of a great chief, called La-kee. At his death none of his sons or sons-in-law could keep the kingdom from falling to pieces, or prevent its crystallizing into the same elements in which La-kee found it.

In many districts the chieftainship is considered hereditary, but in more it is elective; as much as the chief of the executive is in America. The people select the man that pleases them best for chief, no matter what his antecedents may have been; and if after a trial, he does not please them, they elect another. In this way divisions sometimes occur, one part of a village adhering to one chief, and another part to another chief, and they perhaps settle the question by a fight.

In many villages that do not pay taxes or tribute, there are no regularly constituted chiefs. The man with the most property, and the largest family possessing the power without the name.

57—59. There are no divisions of caste among the Karens, and though found in many tribes and clans, the division seems to have arisen from the original separation of families, and communities.

Laws.

60. Although there are no written forms of law among the Karens, yet there is in fact a code of laws preserved in the traditionary commands of the elders that meets all the relations of man to man. The elders are the depositories of the laws, both moral and political, both civil and criminal, and they give them as they receive them, and as they have been brought down from past generations. Every village has its elders, who are expected to teach the young people to do good and to avoid evil. A village without an elder well stored with traditionary instruction would be regarded like a parish in England without a clergyman. To indicate their usefulness, the Karens use this saying: "Where there is no smith, the axes are soft; where there is no cock, the rooms are still." That is, the

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elder gives efficiency to the people, as the smith does to their axes; and excites them to action, as the cock by crowing arouses the sleepers to their work.

The following lectures are from the lips of Bghai elders. Others might not use precisely the same language, but all would convey the same ideas.

Famines.—Children and grandchildren, you are children. You do not know, and have never yet seen difficulties and trouble. But I am old, difficulties I have seen, troubles I have found. I have been in scarcity and famine. Great waters I have met, and mastered; great fires, I have contended with, and overcome. Momentous feuds I have known; with mighty wars I have been acquainted, I am familiar with heat, and I am familiar with rain. I have seen irruptions of rats destroy the crops; I have seen the Talaings and Burmans overrun the country. I have known famines, when the people had to dig deep to obtain poisonous wild yams; and I have seen them die with exhaustion at the diggings. I have known the famine so severe that a man has deceived his associate, and given him a meal of rice and curry, but no sooner had he done eating it, than he seized him as a thief, declaring that he had stolen the food, and then sold him into slavery for the theft. I have known a kyee-zee sold for a sheaf of paddy, and a basket of paddy for a basket of money.

Industry.—Children and grandchildren, do not be lazy, work hard. If you work hard, you will obtain paddy, you will obtain rice; and you can sell it, and obtain money, and what you have to spare, you can take care of; and when times of scarcity and famine come, you can bring out your stores of paddy, and eat and be satisfied, and have enough for your children and grandchildren.

If you are lazy, you will have no paddy, you will have no agreeable food, and you will have nothing with which to buy. When the famine is unendurable, you will steal to eat; and you will then be sold into slavery; or if you do not steal, you will die.

Observe what I say to you, work and labour with cheerfulness and gladness. Grasp the helve of the cleaver firmly, hold it with a strong grip. Expose yourselves to the heat of the sun, and to the pouring rains, and the fierce winds. Bend down your backs, hold firmly the hoe, and live among the weeds. What you do, do thoroughly,

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completely. We love happiness; and our greatest happiness is to clear our fields and to build our houses.

I tell you truly, every thing is in the earth. Therefore I say to you, bend down your backs, grasp the hoe, hoe deep, weed clean; and you will obtain eatables. Then, in times of scarcity and famine you will be able to purchase kyee-zees. Grasp the axe firmly, and clear a wide field; and you will obtain abundance of paddy. Then when times of scarcity and famine come, you will be able to buy buffaloes, and they will be the gains of your labour, the work of your hands.

If you want to obtain gongs, weed and make it all clean around your paddy. Then when times of scarcity and famine come, you will be able to purchase gongs; and they will be the gains of your labour, the work of your hands.

If you want to obtain silver, plant your fields industriously, and when the rains come, your paddy will spring up abundantly, and you will have good crops. Then you will be able to procure silver, and it will be the gains of your labour, the work of your hands.

If you want to obtain hogs and fowls, take cotton and make clothes. Then you will be able to procure hogs and fowls,* and they will be the gains of your labour, the work of your hands.

If you want handsome clothes, spin thread diligently, put in the woof and the warp, and weave. Then you will obtain clothes, and they will be the gains of your labour, the work of your hands.

All things are in the earth, and every one who will work hard, will obtain them; and he will have eatables and drinkables, and will become rich, and will have in abundance. When he dies, he will leave his property to his children and grandchildren, and they will enjoy it. It will not be like those who obtain property by reprisals and forays. That is ill-gotten wealth, and is accompanied by hatred aad malice; and their children never enjoy it. It goes to to their enemies.

Children and grandchildren, work hard, put forth every exertion, and you will obtain everything by the labour of your own hands.

Indolence.—Therefore I say to you concerning the indolent. Lazy people do not like to expose their bodies to the sun, or rain, so their skin and flesh are comfortable, and do not suffer like the skin and

* That is by selling the clothes.

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flesh of the industrious ; but though their skin and flesh are comfortable, their stomachs and mouths are often very uncomfortable. Sometimes the mouth of the lazy man eats, and his stomach is satisfied ; but often his mouth finds nothing to eat, and his stomach is in great distress ; and this is because he does not work with his hands. Children and grandchildren, do not become imitators of people like these.

Help the poor.—Children and grandchildren, work, every one of you, and be prepared for a time of famine. Then, when a time of scarcity or famine comes, let not the rich, and those who have all the rice and paddy, reject the poor who have nothing ; that you may not lose your honour, and be abused ; but that you may be honoured and respected. When hard times come and there is famine in your midst, let the wealthy help those who have nothing with which to buy, and cannot borrow.

Widows and Orphans.—Children and grandchildren, do not forsake the widows and orphans. You must take care of the widows and orphans, you must look after those who have nothing, all that can neither buy nor borrow ; that the poor, the widows and the orphans may not die of hunger nor become slaves. Then it will be noised abroad in other lands, that on your streams, in your land there are many wealthy men, and many elders ; and that they take care of the poor, and the widows and the orphans, and that there none die of hunger, or become slaves among them. When you are thus praised, none will dare to speak evil of you ; and you will become powerful, and be honoured.

But if you do not work, you will have nothing and come to shame because you have nothing. And if you have property, but do not look after each other ; if you are covetous, and do not give compassionately, you will come to shame on that account.

When famine comes among you, if you do not look after the poor, and the widows and the orphans ; if you do not take care of those who have nothing, they will die of hunger or become slaves. Then the inhabitants of other countries will hear and say : "We hear that in that country the poor, and the widows and the orphans become slaves, or die of starvation." Then the inhabitants of other countries will abuse you, and speak evil of you and say, "The people of that land are all the children of poverty. There are no rich men among

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them; or if there be one, he is a covetous fellow, and does not take care of his people; and he leaves them to die, or become slaves." After you get such a bad character as this, should you become exceedingly wealthy, and exalt yourselves, and set yourselves up for this and that, the people of other lands will not believe you, will not fear you, will not regard you at all.

Love.—Children and grandchildren, love one another. Do not quarrel, do not find fault with each other. When we are in the village we are separate people, but when we go together to clear the fields, we are brethren; and if one is taken sick on the road, or in the jungle, we must take care of him; we must look after each other. When we cut fields together, we are brethren, and if one is sick, all are sick; if one dies, all die, and we must carry his body back to his house, and lay it in the hall, that his brethren may see, and his children may see, and his wife may see that he is dead.

Love peace.—Children and grandchildren, love peace, and you will live in peace, and live to be old. He who loves peace, his house will be established, and it will be permanent. He will sleep in peace and have agreeable food to eat. He who walks in peace, will enjoy peace. He will have associates, he will have friends. His daughters will demean themselves with propriety, and his sons will live happily. He will have no adversaries, he will have no enemies. The lovers of peace will live long and be prosperous.

Evil doers.—The evildoer has no friends; he has no houses, no fields; but he has adversaries and enemies. His daughters will become slaves, his sons servants. His wife will become the wife of another, and his kyee-zees and gongs will be all expended. His kyee-zees will become the kyee-zees of others; his money the money of others. His land will be destroyed, and his country will come to destruction.

Children and grandchildren, take no pleasure in them. Evildoers do not live to be old. Their ways go up quickly to old age and death.

Duty to Parents.—Children and grandchildren, he who does not love his father and mother, will suffer for his sin. When he was small, his mother gave him the milk of her breast to drink, and she bore him about, and carried him pick-a-pack, and cleaned him when

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he was dirty; and when he cried, his mother sympathised with him, and did not laugh at him. Great are the sufferings that his mother endured for him while he was an infant.

Therefore, when a man is grown up, he must take care of his mother; if he does not take care of his mother, if he does not furnish her food and drink, he will suffer for his sin. He will be afflicted, and become poor.

Your father left your mother in the house to watch you, and he went out and worked hard for you and your mother, that you might have food and grow, and that your mother might have leisure to watch you. If your mother had not had food provided for her, she would have had to leave you in the house, and you might have fallen out of it and been killed. In order therefore that your mother might take care of you, your father went out to work, and endured burning heat, and bore the drenching rain.

Therefore, children and grandchildren, when you grow up, you must take care of your father, and provide him with food and drink. He that does not take care of his father, will suffer for his sin. When the God of heaven and earth looks down upon him, he will punish him for his sin, and he will become poor and wretched. If he works, he will not succeed in obtaining anything, and he will become sickly, weak, and helpless.

Humility.—Children and grandchildren, he who does not humble himself, but exalts himself, and regards his relatives as nobody, and makes forays and extorts from his brethren without cause, and does as he likes, and is proud, and beats others for nothing, he will not live to old age, he will die young.

Because he acts proudly, and extorts from his brethren without cause, the God of heaven and earth will look down upon him, and will say, " This man has done thee no evil, thou oughtest not to have done evil to him." Then the man that exalted himself, and did the evil, will suffer punishment for his sin, and he will become poor and wretched. If he has kyee-zees, he will lose them, if he has money, he will not enjoy it; and though he should have sons and daughters, they will not live to help him. They will die without apparent cause, and he will be left wretched and childless alone, unhappy, unable to work, and without means to purchase anything.

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Swearing.—Children and grandchildren, by no means curse each other. If there be cause for it, swear, but unless your brethren make trouble in your hearts, do not curse and swear causelessly. For I say to you, if your brethren make trouble in your hearts, and you curse them, and imprecate evil on them, the curse will really come upon them. Because they did evil, the evil curse will come upon them.

But if people do not make trouble in our hearts, do not curse them causelessly. For when you curse each other without cause, your curses go from one place to another to see to whom they belong, and when they find no owner, the Lord of the lands and the waters, the God of heaven and earth, is displeased ; and he says to the curse, " There is no reason why thou shouldest hit this man ; he has done no evil, go back to the man that sent thee."* Then the curse returns to the man who sent it, and enters into his boiled rice, and into his water, and under his finger nails, and he eats it ; and it hits the man who sent it, and he dies.

Children and grandchildren, this is assuredly true. Anciently there was a man who had ten children, and he cursed one of his brethren, who had done him no injury ; but the curse did the man no harm, and he did not die. Then the curse returned to the man who sent it, and all his ten children died. Not a single one survived. Then the man repented, because his children died, and he said ; " Hereafter, may I never curse more. That man did me no wrong. I cursed him without reason. There was no cause for it, so the curse returned and came upon my children ; and all my ten children have died. The God of heaven and earth, the Lord of the lands and the waters, has killed them, that we may not curse people causelessly."

Covetousness.—Children and grandchildren, do not covet the money, do not covet the kyee-zees of others. Covet not the oxen and buffaloes of your brethren. These things are at your own hands, if you will be careful and work hard.

Partiality.—Children and grandchildren, do not act partially ; do not have regard for one more than another.

Backbiting.—Children and grandchildren, do not backbite, do not abuse people who are not present.

* " The curse causeless shall not come."—Prov. xxvi. 2.

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Hatred.—Children and grandchildren, do not hate each other, do not give way to hatred.

Exacting Fines.—Children and grandchildren, do not require fines for trespass, for breaking your arbitrary rules or regulations. Though others make you pay fines for trespass, do not you make them pay you for trespasses in return.

Falsehood.—Children and grandchildren, do not testify to words which are false. In buying and selling do not use deception. Do not defraud, do not be dishonest in your transactions.

Quarrelling.—Children and grandchildren, do not do evil to each other, do not strike and beat each other, do not rage against each other. Do not extort from each other. Do not push each other down. Be careful. Do not pull each other's hair, do not slap each other's cheeks. These things are wrong in the sight of the God of heaven and earth. Cultivate adjoining fields, build neighbouring houses. When you eat rice together, do not boast against each other; when you drink whisky together, do not strike each other. The former elders said, "Sleeping together is warmth, eating together is sweet, travelling together is pleasant."

Oppression.—Children and grandchildren, why is it that one and another suffer so exceedingly as they do? It is because he exalted himself at first, and said: "I am a man, and my hands are strong." And he sold into slavery the widow and the orphan, and regarded his relation as nobody. And he extorted money from others, and treated others outrageously; so when he became old, and his strength failed him, his enemies rose up that he had wronged, and retorted on him, and he suffers for his sins. He did evil, and his evil returns upon him; and he grieves, and weeps, and suffers anguish; and when he dies he has no one to bury him, and his body remains in the field, and the birds devour it.

Theft.—Children and grandchildren, do not steal. Those who steal or destroy, defraud or act dishonestly, their deeds are by no means secret. Though the doers say nothing, though their mouths do not speak; their deeds will become manifest in the ordeal by water, and the ordeal of ascending trees. You will be beaten in remaining under water, you will be beaten in ascending trees. You

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will dive into the water, and come up to the surface quickly; you will ascend trees and fall down. It happens so, because you have stolen, and destroyed, and dealt fraudulently, and have displeased the God of heaven and earth. The God of heaven and earth sees, the Lord of mountains and hills sees, Thie-kho Shukha sees.

Children and grandchildren, if you are hungry, bend down your backs, and weed hard. If you want fish, take your hand-net and go fishing. If you want rats, set traps for them; and if you want to eat beef, deer and stags are abundant in the jungles, and they are to be had without price. They have no owners, no one claims to have nurtured and fed them. Dig deep pits in their paths, that they may fall into them; and set nooses, by which they may be noosed and sprung up in the air. Feed yourselves and families in this way. Borrow not, go not into debt. By no means leave debts for your children to pay after your death.

Every one that does not work hard with his hands, when he steals or borrows laughs; but when he is required to pay, and has nothing; then he weeps. And every one when he steals, and his deeds are hidden, puts himself forward as an honest man, and is bold and laughs; but when his true character becomes manifest, and he is required to pay, all abuse him and speak evil of him, and call him a robber; and his honor is destroyed, and he becomes exceedingly ashamed. No one will believe his professions of honesty afterwards. They will say to him; "Once honest, ten times honest; once a thief, ten times a thief."

Forays.—Children and grandchildren, do not make yourselves wretched by making forays, and taking the property of your brethren for nothing. It is wrong for you to take forcibly the possessions of your brethren. It will be lost in like manner, and your children will not enjoy it. Do not engage in forays; do not make reprisals for injuries received. Those who make forays make enemies who will never forget them, and the ground around their houses will never be smooth, but will be filled with caltrops* and arrow heads. They

* Not precisely caltrops, but pointed bamboos, a few inches high set firmly in the ground, at an angle of about 45°, to pierce the foot of an enemy while running to or from the house. They are rather formidable weapons in their way. I have seen a man's foot with a hole quite through, made by one that caught him on the top of his foot while running away.

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will not be able to sleep, and they will be unhappy while awake. If they obtain kyee-zees or money, they will not use them themselves. If they raise hogs or catch wild fowls, they will not eat them themselves. Their enemies will possess them, and eat them without labour, and they themselves will come to abject wretchedness.

Killing.—Children and grandchildren, do not kill each other causelessly. Man is not like a beast. Man has a Lord and Master; he is not like the wild animals. We are the children of Thie-kho, the children of Shu-kha; we are the children of Shie-oo, the children of Yu-wa, and our God created us. Therefore do not kill each other.

The man who kills his brother without reason, who is not angry with him nor hates him; that man will be killed without cause in like manner.

When a man kills his brother, Thie-kho Shukha sees it, the God of heaven and earth sees it; and Thie-kho Shukha, and the God of heaven and earth look with compassion, and the tears flow from his eyes, and he says to the murderer: "Thou hast killed this man and he did thee no harm. Thou oughtest not to have killed him, and thou wilt be killed in return."

Therefore, he who kills will be given up by the Lord of the lands and the waters into the hands of his enemies, and they will kill him. He will not escape death. Be warned, those who kill, death takes note of them. They will come to want and distress, and be helpless. When night comes, they will long for the day; and when day comes they will long for the night. They will grieve, and take their full of grief; they will weep, and take their full of weeping; and their end will be death. When they die, they will have no children, and there will be none to bury them. Their bodies will be left naked in the fields, and the vultures will devour them. These things I have seen with my own eyes, I know them from my own heart; and they have often happened among us.

Adultery and Fornication.—Children and grandchildren, do not commit adultery or fornication. If you wish for a wife or husband, take one in an upright way with a marriage feast. Do not act covertly. If you commit fornication, your daughters will die, and your sons will not live; and the country will be defiled and destroyed on your account.

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When you commit adultery or fornication, or have illegitimate children, it is displeasing to Thie-kho Shu-kha, it is displeasing to the God of heaven and earth. Then the rains do not come at the proper time, and the dry season is irregular. The crops are bad, and the hunter is unsuccessful; and your vegetables do not come up; because you commit fornication and adultery.

You are poor and become slaves because you do that which displeases the God of heaven and earth. This he makes known to you by bringing on you troubles and difficulties, in order that you may not do evil. Children and grandchildren, be careful.

Suicide.—There is no command against suicide. It is very common where Christianity has not been introduced, and the Karens seem to see little or no guilt in it. It is regarded as an act of cowardice, and the suicide is not awarded an honorable burial; but we are nowhere told that it is displeasing to the God of heaven and earth.

It is singular that hanging is almost the exclusive way by which Karens commit suicide, while poisoning is the most favourite mode with the Burmese.

If a man has some incurable or painful disease, he says in a matter-of-fact way, that he will hang himself; and does as he says. If a girl's parents compel her to marry the man she does not love, she hangs herself. Wives sometimes hang themselves through jealousy, sometimes because they quarrel with their husbands, and sometimes out of mere chagrin, because they are subjected to depreciating comparisons. It is a favourite threat with a wife or daughter, when not allowed to have her own way, that she will hang herself.

One of Mrs. Mason's Paku pupils went and taught school in a Bghai village, where she was very popular. The village preacher observing his wife at her toilet one day, remarked jocosely; "You need not rub your face so much, for you cannot make yourself look as handsome as the Paku girl." She said nothing, but immediately rose up, and went and hanged herself.

A young man in my employ recollects twenty-five persons who have hung themselves within the last fifteen years, in the circle of villages with which he is acquainted, eleven within ten years. Of the whole number, ten were men and fifteen women.

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Criminal Law.—The general principle of criminal law, which the Karens recognise as just, is exactly the same as the Mosaic. An eye for an eye, and a tooth for a tooth. The elders said, "If made blind, take out an eye in return; if the ear is cut off, cut off an ear in return; if an arm is broken, break an arm in return."

The elders do not, however, recommend the exaction of these terms. They say again: "In order that we may not subject ourselves to fines and punishment, we must allow others to treat us as they choose. We must humble ourselves; we must not retaliate. If we are struck, we ought not to strike again. If one grasps the head, grasp the floor; if one slaps the face, slap the floor. If we are made blind, we must not make blind in return; if our ears are cut off, we must not cut off the ear in return. The long is before, the short is behind.* Loving peace, gives a wide place; loving evil, gives a narrow space. It is difficult to obtain happiness, easy to get evil. If we want evil, it is at hand before all the water has run out of a vessel that has been upset."

Law of Inheritance.—The father wills his property to his children; and it is the custom to share it nearly equally among them; but always giving the eldest son the largest share, and sometimes giving a little more to the youngest than to those between. Nothing is given to the widow, but she is entitled to the use of the property till her death.

When a Karen of property made his will, before letters were introduced, he killed an ox, or a buffalo, and made a feast at which every inhabitant of the village was invited to attend. At the feast, he declared his wishes, as to the disposal of his property; and prayed that the disposition he had made, might be carried out after his death.

The mother has no property of her own. If she brought property at her marriage, it became her husband's; but at her husband's death, she takes his place, the Karens say, and the property is hers to use till her death; after which, it goes to the children, according to the will of the father. She has no power to make any other disposition of it.

In the event of a second marriage, the children of a mature age take possession of the property their father left them. The second

* That is, the future is long, the past is short.

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husband is not allowed to appropriate to himself any part of the property of the first husband; nor can the children of the second marriage share in it, though in the case of minors it may remain in the mother's hands.

61. *Lawgiver.*—No tradition of any legislator, or lawgiver has been found. The Karens ascribe all their laws, and instructions, to the elders of preceding generations, and have no idea of any period when they did not exist.

62. *Change of Laws.*—The Karens never make any alterations in their laws, or regulations, for the government of their country. They seem to think that everything of the kind has come down to them from the ancients in a state of perfection, requiring neither addition nor alteration.

63. *Observance of their laws.*—In respect to the observance of their laws, or the instructions of their elders, very little can be said in favour of those who have not come under the influence of Christianity; and many that worship with Christians are Christians in name only.

The truth can be obtained from a Karen much readier than from a Burman, because he is much less artful; not that he has any more regard for the commands of the elders than the Burman has for the commands of Gaudamaa. I have never yet met with a Karen, in the church or out of it, that when he had committed a wrong, would not tell a falsehood to cover it. They have no regard to their engagements or promises. What a Karen says he will not do to-day; under a change of circumstances, he will do to-morrow, and seem to think it all right. He has changed his mind, he says, and that is sufficient.

They have no idea of suffering for truth and righteousness. If their leaders or associates do what is confessedly wrong; they think it quite excusable to go with the multitude. They join themselves to forays, in which they are not concerned, and think they do no wrong, however unjust the attack, because they were hired by others, with whom, they deem, the guilt of their robbery or murder rests.

Theft among themselves is usually discovered and severely punished, so the people are ordinarily honest; but they have no conscience about abstracting small articles when they are not likely to be discovered.

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They are exceedingly vindictive, and demand heavy damages from those who have injured them; and are most implacable enemies. The dying charge of a father to his sons, is often for them to avenge his wrongs, real or imaginary, and should they be unable to do so, to transmit the charge to their posterity. A Gaikho chief was put in jail, and I visited him. He was very humble, and promised every thing to get out. I interceded for him and he was released. He was treated by our Karens with all possible kindness, the few days he staid with them. He soon after died in the jungles, and his last words to his family were, that they should avenge his death on the party that had caused his apprehension.

Natural affection too is weak among them. It is no uncommon thing for a man to curse and strike his mother; and children, notwithstanding the instructions of the elders, take very little care of their parents. I have stood over an old woman dying alone in a miserable shed, and tried in vain to induce her children and grandchildren, close by to come to her help.

The Gho-kho, a Bghai clan, it is said by those who know them, often sell their relations into slavery. If a child is sickly, and the parents think it will not live to advantage, they sell it off, when occasions offer, to strangers. They say among themselves; "This child will never grow up and become our posterity. It is continually sick, and will never be able to do any thing for us. We had better sell it, and then we shall get its price to eat." In seasons of scarcity, they frequently sell their orphan nephews, and nieces to obtain paddy. Occasionally, when a mother gives annoyance to her children by reproving them; one will say: "My mother talks excessively. I shall not be happy till she dies. I will sell her, though I do not get more than a gong or five rupees for her." And he sells her. If an uncle dies, they often sell the widow; and if a brother dies, they demand ten rupees, of the widow as the price of her husband, their brother; and if she has not the means to pay, she is sold into slavery. So also, if a married woman dies, her relatives demand a large price of her husband, which he must either pay or become a slave or fight; and if he has no money, he usually chooses the last alternative.

64—67. *Administration of the Laws.*—It is instructive to see how different the same act looks when viewed from different stand-points.

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The forays of the wild Karens appear to civilized people little better than unqualified robbery and murder ; but a Karen looks upon them much as Europeans do suits at law, and the execution of judgments by the sheriff.

If a Karen is defrauded of his money by dishonest debtors, there are no courts of law to which he can appeal for justice ; so he calls on his friends, to go and seize the debtor, and make him pay the debt with interest, or sell him into slavery. Forays of this kind for debts are called small cause actions, and correspond to what we denominate civil suits.

If a man is killed, there is no authority to which a Karen can go, to have the homicide brought to justice. Every family is expected to avenge its own wrongs. Perhaps a man has been mortally wounded in an attack, or quarrel, and he calls his son and says to him ; " I have been speared and shot without cause. I am very sick. Should I die, get my value, obtain my price. If you can get the living, take the living ; if you can get the dead take the dead." After this charge, a son deems it his sacred duty to avenge the death of his father, whenever a favourable opportunity occurs. These are called great cause actions, and correspond to criminal suits.

In all cases, it is not the custom for the man who occupies the position of plaintiff to go to the foray himself. He employs others, and stays at home to compensate those that go ; because in the event of his death, there would be no one to pay them their wages, or avenge their deaths, should they fall in the attack. Thus a Karen always thinks himself right in taking the law into his own hands ; for it is the custom of the country, which has the effect of law. He is never interfered with, unless he is guilty of some act contrary to Karen ideas of propriety, when the elders and the villagers interfere and exercise a check upon him.

Civil Suit.—When a Karen has been repeatedly to one that owes him money, without obtaining it, and has perhaps been treated uncivilly, he calls out the *posse comitatus*, so far as his friends constitute the *comitatus*, and when a favourable opportunity occurs, they go and seize the debtor in his house or field and bring him off ; sometimes taking along one or two of his family or friends.

When the debtor is set down bound before his creditor, the creditor

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will say to him; "I have no feud with thee. On the contrary I compassionate thee. But thou borrowedst money of me, thou borrowedst kyee-zees of me. The money was in my wallet, and I took it out and gave it to thee; my kyee-zee was in my room, and I tied a string to it, and slung it on thy head, and caused thee to back it away. Therefore I went and asked thee for the return of my money; I went and requested thee the price of the kyee-zee. But thou wouldst not pay me; thou wert abusive to me; thou stirredst up strife. Thy language was contentious; thy words were not peaceable: Thou didst not give me food to eat; thou didst not give me water to drink. Thou wast angry with me, thou didst hate me. I went after thee, and returned hungry and thirsty. I ascended mountains, and descended into valleys; I suffered from heat, and I suffered from cold. Thou didst not repay me my money, thou didst not pay me for my kyee-zee. Many years have now elapsed, many months have past over. So now I have commenced an action against thee; now I have made an attack on thee. Thou didst borrow one kyee-zee of me; now thou must pay me two. Thou didst borrow one share of me, now thou must pay me two. Thou didst borrow one hundred rupees of me, now thou must repay me two hundred. If thou dost not pay me, I will sell thee to repay me for my money, to pay me for my kyee-zee. And when I sell thee, I shall do that which is right and proper."

Criminal suit.—Men are not unfrequently killed in drunken broils; but such cases are not allowed by Karen custom to be a cause of action. No price can be demanded for persons who lose their lives in such circumstances. It is argued there was no malice, no intention to kill; and the person who died was perhaps as much to blame as the man who killed him; and people are not well responsible for what they do in a state of intoxication.

But when a man has had a near relative killed in a foray, it is deemed right that he should have blood for blood, and his friends and others whom he loves, stand ready to avenge him when called upon, and they go and make reprisals.

Theft.—When a thief is discovered, if it be his first act, and he promises to be honest for the future, he is allowed to go free on restoration of the stolen property. But if he be an habitual thief,

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he is sold off into slavery among strangers, so that the village may have no more trouble with him.

When a man is suspected of theft, and there is no positive evidence to sustain the charge; if he denies it, recourse is usually had to the water ordeal.

The accused says to the man who brings the charge. "We will decide this matter ourselves by diving under water. If thou beatest me, by remaining under water longer than I do; if I have kyee-zees, I will give them unto thee; if I have slaves, I will give them to thee. If I do not give thee the kyee-zees or slaves, take my body and rip it open, take my head and cut it off. Split me in two from head to foot, and cut me in two across."

Then the man who makes the charge rises up, and replies: "Thou sayest thou art honest, thou art upright. If I have charged thee falsely, and if I do not beat thee, in remaining longest under water, take my wife and live with her, take my kyee-zee and carry it away, split me in two and cut off my head."

Then in the presence of the friends of each party they go down into the water; and a person puts a board over the heads of the two men as they stand together, and puts down the heads of both into the water at the same instant. The man that comes up first to the surface, is regarded as the guilty party; and he pays a kyee-zee, if he has one. If he has none, his friends pay it for him; but if he has neither kyee-zee nor friends, he is put to death, as he adjudged himself before taking the ordeal.

Another ordeal is to ascend a *Steraulia* tree after it has been striped of its bark, and is very slippery. But I have never known it to be used.

Adultery and Fornication.—When adultery or fornication has been committed, the elders decide that the transgressors must buy a hog, and kill it. Then the woman takes one foot of the hog, and the man takes another, and they scrape out furrows in the ground with each foot, which they fill with the blood of the hog. They next scratch the ground with their hands and pray: "God of heaven and earth, God of the mountains and hills, I have destroyed the productiveness of the country. Do not be angry with me, do not hate me; but have mercy on me, and compassionate me. Now I repair the mountains

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now I heal the hills, and the streams and the lands. May there be no failure of crops, may there be no unsuccessful labours, or unfortunate efforts in my country. Let them be dissipated to the foot of the horizon. Make thy paddy fruitful, thy rice abundant. Make the vegetables to flourish. If we cultivate but little, still grant that we may obtain a little."

After each has prayed thus, they return to the house and say they have repaired the earth.

If one is a widow and the other a widower, no fine is required of them, but if one is the wife of another man, the adulterer is required to pay a fine, and he is not allowed to live with the woman till the fine is paid; but after the fine is paid, they are allowed to live together; and the husband takes the money, and with it, they say, procures another wife. He is regarded as having obtained a divorce from the adulteress, and is at liberty to marry again. If a woman has committed adultery with the husband of another woman, then she must pay a fine; and after the fine is paid the injured party is considered as divorced and can take another husband, if she chooses.

Adultery, or fornication, is supposed to have a powerful influence to injure the crops. Hence if there have been bad crops in a village for a year or two, and the rains fail; the cause is attributed to secret sins of this character, and they say the God of heaven and earth is angry with them on this account; and all the villagers unite in making an offering to appease him.

Persons possessed of poisons.—Poisoning is not uncommon. The Karens purchase their poisons of the Shan traders that travel among them. One of the most common is described as a yellow powder, which resembling türmeric is easily mixed with the food of the victim without danger of detection. This is probably yellow orpiment, the yellow sulphuret of arsenic.

Another poison is a root, perhaps the root of *Gloriosa superba;* but the most virulent, the one that produces death the quickest is said to be in little black grains, and is supposed by the Karens to be the gum of a tree; which must be a mistake.

It is said that the hairs of the whiskers of a tiger, if eaten with the food produce death. They are represented as producing coughing and vomiting of blood.

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Some persons are said to keep poison fangs in their possession for the purpose of killing people. These they thrust into the foot marks of the person they wish to kill, who soon finds himself with a sore foot, and the marks on it, as if bitten by a dog. The sore becomes rapidly worse and worse till death ensues.

Others are represented as having a poison stone, in the shape of a man's hand, which is called the hand of a demon. This is applied to the image of the person to be killed. An image is made of clay, and placed on the variegated leaf of a plant of the ginger family; and the stone hand is then thrown at the small clay image which it breaks to pieces. This is supposed to represent the destruction of the person represented; who immediately sickens and dies. It is essential to success, however, that the operator sit on watch over his image three days and three nights. If he goes to sleep in that time, his labour is all in vain; and he will wake up with a bit of flesh between his teeth, and become possessed of a demon; so it is about as dangerous an experiment to the operator, as to the one operated upon.

Now it is considered unlawful for a man to have such poisons, real or imaginary, in his possession. If found on a man, he is sometimes, by the voice of the people bound and spread out in the sun three days, and after destroying his poisons, he is made to swear the most solemn oaths that he has no more; and will never procure more; or he is sold off into slavery. If he has been guilty of poisoning, or supposed to have poisoned any one, it is considered a meritorious deed to put him to death.

Cursing.—Cursing is, with the Karens, an organised mode of punishment for crimes that cannot be reached in any other way.

When a man will curse another deliberately, he goes on to the verandah of his house, and curses him three evenings in succession. On the third evening, he takes an expiring faggot, an addled egg, and the last droppings of the dishes, which are usually given to the pigs, and he says: "May his life expire, like this dying faggot; may he be destitute of posterity like this addled egg; and may his end be like this refuse of the dishes."

68. *Geography and Statistics.*—The most southern limit of the Karens is in the province of Mergui, north of Latitude 12°; and they are found, in an uninterrupted line to beyond lake Nyoung Yue in

21

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about Latitude 21°. I have followed up the line myself into Karenee; and have met with Taru Karens from the region near Nyoung Yue. Report says they are found much farther north, but they have not yet been verified. On the west they extend to the Aracan hills in Longitude 92°, and on the east to the declivities of the mountains on the right side of the Menam in about Longitude 100°. Thus they are known to be scattered over nine degrees of Latitude, and eight degrees of Longitude. In Siam Proper, at least, the wild tribes on the east side of the Menam are not Karens; for the late Dr. Jones of Bangkok furnished me with a small vocabulary of the language they spoke, and I found it wholly diverse from the Karen. The name of the people which he gave me was *Khà*, and Yule has *Ka-kuas* on his map, near the Cambodia river, who are probably the same people.

69. *Population.*—The Karen population of British Burmah, according to Col. Phayre's last report is 363,756. The Red Karens are estimated at 210,000, which makes upwards of half a million. For Burmah Proper, Siam, and the Shan States we have no data whatever on which to estimate their numbers, but we may hazard a conjecture that they amount to nearly half a million more; and thus we have a million of Karens south of China. It is not probable that there are more; for Dr. Williams ascertained, while in Bamo, that the Ka-khyens in that neighbourhood are identical with the Singhpos; and I have seen Paloungs, from the east of Tagoung who assure me there are no Karens in their neighbourhood. The tribes in the Irrawaddy valley, north of Tagoung, appear to be allied to the Tibetan nations; while the Karen relationship is more with the Chinese. Their languages prove this.

70. The Karen population is certainly not on the increase. In 1831, when I went to Tavoy, the Government census made the Karen population of the province about five thousand; and in 1862, the Deputy Commissioner, Captain Stevenson, reported it at a little less than five thousand. In the interval of thirty-one years, several villagers have immigrated into the district from Siam, and one or two from Yeh, but I am not aware that one has left the province in that time. The most then that can be said for the Karen population of Tavoy is, that it is about stationary.

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In Toungoo the births and deaths, for the last four years among the Christian population, show a slight increase of deaths over the births, which brings us to a similar result.* These examples, it must be observed, are from localities where there have been neither wars nor famines in the period under review, and where the people have had all the advantages of living under the protection of the English Government, and have had the help of Missionaries to furnish them with considerable medicine, and medical advice and instruction.

71. In the Yuneselon valley, where there have been wars and consequent scarcity of provisions, the population has been very greatly reduced within a quarter of a century; and in Toungoo, while I know of many villages that are reported as having been much larger than they now are, I know not one that was said to have increased, or that has apparently done so under my own observation.

72. The people appear to be living as they have always lived. Still, the southern Karens have traditions of some of their observances, having been introduced by a man called Mautan; and they have not been universally adopted. There too they burn their dead, which they regard as a modern custom. Tradition says they formerly buried as the Toungoo Karens do now.

74. There is no tendency to union of races. They have an aversion to marrying out of their own tribe even among themselves. Still, those who live near the Burmese, do occasionally form connections with them.

75. *Social Relations.*—The relations of the Karens to the civilized nations around them, are either antagonistic, or that of tributaries. The Burmese and Talaings brought all under tribute in their territories, excepting a few tribes, and parts of tribes in Toungoo, and the neighbourhood, that have succeeded in maintaining an uncertain independence subject to occasional raids upon them by the Burmese, who burnt and destroyed everything before them. In return, if a few scattered Burmans fell among them, they seldom escaped with their lives. It may be remarked in passing that bad as the Burmese government is, the Karens, that have been subjected to it, are more thrifty, more civilised in every respect, and live more comfortably, than

* See Toungoo News Sheet, October, 1864.

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those who have ever maintained their independence; which goes to prove that a bad government is better for a people than no government.

Among themselves, every tribe is antagonistic to each other. In the south, where there are Pwos and Sgaus, one fought against the other. In the Mergui district, the Pwos are not now more than half as numerous as the Sgaus, but the numbers of the two tribes are said to have been formerly about equal; the present difference being the result of their wars; and before the English took possession of the country, the Sgaus were preparing for another onslaught on the Pwos.

In Toungoo, the Bghais and Pakus have maintained, from time immemorial, a relation to each other, much like that of the French and English of past centuries; regarding each other as natural enemies; and the Bghais being the most addicted to war, were usually the attacking party; while the Red Karens in the distance, more powerful than either, looked impartially on both contending parties, and plundered each as convenient opportunities offered. While these wars were going on in the east, the Bghais had another enemy to contend with in the Gaikhos, on the north, with whom a petty warfare has been ever maintained. Besides the wars of nations and tribes, each village, being an independent community, had always an old feud to settle with nearly every other village among their own people. But the common danger from more powerful enemies, or having common injuries to requite, often led to several villages uniting together for defence or attack.

Karen Free Masonry.—There are established forms of making covenants of friendship, by which each party pledges himself to the other to be his friend; and to aid and support him in all circumstances throughout life. There are three grades. *Mghe*, *Tho*, and *Do*. The strongest, and most sacred is the *Do*. The obligations of the *Tho* are less than those of the *Do;* and of the *Myhe* less than the *Tho*.

When two persons wish to become related to each other, so as to become *Dos;* the one who is at home takes a hog, or a fowl, and cuts off the hog's snout, or the fowl's bill, and rubs the flowing blood on the front of the legs of the other, and sticks on them some of the feathers or down of the fowl. Then they consult the fowl's bones, and if they give a favourable response; they say; " We will

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grow old together; we will visit each other's houses, we will ascend each other's steps."

The visitor next kills a hog or fowl, and performs the same rites on the other. On consulting the fowl's bones he says; "If the fowl's bones are unfavourable, we will die separate, we will go separate, we will work separate; we will not visit each other's houses, we will not go up each other's steps, we will never see each other but for a short time."

If the response is favourable, the two have entered into the relation of *Do*, and consider themselves pledged friends, bound to help each other as long as they live, in any way that they may require assistance; and they no longer call each other by their proper names, but by that of *Do.* In seasons of famine or scarcity, a *Do* helps his colleague to the extent of his ability; and if a man is abused, and evil spoken of, his *Do* defends him, saying; "That man is my *Do*, and to speak evil of him, is to speak evil of me. I do not wish to hear it."

Many multiply their *Dos* in different villages, so that wherever they go, they may be sure of hospitable treatment; and if their enemies plan a foray upon them, and the project becomes known to a *Do*, they are immediately informed of it.

It is said the *Dos* very rarely quarrel, but remain faithful to each other, and the institution seems to exert a very favourable influence in wild Karen society. It may be compared to Masonry without its secrets.

Intercourse by Sea.—Though the Karens have had no intercourse by sea with other nations, yet those near the sea-board have some stories that seem to indicate a knowledge of the existence of Ceylon under the name of Sàlie, the name by which Ptolomy designated the inhabitants of Ceylon. One story says:

"The elders relate that anciently there was a white foreigner who went and traded in a city called Phu-Sà-lie; and the inhabitants of Phu-Sà-lie are upright. When the white foreigner arrived at Phu-Sà-lie, they had heard of the Karens, whom they called elder brother Paku, and the Karens in return, called them younger brother. They took the pods of the black and red cotton plants, and scalding to death the insects in them, they prayed thus; 'If these reach our

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elder brother, may they not die; may every seed vegetate; but if planted on the ways before reaching him, may they die, and none spring up.' They then took the cotton pods, and gave them to the Captain of the ship, saying to him. 'Take and deliver these to our elder brother Paku.'

"When the Captain of the ship, the white foreigner, got back to his own country, he thought to himself; 'We will multiply this cotton, and afterwards carry it to its place of destination.' So he planted it, and it all died.

"Subsequently he went trading again to Phu-Sà-lie, and he was asked if he had carried the cotton seed to elder brother Paku. He told them honestly that he had not, that wishing to multiply them, he had planted the seeds, and all died.

"Phu-Sà-lie said: 'We will try you again. Deliver what we give you now, or never come to this place again.' Then they gave him a golden book for the Karens, and a silver book for the white foreigners, but charged them not to open either on the way. The Captain of the ship took the books and departed, but when half way on his return, the ship's crew insisted on opening the book designated for the white foreigners, and after refusing three times, he complied with their wishes. The book taught them how to obtain food and drink. If they did thus, the consequences would be this; if they did so, the consequences would be that.

"Then the ship's crew said; 'If our book is so good, how much better the Karens' must be'! and they insisted on opening it. To this the Captain of the ship resolutely refused to consent; so they killed him, cutting off his head, and throwing him into the sea. Then they opened the book, and found it taught that 'people should never die.' Then they determined to retain the book, but the ship and all the crew were lost in the midst of the sea, and they never reached their own country again.

"The body of the murdered Captain, however, floated back to the place whence he departed, and the king of Phu-Sà-lie, being on a tower by the sea shore, saw something in the water in the distance, and he ordered his servants to go and see what it was. They returned and reported it to be the body of the ship Captain that had taken away the books, and that it had floated up to the landing-place. The

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king commanded; 'Go call him to my presence.' The messengers went, and in accordance with the king's command, they said to the corpse. 'Arise quickly! The king calls thee.' He immediately arose to life and went before the king, who said: 'Did I not send thee with the Karens' book. Why hast thou returned?' The Captain replied: 'My Lord, the sailors asked to see the book, and when I refused, they plotted together and unanimously determined to cut off my head and kill me. If your majesty doubts it, please look at my neck.' He showed his neck, and all were convinced of the truth of his statement. The king said: 'Remain here at present. Thou shalt return hereafter.'"

76. *Treaty, Offensive and Defensive.*—When two or more villages wish to enter into a condition to support each other against any enemy that may arise against either; they assemble together, and kill an ox or a buffalo, and make a feast. At the close of the feast, the elders take counsel together and say: "Now we speak to each words of peace. Now our children shall marry together. You shall take wives of us, and we will take wives of you. We are not other peoples, we are brethren. If our enemies come, we will not separate ourselves; but we will pursue them together till we kill them; and if we cannot catch them, we will make war upon them, and make reprisals. May we ever support each other, and always be of one heart."

Mode of Warfare.—The Karens never declare war. The great principle of Karen warfare, is to take their enemy by surprise. Nor is war waged ostensibly between one village and another. There is always an individual at the head of every war, on whose account the war is made, and who acts as the general, but never goes to the fight himself. When he deems it a favourable time for his purpose, he kills a hog, or a fowl, and he takes a bit of the heart, and a bit of the liver, and a bit of the entrails; and after mincing them up with salt he rolls the mixture up in a leaf. This he calls tying the heads of his enemies, and after finishing his preparations, he prays: "Lord of the heavens, Lord of the earth; Lord of the mountains; Lord of the hills, mayest thou put down the inhabitants of that village! Make them forgetful, make them to forget themselves, help us, we beseech thee."

He then gives the roll to two men who have been engaged for the service, and says to them: "I send you to spy out the road, go

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look. Is the village easy or difficult to attack? Has it caltrops planted around it or not? Look accurately. Go up into the village and sleep with the people; and if any one invites you to sit with him, take out this roll and mix up its contents privately with their rice and curry. It will tie their heads. I will tie their heads with it; when they eat, they will forget themselves; and then we will go and attack them. And because they have eaten that which ties their heads, they will forget to seize their swords and spears, and before they can recover themselves, we will grasp their arms, and overcome them, and kill them."

When the spies return, they probably say: "These people have not planted a single caltrop. There is no difficulty about the village whatever. If we go and attack it, we shall take it, and kill all the people."

Then the head of the war sends out his people to collect volunteers for his foray. The matter having been arranged before hand, forty or fifty come from one village, and forty or fifty from another, and when all the fighting men assemble together, if they amount to a couple of hundred, it is quite satisfactory, and they are feasted at the village to which they have been called.

Before handing round the whiskey, the head of the war pours out some slowly on the ground and prays: "Lord of the seven heavens, and the seven earths, Lord of the rivers and streams, the mountains and hills, we give thee whiskey to drink, and rice to eat. Help us, we entreat thee. We will now go and attack that village. We have tied the heads of the inhabitants. Help us. Make their minds forgetful; make them to forget themselves. That they may sleep heavily, that their sleep may be unbroken, let not a dog bark at us, let not a hog grunt at us. Let them not seize a bow, a sword, or a spear. And may the Lord help my children and grandchildren, that are going to attack this village, and deliver them from all harm. May they overcome their enemies and not be lost. May they be delivered from the bow, the sword, and the spear." After the prayer, the elders drink part of the whiskey, and it is then circulated freely among the company.

The head of the war next takes a fowl and after killing it, consults its bones as to the success of the war, if commenced then.

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Before the examination, he says; "Fowl, possessor of superhuman powers, fore-endued with divine intelligence, thou scratchest with thy feet, thou peckest with thy bill, thou goest unto Khu-hte (king of death), thou goest unto Tha-ma (monarch of death,) thou goest to She-oo, (the brother of God), thou goest into the presence of God; thou seest unto the verge of heaven, thou seest unto the edge of the horison. I now purpose to go and attack that village. Shall we be hit, shall we be obstructed? If we go, shall we suffer, shall we die by the bow, shall we be pierced by the spear, shall we weary ourselves, shall we exhaust ourselves? If so, reveal thyself unfavourable."

If the omens are unfavourable, he dismisses the troops and each one returns to his home, to wait for a more auspicious opportunity. When he calls them again, he proceeds as before; and on consulting the fowl's bones, prays; "We will go and attack that house. Shall we overcome, shall we utterly destroy? Shall we escape being hit by the bow, and speared by the spear? Shall we not stumble on anything? If they will not resist us, but their lives be destroyed, their village come to utter destruction, then, fowl, reveal thyself favourable."

If the bones give the desired response, the elder that reads it, says: "The bones are good. If we go, we shall meet with no disaster. We shall seize and kill the whole; and if any should remain, they will not be able to resist us."

Then the head of the war leaps up and calls out exultingly to his troops, that they will certainly be victorious. He says; "Soldiers, fear not, nor be anxious. Go fight and be strong. If two or three of you are killed, I am your Lord. If in the battle a spear is broken, bring me the handle; if the barrel of your musket drops out, bring me the stock. I will replace everything. If one or two are killed, bring their bodies to me, I will clothe them, I will give them shrouds and pay their value."

He calls for two to volunteer to be first to go up the ladder into the house first, and these he addresses; "You are a hunting dog, you are a wild boar. If you succeed, you are worthy of a gong, and you shall have it; you are worthy of a buffalo, and you shall have it. If you cannot succeed, if you are killed; let not those you leave behind ask a buffalo of me, let them ask a fowl. Let them not ask of

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me a silk garment on account of your death. You say you are bold, you say you are fearless. You go the first, you return the last. Therefore, if our enemies follow, and you run away and become terrified, and anything happens to the people, you are responsible." He closes with the declaration that he will prosecute the war till he overcomes, whatever may be the resistance they meet.

The troops then go off singing war songs, of which the following is a specimen.

War Song.

I go to war, I am sent;
I go to fight, I am sent.
Clothe me with the iron breastplate,
Give me the iron shield.
I am not strong, may I make myself strong,
I am weak, may I make myself powerful.

I go with a multitude, many persons:
We will go to the house, the foot of the steps:
We will fire muskets and holloa,
The people come with wives and children:
Unsheath the spear, draw the sword;
Smite the neck, spear the side;
The blood flows purple.

I go to war, I am employed;
I go to fight, I am employed.
Employer gave me whiskey to drink;
I drank till I am dizzy.
We march in order, like white ants;
We cross a stream, and trample it dry:

We arrive at the foot of the house,
We reach the foot of the ladder:
We go up into the bedrooms;
Blood flows like a stream of water:
The blood flows down under the house.
The mother cries herself to death.

The great hawk flies over the house,
Pounces down on the chief's red cock:

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The great hawk sweeps around the house,
Carries off its prey at the foot of the steps;
Seizes the chief's white cock.
The great hawk flies away,
Leaving the chief behind weeping.

When the expedition reaches the house to be attacked, a party rushes into the house killing all the men they meet, while the rest surround the house from below. These intercept all that endeavour to escape, and receive in charge women and children that they wish to bring away alive, and bind them. If the inmates resist, the house is fired, and the people who leap out to escape the flames are killed or taken prisoners. They kill without regard to age or sex. Infants are always killed; as they say they would die if carried away. Children are often massacred with the utmost barbarity. Their hands and feet are cut off, and their bodies hacked into small pieces. Adults are often emboweled, split in two, their ears cut off and put in their mouths; and it is not uncommon to bring away the jaws of their victims as trophies, as the North American Indians bring away scalps. Sometimes, after the house has been burnt up, they sow the seeds of vegetables on the ashes, to indicate the utter destruction they have wrought.

On the return of the expedition with their captives, when they come within hearing of the village from which they were sent, they blow loud their war trumpets, and the villagers know by the peculiar call, that they are returning victors. On their arrival, they place all the captives in the hands of the head of the war, who feasts his troops and then dismisses them to their several homes.

The head of the war keeps the captives a considerable time, when, if none of their friends come to redeem them, he sells them off to other districts for oxen or buffaloes if practicable, that he may have an ox or a buffalo to give to each village that came to his aid.

Treatment of Prisoners.

Captives are often ill-treated, beaten, wounded, and occasionally killed. When they are brought in bound and fettered to the head of the war, he sometimes addresses one thus: "I did not begin this war. You killed my father, you killed my mother; you have cut off my head, made my tongue to protrude. You have made the blood to flow to the

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handle of the cleaver, to the sheath of the spear; you have snapped the bow string, you have broken the spear. You have made my father come to corruption, my mother to rottenness. You have exasperated me, you have made my anger to rise. I have not attacked you without reason; there was a righteous cause. You have dried up the waters, you have made the land barren, the grain unproductive, the barns empty. You have angered the God of heaven, you have provoked the Lord of the earth. You have stopped the rains, and made the dry season irregular. You must now redeem yourselves, you must pay money, you must give kyee-zees. If you do not furnish your price you must become slaves and die slaves."

When captives are sold, it is always difficult to obtain buyers for elderly people at any price; but men and women from thirty to forty years of age will sell for one hundred rupees each; and young men and young women for three hundred. Girls and boys between twelve and fifteen years of age are considered the most valuable, and are purchased at rates as high as four hundred rupees each. Children of three or four years of age fetch thirty or forty rupees a piece. Prices, however, are variable. When I was in Karenee, two Shan women were brought in by some Shans, and sold for fourteen rupees each.

Redeeming Captives.—When part of a village attacked escapes, they usually endeavour to redeem the prisoners that have been taken, before they are sold away to strangers. For this purpose, an elder belonging to a neutral village is hired to go and buy off the captives.

When the messenger comes to the head of the war, and explains his object; if acceptable, he takes a hog, and cuts off its snout, and with the blood that flows from it, he besmears the legs of the messenger, which is the sign that he makes him his friend, and he says he will receive him as an ambassador of peace, and he shall make peace between the belligerent parties, and they will become brethren again.

After being well entertained that day, he is dismissed the next morning with the legs and head of the hog that had been killed; and the sight of these, when he returns, is regarded as legal proof that his mission has been accepted in good faith; and that definite arrangements may be made for the redemption of each captive, if they do not quarrel about the price, which they sometimes do. When every

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thing has been arranged satisfactorily, filings are made from a sword, a spear, a musket barrel and a stone, and a dog is killed, these filings are then mixed with a part of its blood, and with the blood of a hog and a fowl; and the whole is put into a cup of water. This is called the "peace-making water." Then the skull of the dog is chopped in two, and one takes the lower jaw, and suspends it with a string around his neck; the other party takes the part of the skull containing the upper jaw, and hangs it around his neck in like manner. They next take in hand the cup of "peace-making water," and say; "We will now make an end of the feud. Hereafter, we will not attack each other; we will not devour each other's property any more, we will become brethren, we will marry into each other's families. We will entertain no hatred, no malice; we will not backbite each other, but we will be happy in each other down to the generations of our children and grandchildren; and our children shall not quarrel, but live in harmony." "If you agree to this," says each party addressing the other, "and will agree to live in accordance with this agreement for ever, unto the generations of our children and grandchildren, then drink of the peace-making water."

After drinking they say: "Now that we have made peace, if any one breaks the engagement, if he does not act truly, but goes to war again and stirs up the feud again, may the spear eat his breast, the musket his bowels, the sword his head; may the dog devour him, may the hog devour him, may the stone devour him! When he drinks whiskey, may it become in him the water that oozes from a dead body, when he eats the flesh of a hog may that hog become the hog of his funeral rites."

After these imprecations, they drink again, and the captives are dismissed.

As they go away a salute of muskets is fired, and a shower of arrows is sent after them, typical of the power of the dismissing party.

Treaty of Peace.—Sometimes when there have been feuds between different villages, and the inhabitants have settled their difficulties, both villages assemble together, and enter into a treaty of peace. Having selected a large and durable tree for a witness, they assemble around it, and each party cuts a deep notch in the tree. When the

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"peace-making water" is prepared and drank, and the imprecation spoken, two elders rise up, spear in hand, and address the people saying, "The cause of action is finished this day. Hereafter act in harmony, associate with each other as brethren. Hereafter if any one brings up a cause of contention, this tree is witness against him. If the elders die, the notches in this tree will remain as evidence against him; and let this spear spear him. He shall be fined a chatty of silver and a cup of gold."

Beyond this notch in a tree, no monuments of peace or war are known to exist.

Weapons of War.—Karen weapons of war are the bow and arrow, spears and javelins, small spears that they throw at an enemy; swords, matchlocks, and old muskets. For defence they use breastplates and shields, they plant pointed bamboos rising a few inches above the ground around their houses, which, for the lack of a more appropriate name, I called caltrops.

History.—The first historical notice we have of the Karens is from the pen of Marco Polo in the 13th century. Malte Brun, on the basis of Marco Polo's travels, says: "Thus the country of Caride is the south-east point of Thibet, and perhaps the country of the nation of the Cariaines; which is spread over Ava."

This statement is confirmed by old Bghai poetry, in which we find incidentally mentioned, the town of Bamo, as a place to which they were formerly in the habit of going to purchase axes and bills, or cleavers as they now do at Toungoo. When this poetry was composed, they must have lived five hundred miles north of their present locality.

The Bghais have also traditions of a people corresponding to the Seres of antiquity, who lived below them, towards the mouths of the rivers*, which goes to show that they formerly occupied a more northern region than they do at present.

The Sgaus have traditions that they came from a country north of the Shans, and had to cross what they call "the river of running sand," which I have suggested may be the great desert between China and Tibet, which Fa Hian also designates the river of running sand.

* See Toungoo News Sheet, August, 1864.

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It is not known, however, that the Karens are mentioned by any European writer from the days of Marco Polo to the mission of Col. Symmes to the court of Ava, at the close of the last century, who devotes a page to them in his book; and though his account of them is not applicable to the younger Karens, yet it is substantially correct of those in the neighbourhood of Rangoon, of whom he spoke.

Gaikho Tradition.—The Gaikhos trace their genealogy to Adam, and make thirty generations from Adam, to the building of the tower of Babel, at which time they say they separated from the Red Karens. The Sgaus call Adam and Eve Tha-nai and E-u, but both the Gaikhos and the Red Karens denominate them Ai-ra-bai, or E-rai-bai, and Mo-ra-mu or Mo-ren-meu. The antiquity of this Gaikho genealogy seems to me very doubtful; but I give it, as I have received it. Kai-kie, the son of Adam, bears some resemblance to Cain, but the other names have nothing like them in the Bible.

The first man and woman created were Ai-ra-bai and Mo-ra-mu;

and Ai-ra-bai	begot Kai-kie,
,, Kai-Kie	,, Plu-dau,
,, Plu-dau	,, Plau-yu,
,, Plau-yu	,, Po-pau,
,, Po-pau	,, Kan-phleu,
,, Kan-phleu	,, Kabau,
,, Ka-bau	,, Ka-die,
,, Ka-die	,, Ka-dau,
,, Ka-dau	,, Htan-mai,
,, Htan-mai	,, Pheu-shai-du-khu
,, Pheu-Shai-du-khu	,, Yu-mu-du-htwe,
,, Yu-mu-du-htwe	,, A-pha-sau-preu,
,, A-pha-sau-preu	,, A-pha-htu-hta,
,, A-pha-htu-hta	,, A-pha-htu-ke,
,, A-pha-htu-ke	,, A-pha-pe-do,
,, A-pha-pe-do	,, Thie-plau-a-phau-hta,
,, Thie-plau-a-phau-hta	,, Lau-wa-a-pha-htu-ke,
,, Lau-wa-a-pha-htu-ke	,, Dwie-tha,
,, Dwie-tha	,, Pro-ka-phau-ka,
,, Pro-ka-phau-ka	,, Ka-so,
,, Ka-so	,, Pra-so,

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and Pra-so	begot Yan-pen-lìe,
" Yan-pen-lìe	" The-phau,
" The-phau	" Kan-pyu,
" Kan-pyu,	" Pra-den-lìe,
" Pra-den-lìe	" Kle-pha-man,
" Kle-pha-man	" Kle-pha-vie,
" Kle-pha-vie	" Kle-pha-oo,
" Kle-pha-oo	" Pan-dan-man.

In the days of Pan-dan-man, the people determined to build a pagoda that should reach up to heaven. The place they suppose to be somewhere in the country of the Red Karens, with whom they represent themselves as associated until this event. When the pagoda was half way up to heaven, God came down and confounded the language of the people, so that they could not understand each other. Then the people scattered, and Thaŋ-mau-raì, the father of the Gaikho tribe, came west, with eight chiefs, and settled in the valley of the Sitang.

Red Karen Tradition.—The Red Karens say they were driven from a place called Ho-htay-lay in the neighbourhood of Ava, sixteen or seventeen generations ago, and preserved an imperfect genealogical tree of the succession of their chiefs from that period. Sixteen or seventeen generations ago would take us back to about A. D. 1400, and that was the period when Ava was founded, which synchronises with the tradition.

Seventeen generations ago, they relate, they were governed by a Queen. This lady once discovered a beautiful silver flower that had sprung up out of the earth in the forest. The people recognised the hand of God in giving it to them, and danced around it, and worshipped.

When this became known, the Burmese came down on the Karens to obtain possession of the silver flower. In the war that ensued, the Queen was killed, and the Karens fled south to the country of Toungoo, where they say they built a city. But the Burmese followed them up, and after a residence of one year in Toungoo they fled each to the region which they now occupy.

Dr. Richardson who visited Eastern Karenee obtained from the people another tradition, in which they represented themselves as

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coming originally from China with a large invading force, and when the Chinese were driven back, the Red Karens were left behind. It was about the period referred to above that Burmese history states Ava was beseiged by a large Chinese force; which is another coincidence adapted to make the truth of the sixteen generations plausible.

When the Red Karens came to their present locality, they found the country inhabited by Shans, whom they drove out. The first chief that came to the country was Than-krie, or Than-htsgen.

The descendants of Than-krie reigned for eight generations, but there is no record of their names. In the eighth generation, the people were joined by the descendants of a brother of Than-krie, under Kha-ma Kha-thya, and they usurped the government.

The genealogy of Kha-ma is traced thus:

> " Kha-ma Kha-thya begot Rie-men Sa-su, and
> Rie-men Sa-su begot Phan-bya."

This Phan-bya neither eat rice nor drank spirits. He lived on yams and fruit; and assumed the character of one possessed of miraculous powers. He said he could see into the invisible world, was skilled in dreams, understood deep things, and could prophecy things to come. The people conferred upon him the title of San-bwa.

"Phan-bya begot Tho-ray," and Thoray eat rice, so the title of San-bwa was not conferred upon him.

" Tho-ray begot Bu-phan, and Phan-bya."

Like their grandfather, Phan-bya, neither of these brethren eat rice; and both were made San-bwas, ruling apparently in conjunction. Bu-phan died without issue; but

" Phan-bya begot Bu-ray."

In the days of Bu-ray, there was no San-bwa again, for he eat and drank like ordinary people.

" Bu-ray begot Ya-yan."

Ya-yan did not eat rice, so he was made San-bwa.

" Ya-yan begot Rie-ray."

There was no San-bwa again in the days of Rie-ray.

" Rie-ray begot Phan-bya."

Phan-bya eat no rice, so became a San-bwa; but he did not live long. The record says he died young, and that he was contemporary with

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Kepho, the present San-bwa of western Karenee who succeeded him. How he came to the government does not appear, but there is strong presumptive evidence that he was a usurper, and probably killed the San-bwa. Kepho has no genealogy to show, but leaps back sixteen generations and says he is the descendant of the first chief Than-krie, but produces no evidence to sustain his pretensions.

Ke-pho eat rice and drank spirits till he was thirty years of age, when he abandoned them and has lived a vegetarian ever since.

Kepho's people close the genealogy saying: "So at last the descendants of Than-krie became San-bwa in the person of Kepho; and Phan-bya who was the first San-bwa prophesied and said: 'Hereafter the descendants of Than-krie will rise to be San-bwas. Then there will be great happiness; and when they become San-bwas do not oppose them.' These words have been fulfilled, for the Ta-ly'a, the descendants of Phan-bya do not oppose the present San-bwa, Kepho; but they observe the prophetic words of their ancient San-bwa, and receive him."

The division of the Red Karens into two tribes, eastern and western, has been usually regarded as a modern event, and began with the father of the present ruler of Karenee, but this tradition throws it back several generations.

Six generations ago Man-pheu appeared among the Red Karens. "He was a Burman who quarrelled with the King of Burmah, and was driven away from Ava, and came and dwelt among the Red Karens; where he succeeded in making himself a ruler.

"Man-pheu begot Man-kay, and
Man-kay begot Bu-phan."

Bu-phan took upon him the prophetic character, neither eat rice nor drank spirits, and became a San-bwa. According to some accounts this Bu-phan was the first ruler of Eastern Karenee, and was a son of the King of Ava who fled from his father in disgrace.

"Bu-phan begot Hto-ray, and
Hto-ray begot Tan-ya, and
Tan-ya begot Ya-hta."

Ya-hta is the present ruler of Eastern Karenee, and the man that protects Shan-loung.

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This genealogy, as given above, is probably inaccurate, being the first ever obtained, but it may serve as a basis for future correction.

Toungoo Tradition.—Thirty years ago I met with a tradition in Tavoy, that the Karens had formerly a city at the north, called Toungoo. On coming here, I found the Karens in the confident belief that the first city in Toungoo was built by a Karen. This tradition is in a measure confirmed by a Burmese history found in the Kyoungs. It is therein stated that about the year A. D. 1298, a teacher at the town of Htieling said to one of his pupils called Karen-ba: "If you go south, you will become a great man." He went south, and took up his abode in the south-east of Kaylen, naming the place, "Karen City."

His name signifies "Karen father," and the Karens claim him for one of their nation, which some Burmans admit, while others say it was a name bestowed upon him, because he treated the Karens like a father. He subsequently united with two Burmans, the history states, the sons of a former ruler in Toungoo, that the king of Martaban had defeated and carried away captive. The three jointly founded the red city of Toungoo, A. D. 1281. The elder brother of the Burmans was killed by the younger, A. D. 1317. The younger survived seven years, dying, A. D. 1324. Karen-ba then reigned alone, but the son and widow of the younger Burman were discovered in a plot to assassinate Karen-ba, and they were both put to death. He reigned quietly eighteen years longer, and died A. D. 1342. This is the last record of Karen-ba in the Burmese books; and though there is nothing incredible in his being a Karen, yet there is no evidence to show that the Karens had any part in the city.

The Karen traditions are pure myths, without a particle of historic truth. They say that the present city of Toungoo, which they regarded as the largest city in the world excepting Ava, was built by a Karen called "Tan-oo Shan," which signifies, "Ruler of Toungoo," and he had a wife called Khai-pa, but known in tradition under the name of Sa-mu-wa, signifying "White Lady."

Soon after Toungoo was built, the King of Ava came down and fought against it, and killed Tan-oo Shan. His death is attributed to his not listening to his wife. While a personal contest was going

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on between the Toungoo ruler and the king of Ava, the White Lady called out to her husband: "Smite him on the neck with your sword and then hit his head with the hilt, and his head will fall off." Tan-oo Shan was paying no attention to his wife, and did not hear; but the King of Ava was more attentive and caught the words, and tried the experiment on Tan-oo Shan, when his head fell to the ground, but it still retained life enough after it was cut off to exclaim: "Toungoo is mine, and when the appointed time arrives, I will return again, and take possession of it with white and black foreigners."

What became of the "White Lady" is not clear from the above legend; but from a single verse that I have met with, it would seem she was neglected and went away, for it is said:

> "Sa-mu-wa, we did not believe her,
> Sa-mu-wa, we did not obey her:
> She returned to her former home.
> And long have we looked for her return."

Another prose tradition says: "Anciently Tan-oo Shan, and Ava Shan contended with each other and fought. Tan-oo Shan was a good man, but Ava Shan was fierce and killed him. Before he died, he promised and gave commands and said: "I do not die for ever." He promised that in seven generations, he would return again to Toungoo and look after the city he had built. And the elders charged their children, generation after generation: "When our Tan-oo Shan died, he said he did not die; he only removed towards the mouth of the river below; and that when seven generations, seven ages were completed, he would come up again." Hence the elders commanded and said: "If people say the Tan-oo Shan has appeared, and he comes from the east, or the north, or the west, wherever he may be, do not believe him, do not follow him. He is not our Tan-oo Shan. But when people say the man has come from below, from the mouth of the river; that is indeed our Lord, the Tan-oo Shan risen again and returned. When you hear that he comes up with his wife and children and followers of white and black foreigners, that is our Tan-oo Shan. Go look at him. Go to him quickly. And look at his wife, Sa-mu-wa. Is she white? If she dresses in red or black, or yellow, or

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variegated, it is not Sa-mu-wa, it is not the wife of our Lord Tan-oo Shan. Look at her accurately. If she be white and dresses in white, she is the veritable Sa-mu-wa; and he is the true Tan-oo Shan."

Additions to the knowledge of Silk;—*by Captain* J. Mitchell, *Superintendent of the Government Museum, Madras.*

[Received 9th October, 1865.]

In the year 1859, I had occasion to examine with the microscope several kinds of raw silk, and I then discovered that the silk of *Antherea paphia*, commonly known as Tussah silk, had a very peculiar structure, differing entirely from that of the several species of *Bombyx.*

My duties, up to a very recent date, left me no time for original research and the Tussah silk was consequently put aside. It was not, however, forgotten, and I have taken advantage of the leisure afforded by a holiday to endeavour to elucidate the structure of the filament.

The silk of *Bombyx* is *cylindrical* or nearly so. It is translucent and, apparently, homogeneous. The larva spins a double filament; the two filaments, being laid side by side like two fine glass rods, are held together by a gummy cement which is soluble in water. The silk of *Antherea paphia* is *flat*, and appears to be composed of a number of opaque rods placed side by side, the intervals between the rods being filled in by a translucent cement, very difficult to dissolve.—The filament is evidently compound. Under certain conditions of illumination, it bears considerable resemblance to one of the coarser bands of Hobert's Test Plate.

This very peculiar appearance of the Tussah filament, is readily seen with a quarter or half inch Achromatic; but the demonstration of its compound structure, in that exact way that will alone satisfy the demands of science, is a more difficult matter, on account of the insolubility of the cement which binds the elementary, or primary filaments together. Macerating the silk in water for upwards of a month did not separate them, alcohol did not do so. Acetic acid mixed with alcohol appears to promise well; but the only way in

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which I have yet been able to effect a separation is by tearing the silk gently with fine bent needles. In this way, small portions have been opened out, and the compound nature of the filament placed beyond a doubt. I have been able to measure the diameter of the filaments, not very accurately, however, on account of their transparency, but the finest do not exceed $\frac{1}{35000}$th of an inch.

It is scarcely prudent to speculate upon the kind of organ by which this silk is produced, there is, however, reason to believe, that the silk issues in the form of a hollow, or ribbed cylinder, of which the opaque ribs are the primary filaments, and the interspaces the cement. Such a cylinder, while in a soft state, would collapse, as soon as the central support was withdrawn, and its application to a leaf, or a part of the cocoon already spun, would cause it to be flat. This of course is only surmise, and is only given as a hint to any one who may have the means and inclination to pursue the enquiry. It can only be demonstrated by a careful preparation of the spinning organs of the caterpillar which, if I have guessed rightly, will be found in the form of a ring of minute apertures set round a central papilla.

The silk of the *Actias selene* is flat like Tussah silk, and from its fibrous appearance, there can be little doubt that it also is compound. That of *Attacus atlas* appears to be cylindrical, it is, however, finely grooved on the surface, and is in all probability a compound structure like the other two.

I have examined several kinds of silk, and have invariably found it to consist of two filaments, simple or compound, as the case may be, placed side by side. I mention this because in all the works save one, to which I have been able to refer the silkworm is said to spin a single thread. The exception is " Adam's Essays on the Microscope." Edition of 1798. It is there correctly stated that the filament is double.

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A SHORT SKETCH OF THE TRIBES OF BHUTTEANAH AND HURRIANAH;* —*by* PETER A. MINAS, *G. M. C. B., Honorary Assistant Surgeon; in Civil Medical charge of the Hissar District.*

[Received 10th April, 1866.]

In connection with the recommendation of Dr. J. Fayrer, regarding ethnological exhibition, I have compiled the accompanying laconic sketch of the tribes of Bhutteanah and Hurrianah. In it is embodied all the information that I could collect during my leisure hours. It is a mere attempt and naturally very short, but it may guide others who will have an opportunity of visiting the same districts, and who are desirous to work out their ethnology.

Baniahs.

بنیا—बनिया.

Origin.—The origin of this tribe is blended into obscurity, but the following is the traditional account: that one, Oogur Sein, a Powar Rajpoot of the Chunderbansee division, took for a wife an Ahírí† woman; she bore him 17 sons, and each son became the head of a tribe.

Division into Classes.—The Baniahs are divided into 6 *goths*‡ viz. Aghorwall, Mahasurree, Uswall, Khuttree, Mahar, and Rorah.

The Aborigines of Agroha,—a village 12 miles north of Hissar—the descendants of Oogur Sein are spread far and wide, each as a distinct tribe, and one cannot intermarry with the other.

The Aghorwall is considered the highest in order, and the Rorah the lowest, for the latter eat meat and drink spirits.

Each caste has its *purihit.*§ The Aghorwall can become *Surrowgee*, a sect very austere in the ceremonies of religion; they do not eat or

* The MSS. of this paper was accompanied by a series of photograms, representing members of the various tribes. It would be too costly to reproduce them, but the original copies are deposited in the Archives of the Society, and can be inspected by any one interested in the subject.—ED.

† اهیر—अहीर, a caste whose business is to attend to cows; a cowherd caste. Wilson, in his glossary, gives a full account of this tribe.

‡ گوتا—गोत्र, pedigree, species, caste, or tribe.

§ پرهت—पुरोहित, a family priest, who presides at the performance of religious ceremonies.

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drink after sunset; avoid injuring or destroying insects or animals, as far as possible.

Habit.—Settled.

Habitat.—The Baniahs are scattered over every village in the North-Western Provinces, and in the largest commercial towns of Bengal and the Punjab. The cities of Sirsa and Hissar are chiefly inhabited by them.

Occupation.—The chief pursuit is commerce.

Religion.—Hindus, and followers of Vishnu.

Character.—Sly, submissive and very parsimonious. Peaceful, timid, and particularly usurious. Intelligent, can read and write, and enterprising in trade.

Diet.—Vegetables, milk, and clarified butter, and confectionaries.

Narcotic.—Only tobacco is smoken in hukas.

Longevity.—About 60 years.

Physical Conformation.—Some have dark, others light yellow or coppery complexion. Many shave their heads, and wear a *chontí*;* others allow their hair to grow. They also shave their beard and allow their moustache to grow. Some are spare built, but the richer class are generally *embonpoint.* Their average height is 5 feet 4 inches.

Dress. Dhotee,† turban of red colour, but of yellow spotted with red, is worn in the spring season, and chudder; on public occasions, silk, plain or brocaded, velvet shawls, &c. are used. Young lads are seen covered with ear-rings, neck chains, armlets, &c. As a mark of distinction, both social and religious, a circular, and several transverse marks are made on the forehead with sandal wood paste, and vermillion.

Bagrees.

باگري—बागरी.

Origin.—The origin is obscure. The Bagrees are allied to Jauts.

Division into Classes.—There is no division of this tribe known.

Habit.—Migratory.

* چوٹي—चोटी, a tuft of hair left at the top of the head, and all the rest is shaved off.

† دھوتي—धोती, cloth worn round the waist, passing between the legs and fastened behind.

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Habitat.—They are chiefly seen towards the desert tract of Bicaneer territory, but are also found in the Bhutteanah district from Jamaul to Bicaneer, and also in the Hissar district.

Occupation.—Agriculturists, and they also let cattle on hire.

Religion.—Hindus.

Character.—Peaceful, timid, and industrious in their field avocations.

Diet.—Vegetarian. Although animal food is not prohibited, yet they refrain from its indulgence for penurious purposes. Amongst this class, except millet seeds—lentil—no other kind of food is *relished;* this is either eaten separately or mixed, the latter mode is preferred during the hot season only, and is called *rabri,** which is prepared by mixing with water a sufficient quantity of salt, and boiled. It is eaten by the rich either with ghee, or, by the poor, with *lussee.*†

Longevity.—About 80 years.

Use of Narcotics.—The Bagrees smoke tobacco by fixing a *tawa*‡ or ghutteeah in a chillum, then cover with lighted dried dung of camel or cow. They also use the country spirit, and take it medicinally in Catarrhus, Pleuritis, Pneumonia, and after confinement.

Physical Conformation.—They are of a dark complexion, slender in form, hair black, and wear moustache and beard.

Dress.—The males wear dhotee, white turban, merzai, and a chudder. The females wear ghugrah§ and chudder of wool, either black or red coloured, with a narrow border of some other dye, but generally dotted red, and ungeeah‖ after marriage.

Bhuttees.

بھتّي—भट्टी.

Origin.—A portion of the inhabitants of Jesselmeer emigrated during the reign of Allahoodeen Garee, King of Delhi, and settled in a place, where a *bhat*¶ only resided,—and in compliment to the bard, the place was denominated Bhatneer,—and called themselves Bhattees. Here they formed a powerful colony, and continued to be governed

* رابري—राबड़ी, pap, or porridge.

† لسي—लस्सी, milk, whey.

‡ توا, a tile.

§ گھگھرا, petticoat or skirt.

‖ انگیا, boddice or stays.

¶ بهات—भाट, a family bard.

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under the authority of the kings of Delhi. They extended their power, and at last secured the tract of land, which derived its name, and retains to this day after them, Bhutteana.

The Bhuttees are also called Pachaddas, which word is a mere corruption of Pacheemabad, meaning, inhabitants or people of the West, so designated by the inhabitants of Delhi.

Division into Classes.—The Bhuttee caste is divided into 2 *thoks,** viz. Kulloka and Bhanaku; these are sub-divided into Joiah, Mendival, Luckwarrah, Bherayka, and Wuttoo.

They first settled on the banks of the Sutledge, and finally located at Sookchain, a village 11 miles north of Sirsa. One of their chief Jodh, settled in a village which was named after him Jodhka; Begoo established another village after his name.

Originally, a Chowhan Rajpoot was the first of the Bhanaka party, who settled in Bhutteanah district during the time of Nabob Nussoor Khan, the 11th in descent, and established 3 villages viz. Khyrika, Boodhabhana, and Bunseedhurree.

There are altogether 7 villages now existing in the Sirsa pergunnah of this clan, a few in the Roree pergunnah, but the majority live in the Putteealah states. Besides the above mentioned, there are other subdivisions viz. *Jhorurs*, originally Rajpoots, who came from Bhuttenda, the *Khurrul*, *Jugrah*, and *Goodharah*.

The previous habit of Bhuttees.—It is said that the Bhuttee population has much diminished since the establishment of British rule, as the pursuits of husbandry are not in accordance with their taste. Those that remain have now quietly settled down as cultivators, but are far from being industrious.

The old people speak of the ancient times with great exultation, alloyed with regret, when they could muster two or three hundred, make raid into the neighbouring foreign states, return with a hundred head of cattle, which were immediately divided, and then disperse with the ill-gotten booty with extreme delight.

Habitat.—The Bhuttees are now found residing near the banks of the Ghuggur, and Choyea in the Sirsa district, also in the Hissar district.

Present occupation.—Agriculturists; but formerly known for their marauding propensities.

* تهوک—थोक, divisions, parties.

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Religion.—Mahomedan.

Character.—Indolent formerly, but are now inclined to earn their livelihood by a reluctant field labour.

Diet.—Animals and vegetables.

Use of Narcotics.—They smoke tobacco in a leathern hooka. Those who live on the borders of Bicaneer, indulge in the use of opium.

Longevity.—About 80 years.

Physical Conformation.—Dark brown complexion, wear the jet black hair down to the shoulder, do not shave the whiskers nor moustache ; low in the mental scale, and of inferior capacity ; and the average height 5 feet, 9 inches.

Dress.—The males wear large turbans of white cloth, a *thymund** or *tybund* of coarse cloth or coloured *loongee*, an *ungerkha* sometimes, and a chudder thrown over all. The females wear until married a *koortee*† and after marriage ungeeah, ghugrah, with large red prints, and a chudder thrown over the body, covering the head also.

Jauts.

جاٹو—जाटू.

Origin.—Traditionally, the Jauts are the offspring of a Rajpoot father, and of an inferior caste of mother—a Sooder.

Division into Classes.—Jauts are divided into several *goths*, viz. : Bynewall, Goodharas, Sohos, &c. They are of two descriptions, the *Dehsee* or settled, and Bagrees or wandering. The former has no real caste, but is only a modified Rajpoot.

Habitat.—Bhutteanah and Hissar districts. This tribe is also seen in Kurnaul, but there many have become Mahomedans.

Habit.—Peaceful and settled.

Occupation.—This class confines itself to agricultural pursuits, and may enlist themselves in the Infantry or Cavalry regiments.

Religion.—Hindus. They pray to Ram, their chief object of devotion. Their widows are not allowed to return to their own family, but are married to their next brother-in-law, or the nephew.

Character.—Hard working, truthful, and very thrifty. They make good soldiers, being brave, and not much troubled with caste prejudices.

* تيهمند, a broad flowing sheet extending to the ankles and tied at the waist.

† كورتي, waistcoat or jacket for females.

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Diet.—They principally live on cereals and vegetables; sometimes eat goat meat. The Sikh Jauts eat better and live well.

Use of Narcotics.—Some Jauts serving as peons in the Jehsul Police &c. add churrus to the tobacco they use for smoking. The higher class use in the proportion of 1 seer of tobacco leaf, to 4 chittacks of goor, and well pounded together. Opium is also used by this class, particularly those residing towards the boundary of Bicaneer territory. They also, without hesitation, drink country spirits.

Longevity.—60 years.

Physical Conformation.—Coppery complexion; iris dark; conjunctivæ yellowish; they are tall, erect, manly, and robust; their limbs are well shaped; features regular, countenance placid and dignified.

Dress.—The men wear *lengota** or kutch, koortap† and *khesh* or chudder, white or coloured turban. The females use chudder, koortee, trowsers and ghugrah. The last is generally dyed red or yellow and is either striped or dotted.

Rajpoots.

راجپوت—राजपुत.

Origin.—Having been driven out of the Jyepoor territory by Sahabooddeen of the Ghoree dynasty about Sumbut 1234 (A. D. 1177) the Rajpoots took possession of all the district now comprising Hissar, Hansee and Bhewannee pergunnahs.

Feroze Shah in 1371 first began to convert them by force, with more or less success, till the time of Aurungzeb, but this effort was relinquished on the decline of the Mahomedan power.

The independence of the Rajpoots of course was always in inverse ratio to the power of the Dehli potentates. All the Jatu tribes of Bhewannee revolted in 1809, and the town was stormed, and taken by the British troops.

The Rajpoots—Hindus and Mussulman converts—still remain in the proportion of 75 villages or about one quarter of what they formerly consisted of.

Division into Classes.—It is needless here detailing that the Raj-

* لنگوٹا, a small narrow slip of cloth passed between the thighs and tucked into a waistbelt before and behind.

† کرتہ, a jacket or waistcoat.

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poots or Raj-pootras, form one of the highest castes of Hindu religion, belonging to the prince or military order.

Habitat.—They are spread over the Hissar district, their principal residence being Bhewannee, Rysoo, and Dhymull. They reside also in the Bhutteana district, chiefly on the borders of the Bicaneer territory.

Habit.—Mostly cultivators. As a class they are brave and proud.

Occupation.—Although particularly fond of land, yet they are indifferent agriculturists. They furnish few men to the Irregular Cavalry.

Religion.—Hindu; Ramchundra is their chief object of worship.

Character.—Domineering, and careful of what they call *izzut.* They are generally addicted to highway robberies, and cattle-thieving; careless of money; decidedly brave.

Diet.—They eat vegetables and all sorts of animals, and pork with delight, but not beef.

Use of Narcotics.—They smoke tobacco, and use opium freely, particularly those living near the Bicaneer territory. They do not hesitate to imbibe fermented liquors.

Longevity.—About 60 years.

Physical Conformation.—Dark, or fairish; iris dark, and the conjunctivæ pretty clean; tall, well formed; having regular features, and well limbed.

Dress.—Usually a red turban is used, white ungerkha, and dhotee of various colours, but they are partially red.

Rahees.

راهي—राहि.

Origin.—Rahee or Raheen, a denomination said to have been derived from a Punjabee word signifying a gardener, or tiller of the soil, and it is said to be so styled from the following circumstance: The town and citadel of Dach, having fallen into the hands of certain parties who had besieged it, they issued orders for a general massacre, but the labourers, cultivators, and artizans were to be exempted; hereupon the Rahees who bore arms resorted to a device, by which their lives were spared, each threw away his weapon, and in its stead carried on his back a plough, or some implement of husbandry, and hence the appellation which up to this day they bear.

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It appears that the territory comprised between Bhutneer in the Bicaneer territory, and Futteeabad in the Hissar district, was inhabited from the earliest time by a set of people known under the general name of Rahees, one portion of whom is said to have emigrated from Sindh, and another from Jesselmeer. In its prosperous state this tract contained 1860 villages, with a corresponding population, addicted to agricultural and pastoral pursuits, but in consequence of constant depredations, at a later period by the Bhuttees, and the anarchy and confusion that resulted, the greater part of the population were led gradually to leave the country, some emigrated into Bareilly and others settled in Pasya.

Division into Classes.—None.

Habitat.—This tribe is to be found near the banks of the Sutledge and Ghugger streams; in different parts of the Punjab, and also in the Rohilcund district.

Habit.—Strictly cultivators.

Occupation.—Their principal occupation is husbandry, but they are prone to follow any form of agricultural pursuits.

Religion.—Mahomedan and Hindu converts.

Character.—Docile, religious, but were migratory before to evade persecution, hence the reason of their being so scattered.

Diet.—The Mahomedan portion enjoy animal and vegetable food, but the Hindus avoid the former.

Use of Narcotics.—They smoke tobacco only.

Longevity.—About 50 years.

Physical Conformation.—The same as the Bhuttees.

Dress.—Ditto ditto.

Ranghurs.

Origin.—They are Rajpoot Mussulmans.

Division into Classes.—They are divided into 3 tribes, Jaut, Sutrolah and Ragoo.

Habitat.—Hissar district; and their chief villages are Bullealee, Bas, and Loharroo.

Habit.—Cultivators.

Occupation.—Fond of agriculture, but they are poor, many prefer taking service in the Irregular Cavalry.

Religion.—Mahomedans.

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Character.—Brave but violent, and proud of their honour, to which they cling tenaciously.

Diet.—They live on animal and vegetable food.

Use of Narcotics.—They smoke the huka only, and abstain from the use of spirituous liquor.

Longevity.—About 55 years.

Physical Conformation.—Complexion varies much from dark to coppery; iris chiefly dark, and the conjunctivæ frequently yellowish; active and full of fire. They are erect, tall, manly and robust; their limbs well shaped; their features regular, and countenance dignified, stern, with an air of heroism and bravery. Their hair raven, and flows down to the shoulders. Average height 5 feet 11 inches. They are on the whole a very superior set of people to look at.

Dress.—Their usual dress is white or red turban; red dopattas, trowsers, merzai, and chudder.

Vishnus.

ویشنو—वैष्णव.

Origin.—Sprung into existence about A. D. 1485, or about 50 years before the foundation of the Sikh religion. Its founder was Jambajee of Peepassur in Bicaneer. They are the followers of Vishnu.

Mode of Worship.—Their mode of worship is to present offering at the shrine, and uttering prayers whilst bathing. Its tenets are to abstain entirely from animal food, to bathe before meals, and to marry none but those of their own persuasion. It is contained in a book called *Jambajee ka banee*, meaning Jambajee's discourse. They salute each other by expressing *neom-salam*, *i. e.*, I salute you most respectfully, the rejoinder is *Jambajee ko*, signifying, May your salutation be acceptable to Jambajee. They convert others by shaving off the *chontí*. They bury their dead bodies in a cow-yard, or close to their place of residence. Their great temple is at Sameerah Dhul in Bicaneer, from which place it is said their first leader took his flight to heaven.

Habitat.—They inhabit Hissar, the neighbouring district of Sirsa; the adjoining foreign territories, and also portions of the North-Western Provinces.

Habit.—Principally cultivators.

Occupation.—Besides using agriculture, they are also good carpenters, and carriers or trainers of camels.

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Religion.—Hindus, worshippers of Vishnu.

Character.—Civil and industrious.

Diet.—Chiefly vegetables. They do not touch meat, and as far as possible they never allow any animal or bird to be slaughtered or shot in their neighbourhood.

Use of Narcotics.—The Vishnus use no narcotics. They neither smoke, nor drink any fermented liquor. Such is their aversion, that they consider it a sacrilege to allow fire from their hearth for the purpose of smoking.

Longevity.—About 60 years.

Physical Conformation.—Rather dark, but yellow predominating. The iris dark or grey, sometimes greenish. The conjunctivæ generally yellowish. Average height 6 feet.

Dress.—The males wear coloured chudder of wool or *loe*,* a pugree, ungerkha and dhotee. The females use coloured woollen dhablah generally of purple colour, and red border, and they always wear shoes.

Wuttoos.

Origin.—Allied to the Bhuttees.

Habitat.—Banks of the river Sutledge in the Bhutteana district, also in the Ferozepore, and Montgomery districts, and in the Bhawulpore territory.

Habit.—Settled and fond of agriculture.

Occupation.—Indolent previously, but now they are inclined to be laborious.

Religion.—Mahomedan.

Character.—Submissive and industrious.

Diet.—Animal and vegetable food.

Use of Narcotics.—They smoke the huka only.

Longevity.—About 80 years.

Physical Conformation.—Complexion light brown, black flowing hair, iris black, wear thick beard and moustache ; some are well built, tall, strong and able-bodied. Average height 5 feet, 10 inches.

Dress.—Turban, dhotee or tymund, and chudder, generally checked, or striped white and blue.

* لوي लुइ, blanket or kambal کمبل—कम्बल.

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THE ADJUSTMENT OF THE HINDU CALENDAR;—*by* BÁBU PRATÁPA-CHANDRA GHOSHA, B. A.

[Received 27th May, 1867.]

Owing to certain causes, presently to be explained, calculations of the Hindus regarding the year are in error. Their calendar in certain points presents a state of things that existed some centuries ago. It is necessary that such corrections be introduced in the elements of their calendar as will make its indications consistent with reality.

The Hindu year is determined by two consecutive conjunctions in longitude of the sun with the star β Arietis. Almost all nations of antiquity have commenced their year from this moment.

By the existing Bengal Calendar, the initial moment of the year is placed on the 13th of April, about seven days earlier than the real conjunction, making the subsequent eleven transits of the sun, the eleven *Sankrántis*, seven days too early.

The initial point of the year has retained in its name the idea of its coincidence with the equinoctial point, a point now removed twenty-one days from the star. The following simple solutions of spherical triangles will show that the ecliptic conjunction of the sun with β Arietis the Açvini Yogatárá of the Hindus happens between the 20th and 21st of April in 1867.

From the Nautical Almanac we have for β Arietis Æ $= 1h.\ 47m.\ 17s.$ which expressed in degrees of arc $= 26^\circ\ 49'\ 44''$.

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In the same Ephemeris the North declination on the 13th of April is 20° 9′ 17,″ the obliquity of the ecliptic being 23° 27′ 15″.

Then DN. $+ \omega =$ 43° 36′ 32″ and $\omega \backsim$ DN. = 3° 17′ 58″.

Hence N. P. D. = 69° 50′ 43″.

$\theta = 116° 49' 4''$ .... 58° 24′ 32″

$\frac{1}{2}(\alpha + \beta) = 21° 48' 16''$.

$\frac{1}{2}(\alpha - \beta) = 1° 38' 59''$.

$\frac{1}{2}(\alpha + \beta)$	Co. Log. Cos.,	....	0·03223
$\frac{1}{2}(\alpha - \beta)$	Log. Cos.,	....	9·99982
$\frac{1}{2}\theta$	Log. Cot.,	....	9·78888
	Log. tan.,	......	9·82093
$\frac{1}{2}(A + B)$	33° 30′ 30″		
$\frac{1}{2}(\alpha - \beta)$	Log. sin.,	....	8·45930
$\frac{1}{2}(\alpha + \beta)$	Co. Log. sin.,	....	0·43082
$\frac{1}{2}\theta$	Log. Cot.,	....	9·78888
$\frac{1}{2}(A - B) = 2° 48'$	Log. tan.,	....	8·68900
B .... 30° 42′ 30″			
59° 17′ 30″		....	3*h*. 57*m*. 6*s*.

Hence by the Nautical Almanac the conjunction is between the 20th and 21st April. The Hindu calculations, however, referring the conjunction to the 13th of April, make the year begin at the wrong moment.

In the above rough calculations Açvini is assumed as identical with β Arietis. The Suryasiddhánta gives the polar longitudes of stars in a very curious and arbitrary way. The author mentions certain numbers as *bija* or root for each star, which numbers multiplied by the constant 10 will give in minutes the polar longitudes of the asterisms. The following are the *bijas* or roots for Açvini and Bharani, 48, 40. Multiplying the *bija* for Açvini by the constant 10, we get 480′ or 8° the *bhága* or position of the asterism in its portion of its polar longitude.

Now let π = Polar Longitude.

ω = Obliquity of the ecliptic.

a = Inclination of the declination circle of the star to the ecliptic.

$\phi =$ Polar Longitude.

$\lambda =$ True Longitude.

$$\frac{1}{\text{Cos}\ \pi}.\ \text{Cot}\ \omega = \tan\ a.$$

$$\sin a \sin \phi = \sin \lambda.$$

$\tan \lambda$. Cot $a = \sin \mu$, the quantity to be added or subtracted from ϕ to give λ.

Position in its portion or *bhága*, ...	8°
Polar Longitude, ...	8°
Polar Latitude, ...	10°

From the above we deduce the following by formula for Açvini.

Lat.	90° 11′ N
Long.	11° 59′

This is the position of Açvini according to the Hindu Tables and astronomical works. This position of the junction star refers us back to the fifth century A. C. In each case, to reduce the distance given in Flamsted's Catalogue for the Vernal Equinox of A. C. 560, we have subtracted 15° 40′ from the longitude there given.

The following, however, are the real position of a and β Arietis by European calculations.

Longitude of β Arietis at about 560 A. C., ...	13° 56′
Latitude, ...	8° 28′ N
Longitude of a Arietis, ...	17° 37′
Latitude, ...	9° 57′ N

Comparing these we find that the position of Açvini coincided more with that of β Arietis than with that of a Arietis. The Hindus used very rude instruments of observation, and an error of even a degree is allowable in their calculations.

The retrograde motion of the equinoxes together with an error in determining the exact length of the year has brought on this difference in their calendar.

The Hindu year, like all solar sidereal years, begins at the moment of the sun's entrance into Açvini, the first asterism of the constellation Aries, and ends with the moment the luminary leaves Piscium to re-enter Açvini. Such a method of determining the length of the year accompanied by the following easy but ingenious distribution of the fractional parts of a day has saved the Hindu year from the error which was an element in the European years before the Julian correc-

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tion. The Hindu civil year differs from the astronomical as regards the fractions of a day. An error, however, in exactly determining the value of this fraction will, following the Hindu method, soon be so accumulated as to necessitate the introduction of a correction that the calculations may agree with actual phenomena. Considering the backwardness of the Hindu Philosophers to profit by recent investigations accompanied by want of that habit of verifying calculations by observations, which Bacon's philosophy alone can teach, it is natural that the Hindu year will represent a state of things that does not really exist.

The motion of the equinoxes in space, though observed in the western world by Hipparchus so early as B. C. 136, was not known to the Hindus in A. C. 400, the earliest date assignable to the Surya Siddhánta from the longitudes of stars there noted. A theory of libration of the equinoxes 27° either side of the first point of Aries is stated in certain Siddhántas, and others again calculate a complete revolution of the points, but in no astronomical work of the Hindus is any use made of such oscillation or motion. No work corrects its calculations according to the precession of the equinoxes, though the Surya Siddhánta gives a rule for determining the numerical value of the same, and instructs the students to introduce the *bija* necessary for the motion of the equinoxes.

As stated before in reckoning civil time, fractions of a day are rejected. When the fraction is less than 30 Ghaḍis (half a Hindu day) the civil year or the month is reckoned as beginning one day later than the astronomical. The year consisting of 365.24486231177907 days, 365 whole days are deducted from it, the fraction, 24486231177907 being carried to the next year forms 365·4897246235814 days. From this again the whole number of 365 days being deducted for the second year leaves a fraction to which the value for another year being added gives 365·7345869353371 days. This sum exceeds 365·5 days and therefore the year is made to commence one day later. Deducting the fractional residue ·73... from 366 days and the remainder ·26541406466279 being again deducted from two tropical years (of 730·4897246235514 days) leaves 730·22431055889535. Deducting from the above for the 4th and 5th years (730) we carry the remainder ·2243105889535 of a day to the 6th year.

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Thus the Hindus bring forward the year one whole day every fourth year nearly or 289 days in 1192 years. The system involves the error of the Julian year, which outruns the Hindu solar year (as well as the European solar year with the Gregorian correction) by nearly 10′ 44″ or two days 23′ 33″ in 400 years;

The annual variation of the equinoxes is according to the Surya Siddhánta about 54″. The position of the initial point of the year with reference to the equinox on the 13th of April, 1867, is found from the following proportion given in the Siddhánta.

(1577917828 days) the number of days in a great Yuga is to (600) the number of revolutions in it, as (1814605) the sum of the days elapsed since the last epoch of conjunction, is to the number or fraction of revolutions elapsed. This is 0 Rev. 248° 23′ 59″.7. The *bhuja* or sine of this, is its supplement 68° 23′ 59″.7 for reducing the supplement to an arc of 27°, which is done by multiplying it by 3 and dividing by 10, we get the *ayanánça*, the actual distance of the initial point of the sphere from the equinox 20° 31′ 11″·9.

One of the apparent reasons for the Surya Siddhánta's not introducing this correction in the calculations is, because the author of the work supports the theory of libration. The colures therefore falling back with respect to the fixed stars in round numbers 50″ annually, the Hindu system slowly advances beyond the true vernal equinox.

The initial point of the year is called the *Mahávishuva mesha Sunkránti*, the vernal equinoctial transit of the sun to Aries. As shown before, this moment is no longer the equinoctial point, but is removed from it by a period of about 22 days. To this period adding the distance of the present initial point from β Arietis as calculated before, seven days, we get the actual distance of the β Arietis from the equinox, the difference between the sign and the constellation Aries. The numerical value of this is about 30 and, assuming 50″ in round numbers being the numerical value of the precession of the equinoxes, we find that about 2260 years before the present time, the Hindu year began with the vernal equinox, and the ecliptic conjunction of the sun with Açvini happened at about the same time, or 300 B. C. is the latest period to which the Hindu observations can be referred. It is well to add that such determination of the dates of the Surya Siddhánta, and the Hindu observation depends decidedly on partial rea-

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soning. All attempts towards accuracy even of centuries must be futile and imperfect. Arguments stated above establish nothing besides what is evident. If the Hindu calculations were as accurate as those of western science, we could then have safely assigned the above given dates to Hindu observations. The above proves that 393 B. C. the initial point of the Hindu year coincided with the first point of Aries and the vernal equinox. Beyond this, we have no reasonable ground to advance. The Hindu observations may have commenced centuries earlier, and the then existing rough methods of observation may have led the credulous Hindu astronomer to believe that the equinox and the first point of Aries were one and the same; when in reality the equinox may have happened on the 4th or 8th day of *Vaiçákha*.

That the Hindu year formerly began about the vernal equinox, and that the moment of such beginning of the year coincided with the moment of the ecliptic conjunction of the sun with Açvini, or that the sign and the constellation Aries coincided at a former period with the initial moment of the Hindu year, is unquestionably proved by the Hindu name for that moment, the sun is said to be then in the asterism Açvini.

Had no errors entered into the calculations of the Hindus, their year would then have commenced at the present century on the 21st of April, instead of the 13th. The Mahávishuva Sankránti then would have differed from the vernal equinox exactly by that amount by which the sign Aries differs from the constellation Aries. But as it is, it involves a double error, and leads one to suppose that about 500 years before the present time, the first day of the Hindu year was brought to coincide with the first point of the constellation Aries (β Arietis) and that since then, owing to the motion of the equinoxes, the initial moment of the year has retrograded 7 degrees. Such a supposition is the only explanation that can at present be offered regarding this anomalous position of the initial point of the year; now that the first of Vaiçákh is placed between the points with which it coincided when the constellations were formed, and in which it should be, if the calendars had received proper corrections. The values of the *bijas* or corrections subsequently added to the Hindu tables as calculated by Mr. Burgess in his notes to the Surya Siddhánta, refers us to the 16th century after Christ. Making due allowance for errors of Hindu

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calculations, this may well be transferred to a century, when Jaya Siñha, it is said, translated the Logarithmic Tables into Sanscrit, and introduced many corrections into the Hindu Science of Astronomy. But the exact date of the correction of the Hindu year cannot be ascertained before the Sanscrit works of Jaya Siñha are brought to light.

The table shows the Hindu months with the corresponding English months at two different epochs.

		Precession of the equinoxes 0° 0′ 0″.	Precession 3° 10′.
Vaiçákha,	♈	March and April,	April and May.
Jyaishṭha,	♉	April and May,	May and June.
Áshádha,	♊	May and June,	June and July.
Çrávana,	♋	June and July,	July and August.
Bhádra,	♄	July and August,	August and Sept.
Áçvina,	♍	August and Sept.,	Sept. and Oct.
Kártika,	♎	Sept. and Oct.,	Oct. and Nov.
Agraháyana,	♏	Oct. and Nov.,	Nov. and Dec.
Paûsha,	♐	Nov. and Dec.,	Dec. and Jan.
Mágha,	♑	Dec. and Jan.,	Jan. and Feb.
Phálgûna,	♒	Dec. and Feb.,	Feb. and March.
Chaitra,	♓	Feb. and March,	March and April.

In A. C. 538 when the Hindu year commenced with Vaiçákha in Açvini the sun's longitude was 0° 0′ and that of the moon 2° 12′.

That the year should begin in one of the equinoxes or solstices is very natural, they are the four principal points in the heavens. The commencement of the year from the vernal equinox dates from great antiquity. The era of *sálivàhana* begins with the vernal equinox or full moon upon or next it. The Hindu year, however, in earlier times began with the winter solstice. The derivation of the name Áçvina speaks a history. Açvini being the first of the 27 asterisms and the one supposed by the Hindus to be coincident with the sign Aries, determines the beginning of the year. The month having a full moon in this asterism is called Áçvina. The conjunction in longitude of the three, the moon, the sun and the asterism may naturally be looked upon as the starting point of heavenly motion. The explanation given by Amara Siñha, the lexicographer, that the month in which the full moon happens in Açvini is Áçvina clears all doubt.

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It is rather improbable that the Hindus would wait for a conjunction of the three to begin their observations. Amara Sinha's explanation quite negatives all such suppositions, as it is impossible that the moon should have the same longitude with the sun and be still a full moon.

To correct then the Hindu Almanac, so as not to violate the Hindu idea of *Mahávishuva mesha Sankránti* is utterly impossible. The year must be made to begin at one or the other of two points. It is proposed therefore to begin the civil year from the vernal equinox or the sign Aries. Though this method enforces the change of the order of the asterisms making Revati (ζ Piscium) the first and Açvini the second, we have yet the advantage conferred by European calculation to support our view. On the other hand, the change of the beginning of the year from the vernal equinox to the 13th of April, is a strong recommendation for bringing the initial point of the year to the moment of ecliptic conjunction *i. e.* on the 21st of April. A change of the order of the asterisms is not new to the çástras. Kritiká (η Tauri, Pleiades) now third, formerly occupied the position of Açvini.

The Hindu calendar is now in one view 22 days in advance, and in another about 7 days behind the real state of things. It is proposed to eject 21 days from the month *Chaitra* and thus to bring the *vishuva* or *mesha Sankránti* back to the equinoxes. Such an innovation or correction of the calendar, involves serious difficulties; the conservative habit of the Hindu mind and the confusion in a political point of view of the dates of payment of rents, &c., are serious, but may be overcome.

The Hindu calculations, owing to the errors of tables made up some centuries past are all defective and need correction. But these are secondary to the correction of the year.

To sound the Hindu opinion on the subject, a circular in Sanscrit was issued by me in October last. There I have quoted most authoritative passages showing that such change of the beginning of the year on account of the precession of the equinoxes is not contrary to the çástras. With a Hindu, authority of the çástra is the only argument.

I append a partial translation of the principal points of the Sanscrit circular.

The Dharma Çástras say—

मेषादौ करको देया वारिपूर्णा च गर्गरी ।

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" that at the beginning of Aries (Vaiçákha) presents of flour and of jugs filled with water are to be made to Bráhmanas."

This ceremony is now performed on the 12th of April. Some doubts as to the propriety of performing the ceremony *Ghatotsarga* on this date having arisen, Professor Bápû Deva of Benares was addressed on the subject. The errors of the Hindu calendar were pointed out in the letter, and he was requested to give his opinion on the proposition of changing the beginning of the Hindu year from the 13th of April to the real *mesha* Sankránti, or the vernal equinox.*

The proposed change of the beginning of the year from the 13th of April is not contrary to the Çástras. Surya Siddhánta, the highest authority in questions of Hindu astronomy, acknowledges in the following, that time effects great changes in calculations.

शृणुष्वैकमनाः पूर्व्वं यदुक्तं ज्ञानमुत्तमं।
युगे युगे महर्षीणां स्वयमेव विवस्वता ॥ ८
शास्त्रमाद्यन्तदेवेदं यत् पूर्व्वं प्राह भास्करः।
युगानां परिवर्त्तेन कालभेदोऽत्र केवलं ॥ ९

"(O Maya,) hear attentively the excellent knowledge (of the Science of Astronomy) which (the) Sun Himself formerly taught to the saints in each of the Yugas."

"I teach you the same ancient science which was formerly told by (the) Sun Himself. (But) the difference (between the present and the ancient works) is caused only by time, on account of the revolution of the Yugas."

Vaçishtha says—

इत्थं माण्डव्यसंक्षेपादुक्तं शास्त्रं मयोदितं।
विस्तरौर्विचस्त्राद्ये भविष्यति युगे युगे॥

An examination of the Púránas will show at once that the Çástras and the ceremonies are changed in time, the gods, and the ceremonies (व्रतयागादि) of the Vedas are now forgotten.

The Rig Veda mentions the 27 stars as being married to the moon and the astronomical phenomena recorded there, show that the vernal equinox happened in *Krittiká* and the autumnal, in Rádhá or Viçákhá (γ Libræ).

* His favourable reply with the original letter of query was noticed in the original circular.

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Amar Singha states that the equinox and the Vishuva are synonyms. So does the lexicographer Hemachandra.

अयने द्वे गतिरुदग्दक्षिणार्कस्य वत्सरः ।
समरात्रिन्दिवे काले विषुवत् विषुवञ्च तत् ॥
इत्यमरः ॥

ध्वान्तं भूच्छायान्धकारं तमसं समवान्धतः
तुल्यनक्तं दिने काले विषुवत् विषुवञ्च तत् ॥
इति हेमचन्द्रः ॥

The above authors in naming the twelve months of the year, begin from Agraháyana (near the winter solstice).

मार्गशीर्षे सहा मार्ग आग्रहायणिकश्च सः ।
पौषे तैष सहस्यौ द्वौ तपा माघेऽथ फाल्गुने ॥
इत्यमरः ॥

पञ्चौ मासौ वत्सरादिर्मार्गशीर्षस्सहस्सहाः ।
आग्रहायणिकश्चाथ पौषे तैष सहस्य वत् ॥
इति हेमचन्द्रः ॥

Laughákshi on the authority of Somákara Kalpa Sutra begins the year four days before the full moon of Mágha.

माघ्याः पौर्णमास्याः चतुरहः पुरस्तात् संवत्सराय दीक्षन्ते ॥

In the Çatapatha and Sánkháyana Bráhmanas we see the year begin on the full moon of Phálgûn.

यावेषा फाल्गुनी पौर्णमासी संवत्सरस्य प्रथमा रात्रिः ॥

The astronomy of the Rig Veda begins the year on the light fortnight of Mágha, and ends on the dark half of the month of Pausha.

माघशुक्लप्रपन्नस्य पौषकृष्णसमापिनः ।
युगस्य पञ्चवर्षस्य कालज्ञानं प्रचक्षते ॥
ऋग्वेदीयज्योतिषभाष्ये ॥

Authorities were quoted from the Goládhyáya of Bháshkarácharya, the Sûrya Siddhánta, the Soma Siddhánta, the Çákalya Sanhitá, the Laghûvácishṭa Siddhánta, Áryabhaṭṭa, Varáha Mihira and Brahma

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Sphûta Siddhánta to show that these authors admit of and give rules for determining the value of the precession of the equinoxes.

The position of Agastya (Canopus) given in the Vishnû Pûrána and in the Parásara and Garga Sanhitás show that the asterisms have moved from their original position in the heavens.

प्रथमे कृत्तिकाभागे यदा भास्वान् तदा शशी।
विशाखायाश्चतुर्थांशे मुने तिष्ठत्यसंशयं ॥
इति विष्णुपुराणे ॥

दृश्यते च किल चण्डमतेर्के रोहिणीमुपगतेऽस्तमुपैति ॥
इति पराशरसंहिता ॥

आसन् मघासु मुनयः शासति पृथ्वीं युधिष्ठिरे नृपतौ।
षड्द्विकपञ्चद्वियुतः शककालस्तस्य राज्यस्य।
एकैकस्मिन् ऋक्षे शतं शतन्ते चरन्ति वर्षाणां।
प्रागुदयतोऽप्यविवराद्य उदयं तत्र संयुक्ता ॥
इति गर्गः ॥

The retrograde motion of the equinoxes has brought a change of the seasons—Vaiçákha and Chaitra constituted the spring of former times.

मधुश्च माधवश्च वासन्तिकावृतू। शुक्रश्च शुचिश्च ग्रैष्मावृतू ॥
इति तैत्तिरीयसंहिता ॥

Lastly the practical proof of the effects of the errors in calculations is given by directing the Pandit to observe the heavens just after sunset in the month of Vaiçákha.

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The Hill-tribes of the Northern Frontier of Assam;—*by* Rev. C. H. Hesselmeyer.

[Received 26th August, 1867.]

The Himalaya mountains, so far as they form the northern boundary of Assam, are inhabited by two distinct races of men. Originally, probably one and the same race, they seem to have undergone a change sufficiently marked to authorize their being considered at the present moment, as two distinct races.

The mountaineers who occupy the eastern half of those frontier-hills seem to be original occupants, or first arrivals, and to have retained their original habits and customs. Those who live to the west, appear to belong to a later period of immigration, subsequent to their descent from Central Asia. When they drove out from before them the first occupants, say the Dimasa and Boro, or Lalong, now living in the plains of Assam, they seem to have come in contact with a certain degree of civilization which effected that change both of feature and habits and customs which is so striking to the beholder.

The last mentioned of these two races are the people commonly called Butias or Butanese—this name applying to all the various and numerous tribes who belong to the same race. These, however, having served our purpose thus far, we may leave for the present, while we turn our attention more in particular to their less civilized brethren to the east.

Unlike the Butias, these possess no common name. The region they occupy, is fully as large as Butan, and equally as interesting. Indeed, little as we know of the people, the country they occupy, is still less known: as much a *terra incognita,* in fact, as the interior of Africa. The few Europeans who have crossed the frontier, have barely done more than skirted this unknown region: none have ever penetrated to the snowy range; none ever crossed its entire width from Assam to Tibet proper. All we know about the country and its inhabitants, we have learnt from the latter, who are, however, not in all cases reliable informants. Until, therefore, a Livingstone or a Wilcox will undertake to traverse its cane-bridged mountain

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torrents, its snow-capped heights, and brave leeches, dum-dam and cannibal Abors,—in order to confirm or otherwise, the statements of native informants,—we shall have to rest satisfied with our present stock of information.

From all, then, we have hitherto been able to collect, it would appear, that that portion of the Eastern Himalayas which lies between the 92° 40′ and 95° 30′ East Long., or between the eastern boundary line of the country of the Tauwang and Kampá Butias, and the Dibong river,—having Assam on its south, and Tibet proper on its north side,—constitutes the home of four peoples, known to the inhabitants of Assam by the names of Aka, Miji, Dafla, and Abor.

Three of these tribes, the Aka, Miji and Dafla, occupy the hills on the southern side of the backbone of the Himalayas, the snowy range. The water of their rivers flows down into Assam *direct.* I make use of the expression *direct*, because I thereby wish to explain the more immediate proximity of their mountain-homes to Assam; for, properly speaking, the rivers that run down the northern slopes of the snowy range pour their waters likewise into the same big river which passes through Assam, viz. the Sampo of Tibet. The Abors alone, in some of their northern clans, are said to dwell on both sides of the snowy mountains, and they are thus in intercourse both with Tibet and Assam.

The seats of these four principal tribes may be defined as follows: commencing from the west or the frontier of Butan we come first upon the Akas. Their country is situated so as to have Assam on the south, Butan on the west, the Miji territory on the north, and the Dafla east. The Buruli river forms the boundary of the Aka and Dafla country, or rather hills. The Mijis again have Butan to the west, and probably north, but the Buruli river running round the northern side of their country until it enters Butan, the Daflas to the east, and their friends and neighbours, the Akas to the south.

The Daflas like the Akas have the valley of Assam for their southern limit, the Akas and Mijis, with the Buruli river intervening, on their west, and the Abors both north and east,—the Subonsiri river running up between the hills of the Abors and Daflas. Then the Abors themselves occupy the whole of the remaining ex-

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tremity of the eastern Himalayas. They inhabit all the country lying between the territories of the Daflas on the southern face of the snowy range, and the Kampo-Butias on the northern face of the same snowy ridge; Tibet on the north, Assam on the south, and the Mishmi-tribes on the east, the Dibong river forming the line of demarkation between the villages of the Abors and Mishmis.

Of all the four tribes above enumerated, the Abors are by far the most important, both as to their numerical strength and their war-like propensities, as well as through the extent of their territory.

In the present communication I shall restrict my remarks to one of the tribes only, namely—

The Akas.

The Akas or Angkas live on hills of moderate height, the highest probably not exceeding 6,000 feet, in the angle formed, as before mentioned, by Assam and Butan. Three to four days climbing over thickly wooded hills, nearly pathless, stumbling up the dry bed of the Buruli and other less important watercourses, thickly strown with large boulders, clambering up the steep faces of rocks, holding on by a cane-rope, bring the traveller to the small settlement of the Akas. The Miri elephant-hunters follow up the bed of the Buruli river, taking a small light boat along with them, which they lift over the water-falls, and so reach the Aka country. There is, however, a better road but somewhat circuitous. This road takes the traveller first to Butan to the settlement of the Sat-rajas due north, after a march of about four days, and then goes on to the Aka country due east which you reach in another two days. This is a road which the Aka women and children, and their ponies travel.

The name Aka, or Angka,—even Ángka—is given to them by their neighbours; they themselves do not use it, but speak of themselves as Hrusso.

The Hrusso do not pretend to be aborigines of the country they now inhabit. They are unable to tell where the real home of their tribe is. They pretend to have been inhabitants of the plains. Our ancestors, they say, lived in Partabgor on the banks of the Giladhari river, north of Bishnath, but were driven out from thence by Krishna and Bolorám.

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The language of the Aka, however, tells a tale, and so does their national character. Their language contains more words which can be traced to the valleys south of the Patkoi range, joining the Shan and Munipuri countries, than words indicating a closer affinity with the Dafla and Abor tribes. They differ mentally and physically from their mountain neighbours to the same degree.

The truth seems to be, that the Hrusso entered Assam about the same period when the far more numerous and daring Ahoms burst from their hills into the valley. Probably the Akas preceded them, and having been driven from place to place, they finally settled on the hills where they now still live. As to numerical importance, the Angkas would barely deserve any notice at all. They do not number more than one thousand souls.

This handful of hill people live in two detached villages. The greater one is inhabited by Akas who have earned for themselves the *sobriquet* of cotton thieves, or Kapás-chor. The smaller is peopled by a less offensive clan called the Hazarikhuka, or breakfast-eaters.

There is a third class of Angkas spoken of by the people of the plains who go by the name of Angka Miris. Old maps have them located beyond the snowy range on the Tibet side. But by all accounts, these Angka Miris live to the east of the Kapás-chor Angkas. The Miris of the plains who are in the habit of hunting for elephants, deny having ever heard of Angka Miris. Further enquiry, however, may enable me to throw more light upon this tribe.

The importance which attaches to the Akas is first the bad name which they bear among the people of the valley, who inhabit the tracts of country bordering on the Aka hills. For the Akas, few as they are in number, make up for this deficiency by being bold and daring robbers and cut-throats. Next in importance is their situation between the people of the valley of Assam and the powerful and very numerous clans of the Miji tribe. The Mijis, it would seem, are not in the habit of visiting Assam, except only one small chief; but they highly prize the silk and cotton cloth the Akas are able to procure from the plains, and for which these demand from the Mijis exorbitant prices. As a third cause of their importance may be adduced the fact that, although powerless themselves, they know how to make themselves formidable,

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through the influence they manage to exercise over the Mijis, whose countless hosts they would be able without much difficulty to lead any day against any foe.

There are about ten clans for which the term households, or families, would be the more appropriate one to use; yet each of these petty clans has a chief whom they style Raja, like their neighbours, the Butias,—not Gam, like their other neighbours, the Daflas.

These clans are so small, that they find room each in a house by themselves. Some clans number only thirty souls, others sixty to one hundred, and according to the number of inmates is the size of each house. The most numerous clan boasts of a chief, who is but too well known among the Assamese, and the neighbouring hillmen, and no doubt the Bengal Government too has learnt to know his name. This is Tagi Raja. This man has succeeded in obtaining the hegemony over all the Kopás-chor Akas, and as he exercises great influence over the Mijis also, he is able to intimidate the rest of the Aka people, and thus may be said to be the head of all the Hrusso.

The Hazarikhuka Akas live in three clans on a separate hill from the Tagi's people.

Internal feuds are numerous. It is a matter of no rare occurrence to see clan against clan, *i. e.* family against family enlist the aid of the Mijis and carry on a miniature warfare.

The Hrusso use the cross-bow and poisoned arrows; a light spear for the purposes of throwing, and a narrow sword, about four feet long. They manufacture their own arms; the iron and steel, however, they buy in Assam. They use neither shield nor helmet. Their tactics are simple; like all the hill-tribes, they rely upon sudden surprise, they lie in ambush and fall upon their foes unawares.

The Assamese Buruas of the days of the native rulers used the Akas for purposes of revenge and intrigue. And it was through the party-spirit of one of the Buruas, or governors of Chardoar in the days of Gaurinath, the last real king of Assam, that the Akas obtained the privilege of levying pieces of Eria silk (Bambyz), and cotton cloth from every household in the Balipara mehal, which they continue to do unto this day. The only occasion on which the Akas have come

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into hostile collision with the present government of Assam, occurred some twenty-five years ago when their daring raids led to the capture of the young Tagi Raja and, after his liberation, to the massacre of the garrison of a stockade close to the pass which leads into their hills.

All attempts to punish this bold and blackguardly act remained unsuccessful, at last the little war seems not to have been carried on with much spirit, and matters between the Hrusso and the British Government were left in *statu quo*.

Since that revengeful and treacherous act, however, the Akas have been content to levy their silk and cotton pieces, and to accept Rs. 860 of black mail per annum, without any further deeds of robbery and murder.

They now pay their annual visit to Assam in the months of February and March; take their due; make their purchases in iron, steel and brass vessels, in beads and other articles of luxury, and, after the above mentioned levying of cloth, return the way they came.

The Aka, though uncivilized, is not devoid of religious ideas. He has no written çastras or religious books of any kind, it is true; he has no system of religion and knows nothing of caste. But the Aka fears the high mountains which tower aloft over his dwelling, and from the snow-clad sides of which leaps the thundering avalanche; he fears the roaring torrents of the deep glen which interposes between him and his friends beyond; and he fears the dark and dense jungles in which his cattle lose their way.

These dark and threatening powers of nature, he invests with supernatural attributes. They are his gods. Thus there is *Fuxu*, the god of jungle and water; *Firan* and *Siman*, the gods of war, and *Satu*, the god of house and field.

Over all these gods the modern Aka places *Hori Deo*, a Hindu deity. This is an innovation, introduced by Tagi Raja after his imprisonment. For whilst a captive, he became a disciple, as it were, of a Hindu guru, who in his turn obliged Tagi, by giving security for his new convert's future good behaviour.

All these gods have their little temples or rather puja-huts, which contain representations of them, some are said to be of silver and gold. These latter most probably would turn out to be Buddist images, obtained from the Butias.

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Near the puja-houses lives the Deori or sacrificing priest. He is always chosen from among the other Akas by divine tokens, it does not matter whether he is a bachelor or married. This Deori has to perform the daily worship for all the people, and on all special occasions he has to sacrifice the requisite number of mithuns, cows, goats, fowls and pigeons. Geese and ducks there are none to be found in all the settlements of either Aka or Miji. The Akas entertain some crude notions of a state of punishment and reward after death.

To follow an Aka through his domestic and public life, I shall have to begin with the erection of the dwelling-house. The Hrusso cannot build a house where he pleases, for the spot on which he intends to erect his future dwelling must first be ascertained to be a lucky spot. The Deori therefore has to be consulted, animals slain as sacrifices, and the place pronounced to be propitious. Then the felling of timber, and the collecting of the other building materials may be proceeded with. All having been collected, *Fuxu* receives his offerings, part of which consist in a portion of the building materials.

The house itself is generally very substantially constructed. It is built on piles from 5 to 7 feet above the ground; boarded and comfortably walled in, with carefully planed planks, in this respect resembling the houses of the Kassias. The roof is thatched with a kind of broad leaf, and on account of the strong winds, mats are firmly, but neatly, fastened all over it. The houses of the Daflas and Abors, including other hill-tribes besides, are less substantially constructed.

All the members of one family or clan, including the slaves, live under the same roof. The size of an Aka dwelling varies therefore with the size of the family. The house of Tagi Raja is 200 feet long and 40 feet broad, a long row of separate compartments running the whole length of the building.

No earthen vessels are used by the Aka for household purposes. They possess huge copper jars to hold the water supplies of the family, and for cooking and eating, they use the brass pots and plates which they obtain in the Tezpore bazar.

The copper jars are not procured by them in Assam, but most likely bartered from the Mijis, who again must have brought them from Butan. The granaries and stables are always built at some distance from the dwelling house for fear of fire.

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The Akas are polygamists: they can marry as many wives as their means allow. A marriage among them is contracted in this wise: The parents or relatives select the future wife from among the female friends of the family, those friends may be either Aka or Miji, for Mijis and Hrusso intermarry. On the day appointed for the wedding, the services of the Deori are again called into requisition; partly with a view to obtain the favour of the gods, but chiefly, I guess, in order to provide an abundance of meat for the hundreds of guests who are to partake of the marriage-feast, and for whom great numbers of mithuns, cows, goats and fowls have to be killed. The festivity, *i. e.* the eating and drinking— for the Akas, like all hill-people indulge in ardent spirits— are to last at least five days and nights uninterruptedly.

The nuptials having thus been duly initiated, the bride and bridegroom are placed by the Deori beneath the canopy, formed of a piece of cloth spread out over them, he then winds another piece of cloth round both, thereby indicating their union, and this ceremony over, they are declared to be man and wife.

At the birth of a child, again sacrifices are brought, but no distinction is made between the sexes: a girl is considered as much a blessing as a boy; the murder of female infants, therefore, is fortunately not known amongst them, although they welcome the birth of a son with the same degree of joy, with which such an event is hailed among far more civilized nations.

In like manner are the gods to be propitiated when the ground is hoed and the seed sown, and also at harvest-time.

Seasons of sickness too require the services of the Deori, for the Aka is not in the habit of resorting to medicines of any kind to effect a cure. If a Hrusso falls ill, fowls &c. are offered to *Fuxu*, and the patient is mesmerised; but should this prove unavailing, matters are left to the good pleasure of *Fuxu* alone.

The dead among the Akas are not burnt, but buried. A grave is dug four to five feet deep and the body reverently deposited therein. Then a share of all his valuables is placed by the side of the dead, including his spear, bow and arrows. Next a platform is raised over the body to keep the earth from falling upon it, and finally the grave is filled in and over it a small stockade of bamboos and sticks erected,

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and — Hindu fashion—a piece of cloth is spread out over the whole.

The Aka, although given to loot and robbery, is yet no idler: he is a great agriculturist. Unlike the Butias, the Akas import no grain from Assam, but subsist on the fruits of their own labour. They cultivate the fine plateaux on the backs of their broad hills, and some of those smiling valleys that stretch themselves out between their hills, miles in length and width.

They hoe the ground and beat the surface fine; then pierce holes with a pointed stick, and drop into each hole 3 to 4 grains of rice (dhan). Their rice-crops they declare to be as good as, if not superior to those of the best parts of Assam. Beside the common kinds of rice, they cultivate a kind of grain, called Dafla-dhan, of a small size but growing in numerous clusters; it is a grain, in fact, resembling millet. Also vegetables of the same description as those which are found in Assam, and pulses of various kinds are cultivated by the Akas.

There are, however, neither cotton, nor hemp and flax-plantations, to be met with; the only fibre used by them and the Mijis, as well as all the other hill-tribes, is that derived from the rind of a tree known in Assam by the name of Odal, and used for nets and ropes. The consequence is, that the women of the Akas neither spin nor weave, but rely for their cotton cloth on the plains, as already mentioned. Nor do they breed the silkworms known to the Assamese. Though they covet the Eria Bor-Kapors of Assam, and the finer silk dhuties, yet they have never taken the trouble of introducing the silkworm into their hills.

The Akas keep large flocks of mithuns or mithans, and cows—their flesh is eaten, but the milk of mithuns, cows and goats they never touch. They breed pigs and rear fowls and pigeons in great numbers, but geese and ducks are forbidden to them by the gods.

The Hrusso pride themselves on being better feeders than any of the other hill-men. They eat the food of civilized people; never touch the flesh of dogs, or elephants, or other objectionable animals. They indulge in the use of opium and tobacco—in fact, the pipe seldom leaves the mouth of an Angka man or woman. Such a pipe is generally a bit of bamboo with a reed inserted into it at a right angle. Now and then, however, Tibetan pipes of composition metal

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may be seen in use amongst them. They likewise chew betel which they obtain in the plains, but tea as a beverage is not in use among them, although they keep up a constant intercourse with their Butan neighbours. The well-known ardent drink however—a species of beer, called Mod— prepared by all the aborigines of Assam and its frontier hills, the Akas too drink to excess.

The dress of the Angka has nothing national, or nothing that could distinguish them from other hill-men that border on Assam, except the profusion of Eria cloth wound round their bodies in all manner of ways, and a kind of half-trousers which consist in a piece of Eria cloth tied in such a fashion beneath the knee, as to allow the fringes to hang down over the ankles. When they move, the ample folds of this kind of legging, keep swinging and flying about their feet, and thus this piece of garment seems to answer admirably the purpose for which it is intended, namely to keep off the leeches and stinging insects, such as the musquitoes and the dum-dam.

As a head-dress the Aka often wears a kind of ring-cap or crown made of cane, three inches high with one or two tall feathers in front. However the felt-caps of the Butias are as commonly met with, while those who claim the rank of a raja sport rings or crowns such as those alluded to, only made of thin wood instead of cane, and covered with embossed silver. Tagi himself, however, never appears in the plains without his Tibetian hat of japanned wood of a bright yellow with a glass-knob on top, and a blue silk damask robe of state, of Chinese manufacture, but rather faded. All are fond of beads, and they wear them in profusion. Thus dressed up, they appear on state occasions only, the long sword at their side, and one or two minor weapons for cutting besides. When at home, the Aka looks more the savage, and dispenses with most of his garments. But winter is severe, and then he appreciates the neighbourhood of Assam, and the cloth of the rayats of Balipara.

In appearance, the Angka bears the same family-likeness with the other Turanian hill-tribes; he is a well-made and strongly built man, with more of daring and defiance in his look than the Dafla or even the Naga.

He is ignorant of the art of reading and writing, and though he covets the productions of art which Assam and Butan supply,

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including Tibetian oil-paintings of Buddhist deities, yet does he look down upon books. The offers of opening a school in their villages, have repeatedly been made to Tagi, but as often politely refused. Tagi dreads the approach of the schoolmaster to his hills, for he knows, that with the schoolmaster there would come a different code of morals and ethics; and he fears, that the English will succeed the schoolmaster, and thus put an end to Tagi, and the selfish aims of the Angka people, as regards the Mijis and the inhabitants of the Balipara Mehal.

ALPHABET.

Showing the Orthoepy of the Dialects spoken by the Hill-tribes of Assam.

a. = Fāther.
o. = *a*ll.
ä. = *e*ver.
e. = m*ay*.
i. = be.
o. = n*o*.
ö. = deux, Fr.; or böse, Ger.
u. = t*oo*.
ü. = t*u*, Fr., or über, Ger.
f. or ph. = Father, or *Ph*iloso*ph*y.
g. = go and give.
h. = house.
k. = cat.
s. = *s*o.
z. = *z*eal.
th. = *th*aler in German.
ch. = *ch*ur*ch*.
j. = joy.
x. = Lo*ch*, Scotch, or glei*ch*, German.
v. = *v*ery.

English.	*Hrusso or Angka.*
one, ...	a.
two, ...	'kse.
three, ...	'tse.

English.	*Hrusso or Angka.*
four, ...	pferi.
five, ...	pfumu.
six, ...	ri.
seven, ...	'mue.
eight, ...	'xi or ksi.
nine, ...	sthö.
ten, ...	erh or 'rr.
twenty, ...	b'sha.
fifty, ...	serre.
hundred, ...	purrua.
I, ...	'nyo or no.
of me, ...	nathi or nadci.
we, ...	ni.
of us, ...	nithi.
thou, ...	ba.
of thee, ...	bathi.
you, ...	jö or jöe.
of you, ...	bathi.
he, ...	phö or pfö.
of him, ...	öthi.
they, ...	b'góuna.
of them, ...	b'góunathi.
hand, ...	gsi.
foot, ...	'ssi.
nose, ...	nüsü.
eye, ...	ni.
mouth, ...	'nsu.
tooth, ...	thu.
ear, ...	phu or pfu,
hair, ...	kechü.
head, ...	khie.
tongue, ...	jabla.
belly, ...	negujü.
back, ...	subúe.
iron, ...	'ssä.
gold, ...	shü.

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English.	*Hrusso or Angku.*
silver, ...	lümmä.
Father, ...	áu.
Mother, ...	áni.
Brother, ...	'nyu.
Sister, ...	nümi.
man, ...	nüna.
woman, ...	pfümi.
wife, ...	gsi.
child, ...	angasa.
son, ...	sau.
daughter, ...	sami.
slave, ...	khla.
cultivator, ...	viddóu.
shepherd, ...	füdsusuen.
god, ...	shemüzü.
sun, ...	dsu.
moon, ...	xubie.
star, ...	litsie.
fire, ...	mi.
water, ...	xu.
house, ...	'nie.
horse, ...	fugra.
cow, ...	fuluxu.
dog, ...	sülö.
cat, ...	ashasa.
cock, ...	damrou,
duck, ...	ossa.
ass, ...	fub-abu.
bird, ...	düö.
go, ...	khabue.
eat, ...	chaue or tsanue.
sit, ...	riue or röue.
come, ...	agekhaue.
beat, ...	güga.
stand, ...	güdzülue.
die, ...	büdzíbi or büjibi.

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English.	*Hrusso or Angka.*
give, ...	dziba or jiba.
run, ...	godzoe or godzue.
up, ...	rafu.
down, ...	ramge.
near, ...	enisa.
far, ...	aniera.
before, ...	avva.
behind, ...	fumu.
who, ...	aninashe.
what, ...	hando.
why, ...	hando.
and, ...	hamso.
but, ...	hamso.
if, ...	soio.
yes, ...	ö.
no, ...	ma.
alas!	ah! ah! kinia! dunia!
father, ...	áu.
of a father, ...	authi.
to a father, ...	au.
from a father,...	audin.
fathers, ...	auangie.
of fathers, ...	auangithi.
to fathers, ...	auangie.
from fathers,...	auangidin.
a daughter, ...	sami.
of a daughter, ...	samithi.
to a daughter, ...	sami.
from a daughter, ...	samidin.
daughters, ...	samiangie.
of daughters, ...	samiangithi.
to daughters, ...	samiangie.
from daughters, ...	samiangidin.
a good man, ...	nünauh.
a good woman, ...	fümiuh.
a bad boy, ...	angasa mikzi.

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English.	*Hrusso or Angka.*
a bad girl, ...	nimie mikzi.
good, ...	uh.
better, ...	angie uh.
high, ...	liujue.
higher, ...	angie linjue.
horse, ...	fugra.
mare, ...	emini.
horses, ...	fugra angie.
mares, ...	emini angie.
bull, ...	ombu.
bulls, ...	ombu angie.
cow, ...	fullu.
cows, ...	fullu angie.
dog, ...	sülö.
bitch, ...	sülö angie.
he-goat,...	kissiglo.
she-goat, ...	kissiemie.
deer, ...	shu.
I am, ...	na éidu.
thou art, ...	ba du.
he is, ...	i or fö dua.
we are, ...	ni éidu.
you are, ...	jö or ze du.
they are, ...	nadu.
I was, ...	na dusö.
thou wast, ...	ba duso.
he was, ...	i or fö duso.
we were, ...	ni duso.
you were, ...	jö or ze duso.
they were, ...	na duso.
be, ...	adaue.
I may, I shall, I should, } be, ...	na danie.
beat, ...	gue.
I beat, ...	na gümbi.

English.	*Hrusso or Angka.*
thou beatest, ...	ba gümbi.
he beats, ...	i or fö gümbi.
we beat, ...	ni gümbi.
you beat, ...	jö or ze gü.
they beat, ...	na gü.
I may, I shall, I should, } beat, ...	na günie.
I am, I was, I shall be, } beaten, ...	na güda.
I go, ...	na khanie.
thou goest, ...	ba khanie.
he goes, ...	i or fö khanie.
we go, ...	ni khanie.
you go, ...	jö or ze khanie.
they go, ...	na khanie.
I went, ...	na khabse.
thou do, ...	ba khabse.
he do, ...	i or fö khabse.
we do, ...	ni khabse.
you do, ...	jö or ze khabse.
they do, ...	na khabse.
What is your name?	Banini hathi aue?
How old is this horse? ...	Fugra oddia khiniavo?
How many sons are there in your father's house?	Bo iniase isa kinia duvo?
The son of my uncle is married to her sister, ...	Avo essau eniu enümi ksidani.
How far is it from here to Kashmir?	Aio bege Kashmir khímia radavo?
I have walked a long way to-day,	'Yo angiera dim doui.
In the house is the saddle of the white horse, ...	Fugra gro dsimie duma nie.
Put the saddle upon his back, ...	Dsimie niva.

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English.	*Hrusso or Angka.*
He is grazing cattle on the top of the hill, ...	Semifu khakus, done fu.
He is sitting on a horse under that tree, ...	Shöni elo fugra idsuze nuna röda.
His brother is taller than his sister,	Enümise eama pshüfada.
The price of that is two rupees and a half, ...	Tokar púkse adulia.

ON THE BIRDS OF THE GOONA DISTRICT; *by* GEORGE KING, M. B., *Assistant-Surgeon, Marwar Political Agency.*

[Received 10th March, 1868.]

Goona is a small station in Central India on the Agra and Bombay mail road, 200 miles south of Agra. It is situated in the territory of H. H. the Maharajah of Gwalior, and in a very thinly populated and comparatively little known part of the country. Having been attached from the months of March to December of the past year, to one of the regiments of Central India Horse stationed there, I took the opportunity of noting the birds of the surrounding district, thinking that a list of them might have some interest with respect to the geographical distribution of species. Not having remained a full year in Goona, the list subjoined is necessarily incomplete in respect of some of the migratory species, especially of water-fowl and waders, and I feel sure that an observer resident there for several years, would be able to add the names of many occasional visitants and *very* local species.

Every care has been taken in the identification of the species given, and the names of none have been inserted on hearsay. I have the authority of the sportsmen of the station for believing that the names of Red Spur-fowl, the Indian Bustard, the Golden Plover, the Kulan, the European Bittern, and the Barred-headed Goose, might have been added, as occasionally occurring in the district, but not having myself shot or seen specimens, I have excluded them. The book chiefly used in identifying the species has been Dr. Jerdon's admirable

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"Birds of India," a book which puts within the easy reach of every resident of India, the means of pursuing the study of a most delightful branch of Natural History.

Goona is too unimportant a place politically or commercially to give its name to a district, but I have used the term "Goona District" as a convenient designation for the tract of country lying between the rivers Scinde on the east, and Parbutty on the west, and bounded on the north and south by lines connecting these two streams, 10 miles distant from the station in either direction. Although I believe the *fauna* of this district to be typical of that of a much wider area, I profess in the present paper only to give a list of the birds found within the limits just indicated.

In respect of climate and physical features, the Goona district may be taken as a type of the north-western part of Central India. Passing south from Gwalior, which is very little higher above the sea than Agra, the land gradually ascends, until at Goona a height of about 1400 feet is attained, and the elevation increases towards the east and south in the directions of Saugor, Bhopal and Indore, while towards the west, the country slopes gently until the sandy plains of Eastern Rajpootana are reached. The surface of this part of Central India is undulating and hilly. Few of the hills, however, rise more than 400 or 500 feet above the plain, and the majority are much lower. They are mostly rounded or flat-topped, and many are thickly strewed with loose stones. In the rains they are green to their summits, and the lower slopes of most are clothed with a dense growth of bushes and low trees. The geologic structure of these hills is chiefly laterite, a term rather vaguely applied to a reddish-brown deposit, which varies in character from masses of hard though often cellular rock* of a jaspery appearance, to beds of loose angular rubble.

The valleys and plains are covered with deep black soil, interspersed here and there with mounds and slopes of reddish gravel and sandy earth, the *debris* of laterite. Scattered over the country there are a considerable number of small natural lakes and streams, many of which, though much reduced in size, retain some water during the hot weather.

* Probably trap.

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The climate gradually increases in moisture south of Gwalior, and at Goona the rainfall is from 40 to 50 inches. Though the hot weather may be said to be comparatively mild, the draught is sufficiently great to burn up all herbaceous plants, except those growing near water. The rains extend from the middle of June to September, and towards the end of that month the cold weather birds begin to appear.

Cultivation is the exception in these regions. Here and there all through the jungle are scattered small hamlets, each with its little patch of cultivation, but on all sides of these *oases* there stretch thousands of acres of grassy plain and bushy downs, over the remoter parts of which even the village buffaloes and goats never stray. Grain-feeding birds are therefore not numerous, and the country is a bad one for small game.

The prevailing trees and bushes are *Butea frondosa*, *Acacia Catechu*, *Buchanania latifolia*, *Ægle Marmelos*, a *Diospyrus* and several species of *Zizyphus*, with *Carissa Carandas* in the moister valleys ; and the prevailing grass is that known as "spear-grass," a term including several species of *Apluda* and *Andropogon*. I always found that spear-grass gives cover to extremely few birds of any kind, and indeed I was often struck by the scarcity of animal life in the jungle generally. Near villages there are Tamarind, Peepul, Banyan, and Mowa* trees, but there are very few gardens.

The subjoined list includes the names of 21 Raptorial species. Of the two larger carrion-feeders given the Black Vulture (*Otogyps calvus*) and the Common Brown Vulture (*Gyps Bengalensis*)—the former is by far the more common, and the latter does not occur at all during the hot weather. Of the predatory species that arrive in the cold weather, the first to come are the various species of *Circus*, and *Haliastur Indus*. *Circus cyaneus*, *Linn.*, a bird which in India does not usually extend to the plains, is inserted on the strength of a single female bird which I shot near the Parbutty river early in December. Towards the end of October, *Poliornis teesa* arrives in large numbers, and is by far the commonest bird of prey during the cold season. Previously to October, I did not observe the tawny eagle (*Aquila fulvescens*) but

* *Bassia latifolia*, from the flowers of which a spirit is distilled.

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during that and the succeeding months I noted a good many, and in November I found two pairs breeding in tall trees near a village. The common kite *(Milvus Govinda)* is a permanent resident. I have not seen it recorded anywhere that this bird bathes* in water, but this I once saw one do. I was unfortunate in procuring owls, and I feel sure that there must be others in the district besides the two that appear in my list.

The *Insessores* are of course the most numerous group. These include 85 species. Of swallows, *H. filifera* and *daurica* are about equally common, and both reside in the district during the hot weather and the rains, as well as in the cold season. *H. filifera* breeds in the district, for although I never found the nest, very young birds were not uncommon in April and May. *Cotyle concolor* and *Cypselus affinis* are also permanent residents and breeders. I found nests of the former containing young, in the walls of an old fort early in September.

The only Hornbill inhabiting the district is the *Meniceros bicornis*, and that is very common, but it occurs only in the cold weather. Of *Tockus gingalensis*, I saw but one individual, which I shot. It occurred early in April, and was a sickly bird in very bad plumage and evidently a straggler.

The rose-ringed Paroquet *(Palæornis torquatus)* is extremely numerous at all seasons. During the hot weather, a colony of many hundreds established themselves in a clump of Tamarind trees near the village of Goona. These quarters, however, were occupied only during the night, for regularly every morning, after much preliminary chattering, the whole flock betook itself, in parties of from twenty to thirty, to the jungles, returning again about sunset in like manner but flying at a greater height.

Taccocua affinis, the only species of the genus in the list, is not uncommon in the district. It frequents low bushy jungle when feeding, but perches on trees. I have frequently met with it associating with flocks of the common blue Pigeon near wells.

With the cold weather, large numbers of two species of *Pratincola* (*P. caprata* and *P. Indica)* appear. *Saxicola œnanthe* also comes,

* The bathing may be almost daily witnessed on the Calcutta maidan, during the cold and hot weather. (Ed.)

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though not in abundance. In marching westward from Goona to Rajpootana, I was much struck by the change in the common species of *Saxicoline* birds. The two *Pratincolas* just mentioned continue numerous as far west as Kotah and Boondee, but there they begin to be replaced by *Saxicola leucoroides*, a bird I never saw near Goona. Towards Deolee *S. deserti* begins to appear, and in Marwar, both this species and *P. leucoroides* are as common as the two *Pratincolas*, common at Goona, are scarce; and a still more western species, namely *P. leucomela*, is found in small numbers.

The occurrence of the common Starling so far south as Goona, has not often been noted. It is by no means common there, unless indeed flocks arrive subsequently to December. In January last, I saw near Ajmere large numbers both of this species and of *Pastor roseus*, and both are numerous in Marwar. I observed only a single flock of *P. roseus* near Goona. It contained a number of young birds, and arrived early in September, but remained only a few days. Rain crops (which ripen in the early part of the cold weather) are by no means largely cultivated in the district, and I fancy this bird chiefly frequents districts where, as in Marwar, a great extent of land is laid down in these cereals.

The rasorial group is represented by only 10 species, and of these the only one very common is the Peafowl, which being sacred, is protected and even fed, and consequently lives much about villages. The scarcity of other species is no doubt owing to the small amount of cultivation, and the number of carnivorous mammals abounding in these wild regions.

Of *Grallatores* there are 36 species. The two lapwings, the red and yellow-wattled, are very, and about equally, common. To the westward, the latter gradually disappears, and in Rajpootana it is replaced by *Chettusia gregaria*.

Twenty-two species of *Natatores* occur in the district. As a rule, ducks and geese are but winter visitants in India. Two, however, remain in the tanks near Goona all the year round. These are that pretty little goose *Nettapus Coromandelianus* (the cotton teal of sportsmen), and the whistling teal, *Dendrocygna awsuree*. I have no doubt these two species breed, but I never succeeded in finding their nests. The rainy season was introduced last

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year at Goona by a storm of wind and rain, which filled in a day many tanks and nullahs that had been dry for months. The storm was succeeded by a week of cloudy but dry weather, during which the newly filled tanks were frequented by large flocks of the two species just mentioned, and also by smaller parties of *Anas pœcilorhyncha* and *Sarcidiornis melanotus*; at the same time perfect crowds of *Buphus coromandus* and *Threskiornis melanocephalus* were collected by the grassy banks of a nullah, which had not been dried by the hot weather sun. In a few days all had gone, [except a few of the cotton and whistling teal which, as just mentioned, remained during the rains] and I did not observe a single individual of any of them until the cold weather had begun. These sudden movements were, I dare say, an episode in some general migration.

List of Birds of the Goona District.

RAPTORES.

Otogyps calvus, *Scop.*
Gyps Bengalensis, *Gmel.*
Neophron Ginginianus, *Lath.*
Lithofalco subbuteo, *Linn.*
——— Chicquera, *Daud.*
Tinnunculus alaudarius, *Briss.*
Micronisus badius, *Gmel.*
Aquila fulvescens, *Gray.*
Eutolmaetus Bonelli, *Temm.*
Poliornis teesa, *Frankl.*
Circus cyaneus, *Linn.*
—— Swainsonii, *A. Smith.*
—— cineraceus, *Montague.*
—— melanoleucos, *Gmel.*
—— æruginosus, *Linn.*
Haliastur Indus, *Bodd.*
Milvus Govinda, *Sykes.*
Pernis cristata, *Cuvier.*
Elanus melanopterus, *Daud.*
Bulaca ocellata, *Lath.*
Athene Brama, *Temm.*

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Insessores.

Hirundo rustica, *Linn.*
—— filifera, *Stephens.*
—— erythropygia, *Sykes.*
Ptinoprogne concolor, *Sykes.*
Cypselus affinis, *Gray.*
Caprimulgus Asiaticus .*Lath.*
Merops viridis, *Linn.*
Coracias Indica, *Linn.*
Halcyon Smyrnensis, *Bodd.*
Alcedo Bengalensis, *Gmel.*
Ceryle rudis, *Linn.*
Meniceros bicornis, *Scop.*
Tockus gingalensis, *Shaw.*
Palæornis torquatus, *Bodd.*
—— rosa, *Bodd.*
Picus Mahrattensis, *Lath.*
Xantholæma Indica, *Lath.*
Cuculus micropterus, *Gould.*
Coccystes melanoleucos, *Gmel.*
Centropus rufipennis, *Illiger.*
Taccocua affinis, *Blyth.*
Arachnechthra Asiatica, *Lath.*
Upupa epops *Linn.*
Lanius lahtora, *Sykes.*
—— erythronotus, *Vigors.*
—— Hardwickii, *Vigors.*
Tephrodornis pondiceriana, *Gmel.*
Graculus Macei, *Less.*
Pericrocotus erythropygius, *Jerdon.*
Dicrurus macrocerus, *Vieill.*
Tchitrea paradisi, *Linn.*
Leucocera pectoralis, *Jerdon.*
Cryptolopha cinereocapilla, *Vieill.*
Cyornis banyumas, *Horsf.*
Petrocossyphus cyaneus, *Linn.*
Pyctorhis sinensis, *Gmel.*

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Dumetia albogularis, *Blyth.*
Malacocircus terricolor, *Hodgs.*
—— Malcolmi, *Sykes.*
Chatarrhœa caudata, *Dum.*
Pycnonotus pusillus, *Blyth.*
Oriolus Kundoo, *Sykes.*
Copsychus saularis, *Linn.*
Thamnobia fulicata, *Linn.*
—— Cambaiensis, *Lath.*
Pratincola caprata, *Linn.*
—— Indica, *Blyth.*
Saxicola œnanthe, *Linn.*
Ruticilla rufiventris, *Vieil.*
Orthotomus longicaudata, *Gmel.*
Prinia socialis, *Sykes.*
—— gracilis, *Frankl.*
Cisticola schaenicola, *Bonap.*
Drymoipus inornatus, *Sykes.*
—— longicaudatus, *Tickell.*
—— neglectus, *Jerdon.*
Phylloscopus Indicus, *Jerdon.*
Motacilla Maderaspatana, *Briss.*
—— Dukhunensis, *Sykes.*
Budytes viridis, *Gmel.*
Zosterops palpebrosus, *Temm.*
Machlolophus xanthogenys, *Vigors.*
Corvus culminatus, *Sykes.*
—— splendens, *Vieill.*
Dendrocitta rufa, *Scop.*
Sturnus vulgaris, *Linn.*
Sturnopastor contra, *Linn.*
Acridotheres tristis, *Linn.*
Temenuchus pagodarum, *Gmel.*
Pastor roseus, *Linn.*
Ploceus baya, *Blyth.*
Munia Malabarica, *Linn.*
Estrelda amandava, *Linn.*

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Estrelda formosa, *Lath.*
Passer Indicus, *Jard.* and *Selby.*
—— flavicollis, *Frankl.*
Euspiza luteola, *Sparr.*
Melophus melanicterus, *Gmelin.*
Mirafra Assamica, *McL.*
—— erythroptera, *Jerd.*
Ammomanes phænicura, *Frankl.*
Pyrrhulauda grisea, *Scop.*
Calandrella bracydactyla, *Temm.*
Spizalauda deva, *Sykes.*
Alauda gulgula, *Frankl.*

GEMITORES.

Crocopus phœnicopterus, *Lath.*
Columba intermedia, *Strickl.*
Turtur Cambayensis, *Gmel.*
—— Suratensis, *Gmel.*
—— risoria, *Linn.*

RASORES.

Pterocles fasciatus, *Scop.*
—— exustus, *Temm.*
Pavo cristatus, *Linn.*
Francolinus pictus, *Jard.* and *Selby.*
Ortygornis Ponticeriana, *Gmel.*
Perdicula Cambayensis, *Lath.*
—— Asiatica, *Lath.*
Coturnix communis, *Bonat.*
—— Coromandelica, *Gmel.*
Turnix Sykesii, *A. Smith.*

GRALLATORES.

Sypheotides auritus, *Lath.*
Cursorius Coromandelicus, *Gmel.*
Aegialitis Philippensis, *Scop.*
Lobivanellus Goensis, *Gmel.*
Sarciophorus bilobus, *Gmel.*
Œdicnemus crepitans, *Temm.*
Esacus recurvirostris, *Cuvier.*

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Grus Antigone, *Linn.*
Gallinago scolopacinus, *Bonap.*
—— gallinula, *Linn.*
Rhynchæa Bengalensis, *Linn.*
Philomachus pugnax, *Linn.*
Actitis glareola, *Gmelin.*
—— ochropus, *Linn.*
—— hypoleucus, *Linn.*
Totanus glottis, *Linn.*
—— stagnatilis, *Bechst.*
—— fuscus, *Linn.*
Himantopus candidus, *Bonnat.*
Metopidius Indicus, *Lath.*
Leptoptilos argala, *Linn.*
Mycteria Australis, *Shaw.*
Ciconia leucocephala, *Gmelin.*
Ardea cinerea, *Linn.*
—— purpurea, *Linn.*
Herodias alba, *Linn.*
—— garzetta, *Linn.*
Buphus Coromandus, *Bodd.*
Ardeola leucoptera, *Bodd.*
Butorides Javanica, *Horsf.*
Nycticorax griseus, *Linn.*
Tantalus leucocephalus, *Gmel.*
Platalea leucorodia, *Linn.*
Anastomus oscitans, *Bodd.*
Threskiornis melanocephalus, *Linn.*
Geronticus papillosus, *Temm.*

NATATORES.

Sarcidiornis melanonotus, *Penn.*
Nettapus Coromandelianus, *Gmel.*
Dendrocygna awsuree, *Sykes.*
Casarca rutila, *Pallas.*
Spatula clypeata, *Linn.*
Anas pœcilorhyncha, *Penn.*
Chaulelasmus streperus, *Linn.*

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Dafila acuta, *Linn.*
Querquedula crecca, *Linn.*
—— circia, *Linn.*
Aythya ferina, *Linn.*
—— nyroca, *Güldenst.*
Fuligula cristata, *Ray.*
Gallinula chloropus, *Linn.*
Podiceps Phillipensis, *Gmelin.*
Sylochelidon caspius, *Lath.*
Hydrochelidon Indica, *Stephens.*
Seena aurantia, *Gray.*
Graculus Sinensis, *Shaw.*
—— Javanicus, *Horsf.*
Plotus melanogaster, *Gmel.*

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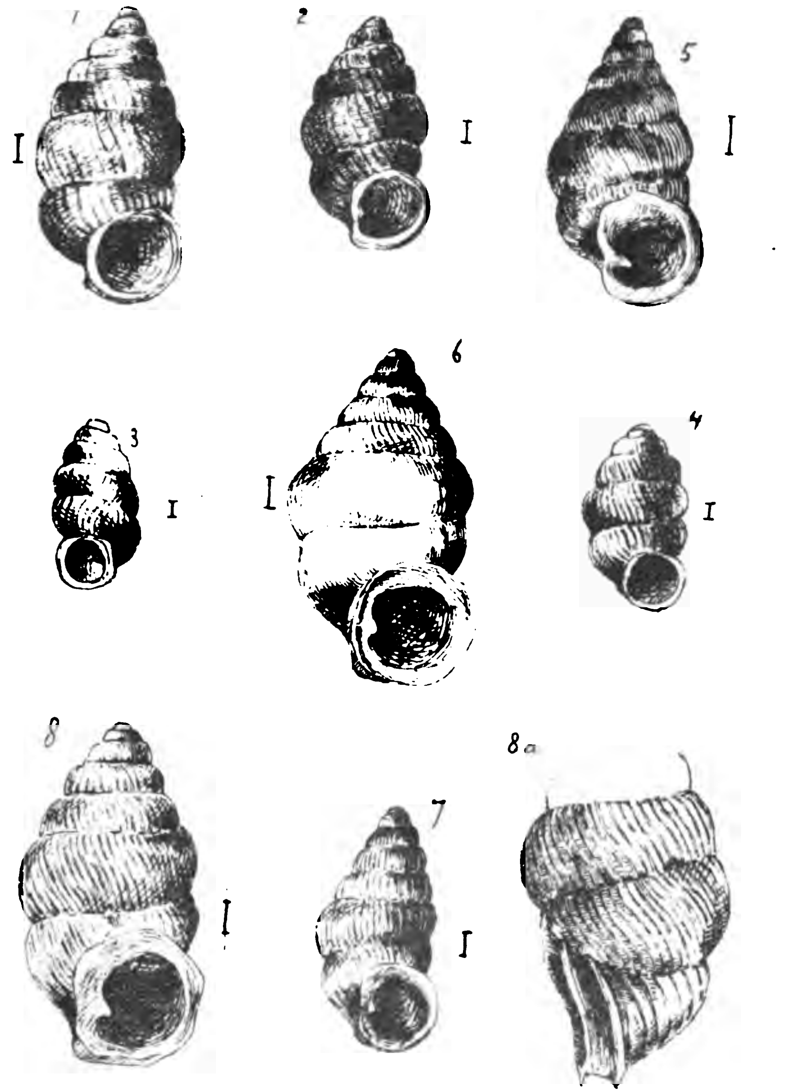

HIMALAYAN SPECIES.

Fig.	1	Diplommatina folliculus Pfr.	,,	5	D. pachycheilus. Benson.
,,	2	do. do. do. var.	,,	6	D. semisculpta. n. sp.
,,	3	D. Huttoni, Pfr.	,,	7	D. pullula. Bens.
,,	4	D. costulata. Hutton.	,,	8	D. Blanfordiana. Bens.

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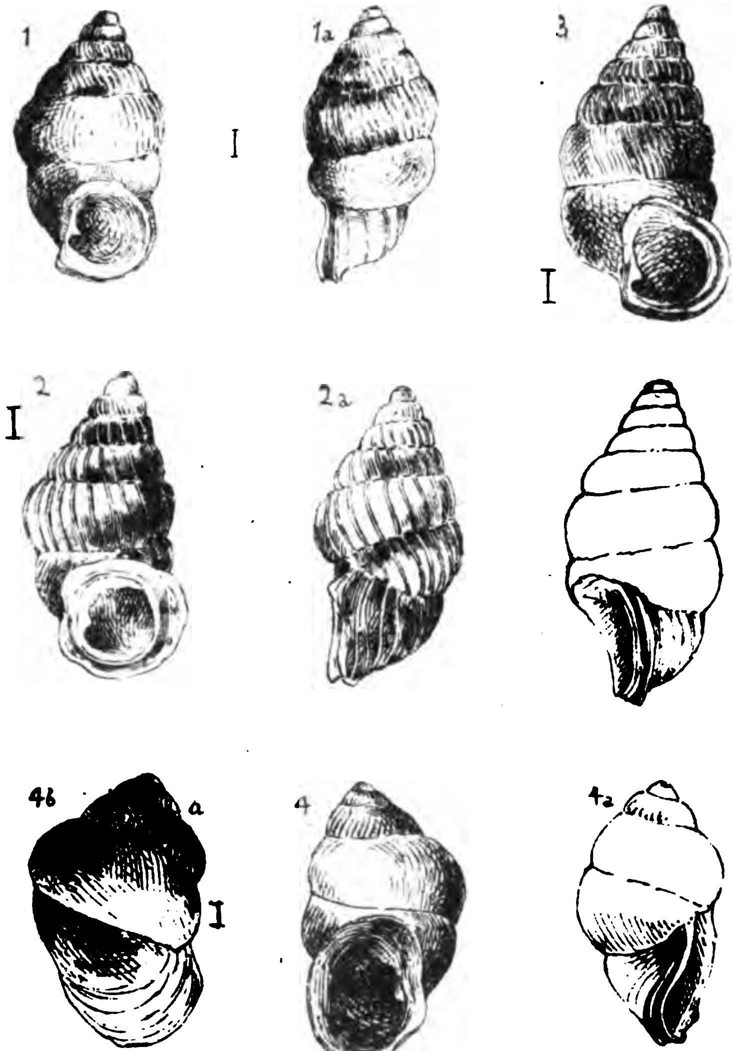
Pl. II.



KHASI HILL SPECIES.

Fig. 1. 1a. D. diplocheilus. Bens.
„ 2. 2a. D. scalaria. n. sp.
„ 3. 3a, D. labiosa. n. sp.
„ 4. 4a. 4b. D. gibbosa. n. sp.

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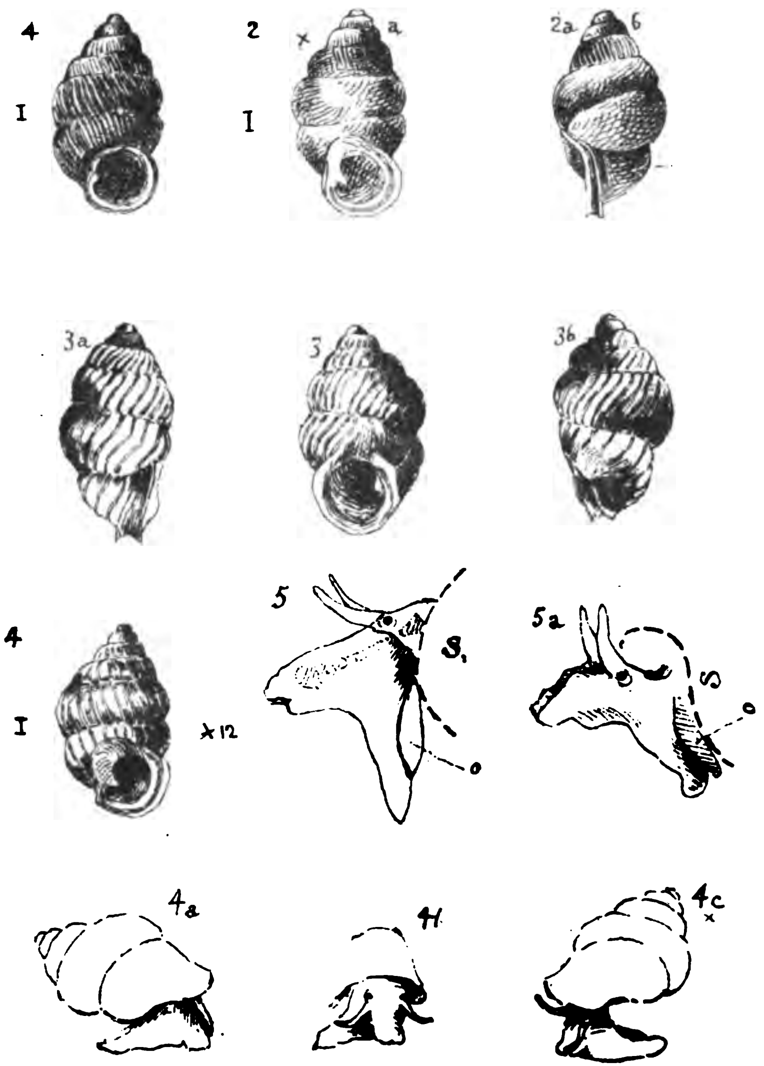

KHASI HILL SPECIES.

Fig. 1	D. polypleuris. Bens.	" 4. 4a. 4b. 4c.	D. oligopleuris. n. sp.
" 2. 2a.	D.———?	" 5. 5a.	D. folliculus. Pfr. (animal
" 3. 3a. 3b.	D. n. sp.		

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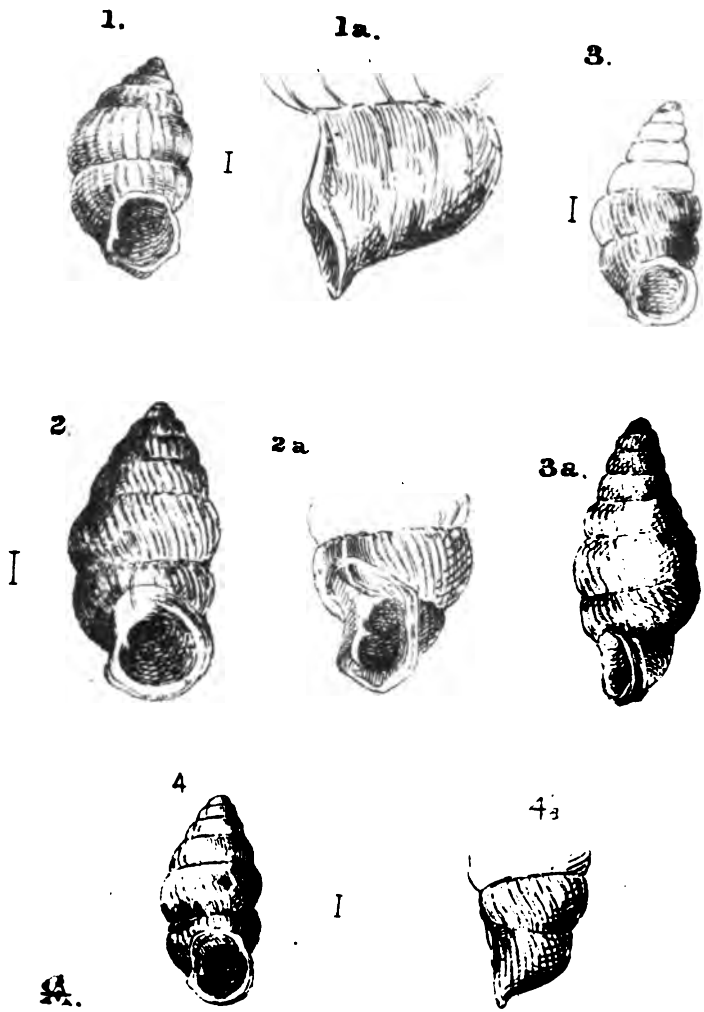

BURMESE SPECIES.

Fig. 1. 1a. D. sperata. W. Blanf.
,, 2. 2a. D. Puppensis. W. Blanf.
,, 3. 3a. D. exilis W. Blanf.
,, 4. 4a. D. nana W. Blanf.

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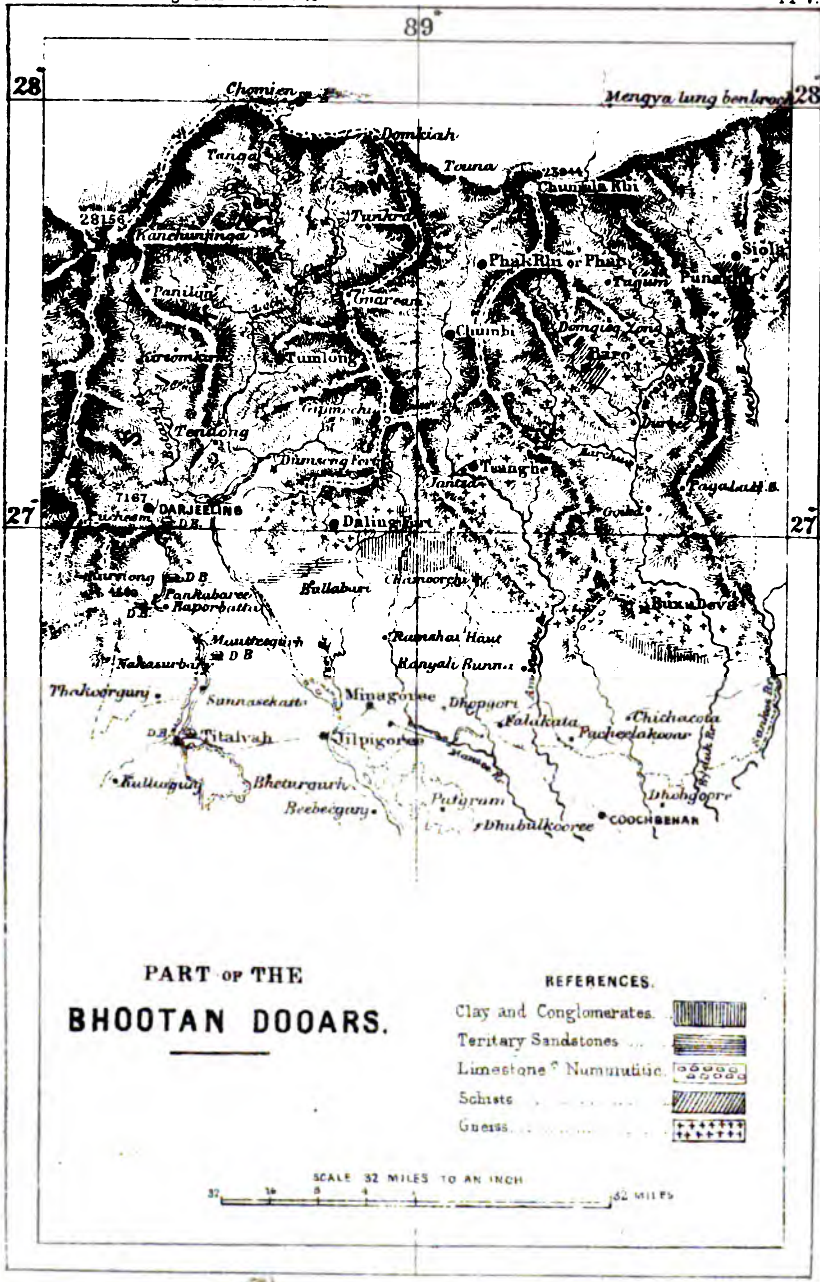

Litho. at the Sur. Genl's Office Calcutta 1868.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1867.

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 the Barometer at 32° Faht.	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	30.047	30.106	29.999	0.107	68.1	78.9	59.8	19.1
2	.103	.167	30.060	.107	68.6	78.4	60.0	18.4
3	.130	.195	.068	.127	69.3	79.8	61.3	18.5
4	.129	.209	.080	.129	68.8	78.2	60.6	17.6
5	.122	.198	.060	.138	68.3	77.9	60.2	17.7
6	.085	.159	.035	.124	69.8	79.5	61.8	17.7
7	.063	.141	.010	.131	70.3	80.2	62.4	17.8
8	29.997	.075	29.950	.125	67.2	73.0	63.6	9.4
9	30.039	.117	.969	.148	68.2	74.0	64.0	10.0
10	.134	.209	30.074	.135	67.0	75.6	59.0	16.6
11	.154	.248	.085	.163	66.3	75.0	58.0	17.0
12	.090	.158	.020	.138	65.0	72.6	58.4	14.2
13	.032	.104	29.959	.145	65.1	74.0	58.0	16.0
14	.012	.089	.958	.131	65.9	75.0	57.6	17.4
15	.033	.103	.977	.126	68.3	79.2	58.2	21.0
16	.013	.088	.952	.136	70.7	80.5	64.2	16.3
17	.013	.091	.964	.127	70.8	79.8	63.4	16.4
18	.049	.137	.993	.144	69.3	78.6	60.8	17.8
19	.077	.144	30.016	.128	70.1	80.0	63.0	17.0
20	.047	.130	29.971	.159	69.6	80.7	60.2	20.5
21	.006	.087	.945	.142	71.9	82.4	65.8	16.6
22	29.994	.069	.924	.145	72.2	83.2	63.0	20.2
23	.994	.033	.886	.147	74.3	82.8	67.0	15.8
24	.938	.011	.889	.122	74.9	83.0	69.0	14.0
25	.958	.040	.910	.130	75.4	83.2	70.4	12.8
26	30.043	.114	.961	.153	70.8	76.2	66.6	9.6
27	.073	.153	30.021	.132	66.2	75.2	59.0	16.2
28	.081	.163	.027	.136	64.3	74.4	55.2	19.2
29	.036	.108	29.975	.133	65.7	77.0	56.0	21.0
30	.035	.127	.968	.159	67.9	79.5	57.6	21.9
31	.004	.103	.942	.161	70.2	81.3	60.2	21.1

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1867.

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	62.7	5.4	58.4	9.7	0.496	5.47	2.08	0.73
2	63.4	5.2	59.2	9.4	.509	.63	.04	.73
3	63.5	5.8	58.9	10.4	.504	.56	.27	.71
4	62.5	6.3	57.5	11.3	.481	.31	.40	.69
5	62.6	5.7	58.0	10.3	.489	.40	.20	.71
6	64.3	5.5	59.9	9.9	.521	.73	.22	.72
7	65.3	5.0	61.3	9.0	.546	6.01	.07	.74
8	64.8	2.4	62.9	4.3	.576	.38	0.97	.87
9	64.9	3.3	62.3	5.9	.565	.23	1·35	.82
10	62.1	4.9	58.2	8.8	.493	5.45	.85	.75
11	60.3	6.0	55.5	10.8	.450	4.99	2.16	.70
12	58.7	6.3	53.7	11.3	.423	.71	.16	.69
13	58.9	6.2	53.9	11.2	.426	.74	.15	.69
14	59.9	6.0	55.1	10.8	.444	.93	.13	.70
15	63.7	4.6	60.0	8.3	.523	5.78	1.82	.76
16	65.5	5.2	61.3	9.4	.546	6.01	2.17	.74
17	63.1	7.7	56.9	13.9	.472	5.17	3.03	.63
18	60.9	8.4	54.2	15.1	.431	4.74	.09	.61
19	63.1	7.0	57.5	12.6	.481	5.29	2.74	.66
20	62.4	7.2	56.6	13.0	.467	.14	.76	.65
21	66.7	5.2	62.5	9.4	.568	6.24	.24	.74
22	64.6	7.6	58.5	13.7	.498	5.44	3.11	.64
23	69.4	4.9	66.0	8.3	.638	6.97	2.15	.76
24	71.6	3.3	69.3	5.6	.711	7.74	1.54	.83
25	70.2	5.2	66.6	8.8	.651	.08	2.35	.75
26	63.0	7.8	56.8	14.0	.470	5.16	3.04	.63
27	58.3	7.9	52.0	14.2	.400	4.43	2.69	.62
28	56.9	7.4	50.2	14.1	.376	.19	.53	.62
29	58.5	7.2	52.7	13.0	.409	.55	.47	.65
30	60.2	7.7	54.0	13.9	.428	.72	.79	.63
31	63.0	7.2	57.2	13.0	.476	5.23	.82	.65

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1867.

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. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	30.052	30.158	29.937	0.221	65.6	73.0	59.4	13.6
1	.042	.151	.922	.229	65.0	72.5	58.6	13.9
2	.034	.142	.913	.229	64.3	72.2	58.0	14.2
3	.026	.134	.906	.228	63.7	71.8	57.4	14.4
4	.020	.126	.899	.227	63.2	71.7	57.0	14.7
5	.031	.146	.912	.234	62.6	71.6	56.6	15.0
6	.047	.169	.928	.241	62.0	71.2	56.2	15.0
7	.069	.194	.943	.251	61.6	70.5	55.2	15.3
8	.092	.225	.968	.257	63.6	70.4	58.0	12.4
9	.116	.248	.989	.259	67.1	72.4	61.2	11.2
10	.124	.241	30.011	.230	70.4	75.5	66.1	9.4
11	.105	.217	29.990	.227	73.2	78.0	65.8	12.2
Noon.	.073	.173	.969	.204	75.3	80.0	67.9	12.1
1	.042	.134	.945	.189	76.6	81.4	68.0	13.4
2	.016	.110	.910	.200	77.7	82.9	71.8	11.1
3	.001	.093	.893	.200	78.3	83.2	72.6	10.6
4	29.996	.088	.886	.202	76.7	81.8	71.4	10.4
5	30.001	.103	.889	.214	75.2	81.0	70.0	11.0
6	.013	.126	.911	.215	72.8	79.0	68.0	11.0
7	.028	.134	.920	.214	70.8	78.2	66.2	12.0
8	.045	.163	.940	.223	69.4	76.4	63.4	13.0
9	.058	.166	.949	.217	68.3	75.4	62.8	12.6
10	.066	.173	.961	.212	67.3	74.4	61.8	12.6
11	.059	.162	.951	.211	66.4	73.6	61.0	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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1867.

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.	62.0	3.6	59.1	6.5	0.508	5.63	1.37	0.80
1	61.5	3.5	58.7	6.3	.501	.57	.30	.81
2	61.1	3.2	58.2	6.1	.493	.48	.24	.82
3	60.6	3.1	57.8	5.9	.486	.41	.18	.82
4	60.3	2.9	57.7	5.5	.485	.39	.10	.83
5	59.8	2.8	57.3	5.3	.478	.34	.03	.84
6	59.5	2.5	57.2	4.8	.476	.32	0.93	.85
7	59.2	2.4	57.0	4.6	.473	.29	.88	.86
8	60.4	3.2	57.5	6.1	.481	.36	1.21	.82
9	62.1	5.0	58.1	9.0	.491	.43	.89	.74
10	63.7	6.7	58.3	12.1	.494	.43	2.67	.67
11	64.7	8.5	57.9	15.3	.488	.33	3.49	.60
Noon.	65.3	10.0	58.3	17.0	.494	.37	4.03	.57
1	65.7	10.9	58.1	18.5	.491	.32	.45	.55
2	65.9	11.8	57.6	20.1	.483	.22	.88	.52
3	65.9	12.4	57.2	21.1	.476	.14	5.14	.50
4	65.4	11.3	57.5	19.2	.481	.22	4.58	.53
5	65.4	9.8	58.5	16.7	.498	.41	3.96	.58
6	65.7	7.1	60.0	12.8	.523	.72	2.99	.66
7	65.3	5.5	60.9	9.9	.539	.92	.28	.72
8	64.5	4.9	60.6	8.8	.534	.87	1.99	.75
9	63.7	4.6	60.0	8.3	.523	.78	.82	.76
10	63.2	4.1	59.9	7.4	.521	.77	.60	.78
11	62.7	3.7	59.7	6.7	.518	.74	.43	.80

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		℔	
1	136.4	...	S. S. W. & S. S. E.		Clear.
2	137.0	...	S. S. W. & N. E.		Clear. Foggy from 8 to 11 P. M.
3	138.5	...	N. N. E. & E.		Clear. Foggy from 7 to 11 P. M.
4	137.0	...	E. N. E. & N. by W.		Clear. Slightly foggy at 6 to 7 P. M.
5	131.8	...	N. W. & N. N. E.		Chiefly clear. Slightly foggy from 8 to 11 P. M.
6	134.8	...	S. by E. & S. W.		Clear. Slightly foggy from midnight to 9 A. M.
7	139.0	...	S. by E. & S.		Clear to 11 A. M., scatd. _i to 6 P. M., clear afterwards. Foggy from 5 to 8 A. M. Lightning to W. at 11 P. M.
8	119·0	0.48	N. by W. & N. N. E.		Overcast to noon, scatd. \\i to 6 P. M., clear afterwards. Rain at 3, 4, & 7 A. M., foggy at 7 & 8 P. M.
9	...	...	N. by W. & N. E.		Overcast to 8 A. M., scattered clouds to 5 P. M, clear afterwards. Foggy from 7 to 11 P. M.
10	137.0	...	N. N.E. & W.N.W.		Clear to 10 A. M, scatd. ⌒i to 3 P. M, clear afterwards. Slightly foggy at midnight & 1 A. M.
11	139.0	...	N.W. & .N N. W.		Chiefly clear.
12	130.4	...	N. N. W. & W. by N.		Clear.
13	129.2	...	W. by N. & W.		Clear. Foggy from 9 to 11 P. M.
14	135.0	...	W. & W. N. W.		Clear. Foggy from midnight to 4 A. M.
15	136.0	...	S. W.		Chiefly clear. Foggy from 5 to 7 A. M.
16	142.0	...	S. S. W. & N. W.		Clear to 9 A. M. scatd. \\i to 5 P. M, clear afterwards. Foggy from 4 to 9 A. M. & from 7 to 11 P. M.
17	137.0	...	W. & N. W.		Clear. Slightly foggy from midnight to 6 A. M & from 8 to 11 P. M.
18	136.0	...	N. by W. & W. by S.		Chiefly clear. Slightly foggy at 7 & 8 P. M.
19	137.0	...	N.W. & S. by W.		Clouds of different kinds to 6 P. M, clear afterwards. Foggy from 4 to 8 A. M.
20	137.0		W. by S. & N.W.		Clear.
21	139.4		N. W. & variable.		Clear to 4 A. M, scatd. \\i to 11 A. M., clear afterwards.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
22	141.0	...	N. by E. & variable.	...	Clear to noon, scattd. clouds afterwards. Lightning to S. W. at 8 P. M. Slight rain at 3½ P. M.
23	137.0	...	W. by S.		Clear. Foggy at 7 A. M. & at 9 & 10 P. M.
24	140.0	...	S. & S. W. & E.		Clear to 9 A. M, scattd. clouds afterwards. Slightly foggy from 1 to 9 A. M. & at 8 & 9 P. M.
25	141.0	0.01	N. N. W. & variable.		Light clouds to 8 A. M. \i to 6 P. M. Light clouds afterwards. Foggy from 1 to 3 A. M. Thin rain at 4 & 5 A. M.
26	123.0	0.06	N. E. & E. by S		Light clouds to 1 P. M, clear afterwards, Rain at 1 P. M.
27	134.0	...	N. N. W. & N. W.		Clear. Foggy at 10 & 11 P. M.
28	144.0	...	N. N. W. & N. W.		Clear.
29	136.0	...	N. W. & N. N. W.		Clear. Slightly foggy at 11 P. M.
30	138.0	...	N. W. & N. N. W.		Clear.
31	138.0	...	S. by W. & variable		Clear to 3 A. M., \i to 1 P. M., clear afterwards.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒i Cumulo strati, \⌒i Nimbi, \⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	30.048
Max. height of the Barometer occurred at 9 A.M. on the 11th ...	30.248
Min. height of the Barometer occurred at 4 P. M. on the 23rd ...	29.886
Extreme range of the Barometer during the month	0.362
Mean of the daily Max. Pressures	30.125
Ditto ditto Min. ditto	29.989
Mean daily range of the Barometer during the month	0.136

	o
Mean Dry Bulb Thermometer for the month	69.0
Max. Temperature occurred at 3 P. M. on the 1st 22nd & 25th ...	83.2
Min. Temperature occurred at 7 A. M. on the 28th	55.2
Extreme range of the Temperature during the month	28.0
Mean of the daily Max. Temperature	78.4
Ditto ditto Min. ditto, ...	61.4
Mean daily range of the Temperature during the month... ...	17.0

Mean Wet Bulb Thermometer for the month	63.1
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	5.9
Computed Mean Dew-point for the month	58.4
Mean Dry Bulb Thermometer above computed mean Dew-point ...	10.6
	Inches.
Mean Elastic force of Vapour fo r the month	0.496

	Troy grain.
Mean Weight of Vapour for the month	5.46
Additional Weight of Vapour required for complete saturation ...	2.30
Mean degree of humidity for the month, complete saturation being unity	0.70

	Inches.
Rained 4 days,—Max. fall of rain during 24 hours	0.48
Total amount of rain during the month	0.55
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.53
Prevailing direction of the Wind... ... N. W. & N. by W.	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Jan. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night	1		2				2						1		1						1		2	
1	1		2				2				1		2								1		2	
2	2				1		3				1		1				1				2		2	
3	2		2		1		1		1				2				1				1		3	
4	1		2		3	1	1		1				1						1				3	
5	2		2		4						1		1										2	
6			2		5						1		3										2	
7	1		1		5		1	1	1		1						1						1	
8	4		2		2		3		1						1		1		1					
9	2		1		6		4		2				1						2					
10			1		7		4		1				3				2		1		1			
11	1		1		2		3		1				4		1		2		2					
Noon.	2		1		4		2						3						2		1			
1	2				1		1		1				1		2						1			
2	2				3		1								1		1				3		1	
3	3				2				1				1								3			
4	1	1			2		1				2										1			
5							2		1				1				1							
6							2		2						1									
7							1				1				2									
8					1		1						1		1									
9					1		1								2				2					
10			1		2								2								1		1	
11			1		1		1		1				1						1				1	

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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	2		1		3		2						2		2		2		4		1		1	
1	2		1		3		2				1		2		1		1		3		1		2	
2	1		1		4		2				1		2		1				2		2		1	
3	2	1	1		2		3						1		1						5		1	
4			1		2		2		1				1		1				2	1	4		2	
5			1		2		2						2		2	1	1		1		5		1	
6					1		2				1		2		1		3				5		2	
7					1		2				1		2		2		2				4		4	
8					1		2				1		2		2		1		1		2		4	
9	1				1		1				1		1		1				2		2		3	
10							1				1		1				1		3		1		3	
11							2				1		1				1		4		2		3	
Noon.	1		2				2		1				2				3		3		1		1	
1	3		1				2		2				1		1		2		7	1	2		1	
2							1		1		2		4				3		5		1		2	
3	2								2		1		3		1		2		7		2		1	
4	1		1		1		1				2		2				2		9		1		4	
5	2		1		1		1				2		3		2		2		6		3		3	
6	2		1		1		1				3		2		1		4		4		3		4	
7	2		1		1		2				3		1		2		2		6		3		4	
8	2		1		2		1				3		1		2		2		7		2		4	
9	1		1		3						2		1		2		2		8		2		3	
10	3				2						2		2		2		2		7		2		2	
11	3		1		3		1						2		2		2		6		1		3	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1867.

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 the Barometer at 32° Faht.	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	29.995	30.063	29.934	0.129	71.9	80.2	64.8	15.4
2	30.035	.098	.983	.115	69.3	78.0	61.4	16.6
3	.039	.121	.978	.143	68.9	80.0	55.8	24.2
4	.040	.118	.989	.129	70.1	81.0	60.4	20.6
5	.003	.109	.909	.200	71.6	83.4	60.8	22.6
6	29.955	.041	.902	.139	69.2	75.6	64.0	11.6
7	.982	.058	.932	.126	69.5	76.8	64.0	12.8
8	30.006	.085	.965	.120	69.2	78.6	60.4	18.2
9	.010	.091	.966	.125	71.2	80.6	62.6	18.0
10	29.962	.043	.884	.159	73.6	82.4	67.6	14.8
11	.910	29.979	.864	.115	75.5	84.6	70.0	14.6
12	.897	.977	.848	.129	74.4	83.8	66.0	17.8
13	.848	.908	.773	.135	75.3	81.6	71.2	10.4
14	.970	30.063	.888	.175	74.2	83.0	68.0	15.0
15	30.009	.096	.952	.144	71.3	81.6	62.2	19.4
16	29.963	.052	.889	.163	70.4	79.8	60.8	19.0
17	.921	.003	.856	.147	71.3	82.0	60.2	21.8
18	.918	29.995	.867	.128	73.2	84.8	63.0	21.8
19	.922	.998	.866	.132	76.2	86.6	69.0	17.6
20	.897	.964	.815	.149	78.8	88.4	72.8	15.6
21	.927	30.020	.859	.161	76.4	83.6	71.8	11.8
22	.985	.066	.940	.126	72.4	81.8	63.2	18.6
23	.968	.047	.889	.158	73.2	84.4	64.6	19.8
24	.989	.055	.928	.127	74.0	82.8	67.4	15.4
25	30.027	.105	.962	.143	74.2	84.0	65.0	19.0
26	29.973	.050	.893	.157	76.2	87.4	68.4	19.0
27	.940	.022	.891	.131	78.3	88.6	70.2	18.4
28	.945	.023	.871	.152	78.1	88.4	69.2	19.2

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 February 1867.

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	66.4	5.5	62.0	9.9	0.559	6.13	2.35	0.72
2	60.4	8.9	53.3	16.0	.418	4.61	3.22	.59
3	60.9	8.0	54.5	14.4	.435	.80	2.94	.62
4	62.8	7.3	57.0	13.1	.473	5.20	.83	.65
5	64.3	7.3	58.5	13.1	.498	.45	.95	.65
6	64.9	4.3	61.5	7.7	.550	6.06	1.75	.78
7	65.0	4.5	61.4	8.1	.548	.04	.84	.77
8	63.7	5.5	59.3	9.9	.511	5.63	2.18	.72
9	65.6	5.6	61.1	10.1	.543	.96	·34	.72
10	68.6	5.0	65.1	8.5	.619	6.77	.16	.76
11	69.4	6.1	65.1	10.4	.619	.75	.71	.71
12	67.2	7.2	62.2	12.2	.563	.14	3.01	.67
13	71.9	3.4	69.5	5.8	.715	7.79	1.61	.83
14	65.7	8.5	59.7	14.5	.518	5.65	3.44	.62
15	62.0	9.3	54.6	16.7	.437	4.79	.54	.58
16	60.9	9.5	53.3	17.1	.418	.60	.50	.57
17	61.6	9.7	53.8	17.5	.425	.66	.67	.56
18	64.8	8.4	58.1	15.1	.491	5.36	.46	.61
19	71.6	4.6	68.4	7.8	.690	7.50	2.16	.78
20	73.4	5.4	69.6	9.2	.717	.76	.68	.74
21	69.5	6.9	64.7	11.7	.611	6.64	3.08	.68
22	62.1	10.3	53.9	18.5	.426	4.67	.93	.54
23	66.2	7.0	60.6	12.6	.534	5.82	.00	.66
24	65.8	8.2	60.1	13.9	.525	.73	.31	.63
25	64.7	9.5	58.0	16.2	.489	.33	.76	.59
26	70.3	5.9	66.2	10.0	.642	6.98	2.68	.73
27	68.9	9.4	62.3	16.0	.565	.11	4.17	.59
28	67.6	10.5	60.2	17.9	.527	5.70	.52	.56

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1867.

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. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.969	30.047	29.863	0.184	69.1	74.8	64.7	10.1
1	.961	.033	.858	.175	68.7	75.0	63.4	11.6
2	.951	.027	.846	.181	68.1	74.6	62.8	11.8
3	.943	.025	.834	.191	67.4	74.0	62.4	11.6
4	.937	.023	.823	.200	66.7	73.2	60.0	13.2
5	.948	.030	.832	.198	66.1	72.8	59.6	13.2
6	.964	.050	.840	.210	65.6	73.0	59.2	13.8
7	.984	.068	.854	.214	65.4	72.8	55.8	17.0
8	30.007	.087	.878	.209	67.9	75.5	61.4	14.1
9	.033	.118	.905	.213	71.2	78.6	65.5	13.1
10	.044	.121	.908	.213	74.6	81.2	66.0	15.2
11	.033	.108	.896	.212	77.4	84.1	69.8	14.3
Noon.	.006	.078	.869	.209	79.5	85.4	72.6	12.8
1	29.974	.048	.836	.212	81.1	87.6	73.8	13.8
2	.944	.020	.809	.211	81.8	88.4	75.6	12.8
3	.922	29.999	.785	.214	82.5	88.4	74.7	13.7
4	.911	30.000	.773	.227	81.9	88.6	74.2	14.4
5	.911	29.998	.795	.203	80.6	87.8	74.0	13.8
6	.920	.993	.818	.175	77.6	83.5	72.0	11.5
7	.932	30.008	.826	.182	75.2	81.0	70.8	10.2
8	.954	.035	.855	.180	73.5	79.0	69.2	9.8
9	.970	.055	.871	.184	72.3	78.0	68.4	9.6
10	.980	.067	.874	.193	71.1	76.7	67.4	9.3
11	.974	.055	.873	.182	70.2	75.8	66.2	9.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1867.

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.	65.1	4.0	61.9	7.2	0.557	6.14	1.64	0.79
1	64.7	4.0	61.5	7.2	.550	.07	.62	.79
2	64.3	3.8	61.3	6.8	.546	.03	.52	.80
3	63.8	3.6	60.9	6.5	.539	5.96	.43	.81
4	63.4	3.3	60.8	5.9	.537	.95	.28	.82
5	63.0	3.1	60.5	5.6	.532	.90	.20	.83
6	62.6	3.0	60.2	5.4	.527	.85	.15	.84
7	62.5	2.9	60.2	5.2	.527	.85	.10	.84
8	63.8	4.1	60.5	7.4	.532	.89	.62	.78
9	65.1	6.1	60.2	11.0	.527	.78	2.52	.70
10	66.0	8.6	60.0	14.6	.523	.69	3.51	.62
11	67.0	10.4	59.7	17.7	.518	.61	4.40	.56
Noon.	67.5	12.0	59.1	20.4	.508	.48	5.18	.51
1	68.1	13.0	59.0	22.1	.506	.44	.73	.49
2	68.3	13.5	58.8	23.0	.503	.39	6.01	.47
3	68.3	14.2	58.4	24.1	.496	.31	.33	.46
4	68.4	13.5	58.9	23.0	.504	.41	.03	.47
5	68.1	12.5	59.3	21.3	.511	.50	5.51	.50
6	68.2	9.4	61.6	16.0	.552	.97	4.10	.59
7	68.1	7.1	63.1	12.1	.580	6.31	3.06	.67
8	67.3	6.2	63.0	10.5	.578	.31	2.59	.71
9	66.8	5.5	62.4	9.9	.567	.20	.38	.72
10	66.3	4.8	62.5	8.6	.568	.24	.04	.75
11	65.8	4.4	62.3	7.9	.565	.21	1.84	.77

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		℔	
1	120.8	...	W. & variable.		Chiefly clear.
2	120.0	...	N. N. E. & N. W.		Clear.
3	122.0	...	N. E. & W.		Clear.
4	119.0	...	N. E. & E. S. E.		Clear.
5	121.0	...	N. N. E. & N. E.		Clear.
6	...	0.58			Clear to 5 A. M. Scattered \i to 5 P. M. Overcast afterwards. Lightning at 9 & 10 P. M. Thunder at 10 P. M. Rain at 8½ A. M. 7½ & 10 P. M.
7	119.0	...			Scattered clouds to Noon. Clear afterwards.
8	119·8	...	E. by N.		Clear. Slightly foggy at 7 & 8 P. M.
9	121.4	...	E. N. E. & variable.		Clear.
10	123.8	...	S. S. E. & variable.		Scatd. \i & _i to 5 A. M., scattered \i to 4 P. M, clear afterwards.
11	125.0	...	N. N. W. & N. W.		Clear to 5 A. M. Thin clouds to 8 A. M., clear afterwards. Slightly foggy at 8 & 9 P. M.
12	122.0	...	W .N. W. & N. E.		Clear. Slightly foggy at 7 & 8 P. M.
13	...	...	S. & W. S. W.		Clear to 4 A. M. Scatd. ⌒i to 8 P.M., clear afterwards. Foggy at 6 & 7 A. M.
14	124.0	...	NNE.&NE&N.byE.		Clear to 5 A. M., scattered ⌞i to 9 A. M., clear afterwards.
15	123.6	...	N. N. E. & W. N. W.		Clear. Slightly foggy from 8 to 11 P. M.
16	120.8	...	W.N.W & variable.		Clear.
17	121.0	...	N.W. &W.		Clear. Slightly foggy at 7 P. M.
18	120.4	...	W. & S. S. W.		Clear.
19	120.0	...	S. W. & S. S. W.		Clear to 4 A. M. Thin clouds to 8 A. M., scatd. ⌒i to 4. P. M. Clear afterwards. Foggy from 6 to 9 A. M.
20	127.5	0.12	S. S. W. & S. by W.		Clear to 3 A. M., scattered ⌒i afterwards. Lightning at 7 & 10 P. M. Thunder at 10 P. M. Rain at 10½ P. M.
21	123.5	...	N. W.		\i to 10 A. M. clear afterwards
22	120.0	...	N. E. & E. N. E.		Clear. Slightly foggy at 9 & 10 P. M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
23	122.5	0.12	Variable.	...	Clear to 1 P. M. clouds of different kinds afterwards. Lightning at 7 & 8 P. M.. Thunder at 8 P. M. Rain from 6½ to 8 P. M.
24	121.5	...	Variable.		Clouds of different kinds to 4 A. M., clear to 11 A. M. \i to 6 P. M., clear afterwards.
25	130.0	...	W. by N. & variable		Clear.
26	128.0	...	SW & SSW & WSW		Clear to 3 A. M. Thin clouds to 11 A. M., clear afterwards. Slightly foggy from 4 to 7 A. M.
27	130.0	...	W. S. W. & N. W.		Clear.
28	128.0	...	W.		Clear.

\i Cirri, —i Strati, ⌒i Cumuli, ⌞i Cirro-strati, ∼i Cumulo strati, ⌒∼i Nimbi, ⌒\i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1867.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.966
Max. height of the Barometer occurred at 10 A. M. on the 3rd ...	30.121
Min. height of the Barometer occurred at 4 P. M. on the 13th ...	29.773
Extreme range of the Barometer during the month	0.348
Mean of the daily Max. Pressures	30.045
Ditto ditto Min. ditto	29.903
Mean daily range of the Barometer during the month	0.142

	o
Mean Dry Bulb Thermometer for the month	73.1
Max. Temperature occurred at 4 P. M. on the 27th	88.6
Min. Temperature occurred at 7 A. M. on the 3rd	55.8
Extreme range of the Temperature during the month	32.8
Mean of the daily Max. Temperature...	82.6
Ditto ditto Min. ditto, ...	65.2
Mean daily range of the Temperature during the month... ...	17.4

Mean Wet Bulb Thermometer for the month	65.9
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	7.2
Computed Mean Dew-point for the month	60.1
Mean Dry Bulb Thermometer above computed mean Dew-point ...	13.0
	Inches.
Mean Elastic force of Vapour for the month	0.525

	Troy grain.
Mean Weight of Vapour for the month	5.74
Additional Weight of Vapour required for complete saturation ...	3.05
Mean degree of humidity for the month, complete saturation being unity	0.65

	Inches.
Rained 3 days,—Max. fall of rain during 24 hours	0.58
Total amount of rain during the month	0.82
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.76
Prevailing direction of the Wind... ... N. N. W. & N. E.	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Feb. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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			2		1		1				2								1		4				1		1		4		3		1						2				1					
1					3		2				1				1				2		3				1		1		1		5						1		2								1	
2			1		2		3		2				1						1		1		2		1		1		1		3						2		1				1		1			
3			2		3		4		1										1		1		2		2						1		2				2		1		1		1					
4	1		1		4		2		1												1		2						2		1		2				1						1		4			
5	1		1		2		2		1				1								2				2						2		2				1						2		3		1	
6	3		1		2		2		1						1						1		1		1						1		2		1		3						1		3		1	
7	2				4		2		2		1						1						2		1								2				3						1		4			
8					2		6		2		1		1				1						1		1		1				1		2				2						2		2			
9					2		3		3		4		1												1						4		1				1				1		2		2			
10					1		4		4		1								1						1				1		3		1				2						3		2		1	
11	1		1				6						1				1		1						1						4				2				2		1		2		2			
Noon.	2				5		1						1		1				2						1				1		1		2		1		3				1		3					
1					4		3				1								1										1		2				1		3		1		3		2		2		1	
2	1				1				1										1		2				1				2		1		2				2		1		4		3		3		1	
3					1		5		2																1				2				2		3				2		4		3		1			
4					1		1		1				1				2				1		1		1		1				1		1		1		1		2		3		4		1		1	
5							1		1		1				1		1				1				1		2		2		1						1		2		5		3		1		1	
6					1				1		1				1		1						1		2	1	1		3								2		2		5		4					
7					1				1		1						1										1		3		4	1			1		1		2		6		2		1			
8	1				1		1		1		1										1				2	1	2		3				2		1				1		5		1		2			
9					2		3		1		1		1								1				1		1		4		1		1				1		2		1		1		2			
10	1						3				2				1						2		1				1		5		3		1				1		1				1		1			
11			2		1		1		1		1						1		1		2		1		2				3		4		1				1						1					

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1837.

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 the Barometer at 32° Faht.	Range of the Barometer during the day. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature during the day. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.839	29.971	29.809	0.162	78.7	90.0	70.0	20.0
2	.856	.913	.812	.101	81.0	90.4	73.6	16.8
3	.883	.945	.828	.117	81.4	94.2	73.4	20.8
4	.925	.995	.853	.142	81.2	92.0	73.2	18.8
5	.897	.983	.793	.190	80.8	92.0	72.6	19.4
6	.822	.898	.743	.155	79.6	89.0	72.8	16.2
7	.819	.898	.773	.125	80.9	90.0	73.6	16.4
8	.922	30.012	.833	.179	80.3	87.6	74.9	12.7
9	30.000	.080	.909	.171	79.6	89.0	73.6	15.4
10	29.994	.061	.923	.138	78.5	88.0	72.0	16.0
11	.955	.032	.884	.148	78.4	87.0	70.4	16.6
12	.935	.003	.865	.138	80.2	90.6	69.6	21.0
13	.891	29.954	.815	.139	80.4	88.8	74.0	14.8
14	.909	.969	.854	.115	81.8	91.7	74.4	17.3
15	.918	.990	.834	.156	82.0	92.8	73.0	19.8
16	.846	.925	.781	.144	81.1	92.4	71.4	21.0
17	.856	.927	.791	.136	83.4	94.0	74.4	19.6
18	.856	.911	.779	.162	81.4	91.4	75.0	16.4
19	.876	.957	.774	.183	80.5	92.6	73.0	19.6
20	.813	.921	.756	.165	79.2	88.2	72.4	15.8
21	.850	.858	.725	.133	80.8	90.8	72.8	18.0
22	.816	.897	.725	.172	82.4	92.0	73.8	18.2
23	.897	.983	.829	.154	80.3	90.0	73.6	16.4
24	.917	.979	.843	.136	79.3	88.9	74.2	14.7
25	.898	.975	.838	.137	78.3	85.8	71.9	13.9
26	.887	.961	.825	.136	81.0	90.4	72.2	18.2
27	.905	.957	.840	.117	79.9	91.2	71.8	19.4
28	.944	30.050	.876	.174	78.6	88.6	69.4	19.2
29	.960	.974	.899	.175	78.0	86.4	71.4	15.0
30	.921	.002	.855	.147	75.1	81.2	69.4	11.8
31	.867	29.963	.799	.164	78.5	89.4	68.6	20.8

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1867.

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	71.0	7.7	65.6	13.1	0.630	6.82	3.59	0.66
2	74.2	6.8	69.4	11.6	.713	7.67	.47	.69
3	73.0	8.4	67.1	14.3	.661	.12	4.15	.63
4	73.3	7.9	67.8	13.4	.677	.29	3.92	.65
5	71.7	9.1	65.3	15.5	.623	6.71	4.36	.61
6	72.7	6.9	67.9	11.7	.679	7.33	3.36	.69
7	73.4	7.5	68.1	12.8	.684	.35	.75	.66
8	70.9	9.4	64.3	16.0	.603	6.50	4.41	.60
9	74.2	5.4	70.4	9.2	.736	7.95	2·74	.74
10	72.1	6.4	67.6	10.9	.672	.28	3.07	.70
11	70.1	8.3	64.3	14.1	.603	6.53	.78	.63
12	71.7	8.5	65.7	14.5	.632	.81	4.07	.63
13	75.2	5.2	71.6	8.8	.766	8.25	2.69	.75
14	75.3	6.5	70.7	11.1	.744	.00	3.40	.70
15	73.8	8.2	68.1	13.9	.684	7.34	4.13	.64
16	71.8	9.3	65.3	15.8	.623	6.71	.46	.60
17	74.6	8.8	68.4	15.0	.690	7.39	.57	.62
18	73.8	7.6	68.5	12.9	.692	.45	3.82	.66
19	73.6	6.9	68.8	11.7	.699	.52	.46	.69
20	72.9	6.3	68.5	10.7	.692	.48	.08	.71
21	75.5	5.3	71.8	9.0	.771	8.30	2.77	.75
22	76.1	6.3	71.7	10.7	.768	.24	3.37	.71
23	74.1	6.2	69.8	10.5	.722	7.78	.13	.71
24	74.6	4.7	71.3	8.0	.758	8.20	2.39	.77
25	73.1	5.2	69.5	8.8	.715	7.74	.54	.75
26	72.9	8.1	67.2	13.8	.664	.14	4.00	.64
27	70.3	9.6	63.6	16.3	.590	6.36	.42	.59
28	69.5	9.1	63.1	15.5	.580	.26	.12	.60
29	69.6	8.4	63.7	14.3	.591	.41	3.78	.63
30	67.6	7.5	62.3	12.8	.565	.15	.19	.66
31	70.1	8.4	64.2	14.3	.601	.50	.85	.63

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1867.

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.	29.901	30.003	29.806	0.197	75.8	78.8	71.4	7.4
1	.891	29.996	.800	.196	75.2	78.2	71.0	7.2
2	.882	.992	.794	.198	74.8	77.8	70.2	7.6
3	.873	.988	.783	.205	74.2	77.4	69.8	7.6
4	.869	.979	.775	.204	73.6	77.4	69.3	8.1
5	.880	.993	.792	.201	73.2	76.8	68.6	8.2
6	.896	30.007	.806	.201	72.8	76.6	68.7	7.9
7	.915	.025	.817	.208	73.3	78.2	69.5	8.7
8	.943	.054	.837	.217	76.2	81.8	71.0	10.8
9	.962	.078	.854	.224	79.0	84.6	74.2	10.4
10	.966	.080	.858	.222	82.1	86.6	78.0	8.6
11	.955	.067	.844	.223	84.6	89.2	78.8	10.4
Noon.	.931	.036	.830	.206	86.8	90.6	79.6	11.0
1	.899	.004	.795	.209	88.3	92.0	80.2	11.8
2	.868	29.969	.759	.210	89.0	93.4	81.2	12.2
3	.843	.942	.737	.205	89.6	94.0	81.2	12.8
4	.832	.923	.725	.198	89.3	94.2	79.9	14.3
5	.832	.931	.725	.206	87.4	92.2	75.0	17.2
6	.842	.938	.729	.209	84.0	88.2	76.0	12.2
7	.859	.969	.755	.214	81.7	86.0	75.4	10.6
8	.881	30.031	.777	.254	79.5	84.2	73.6	10.6
9	.904	.025	.798	.227	78.4	82.4	73.0	9.4
10	.916	.058	.821	.237	77.2	80.0	72.0	8.0
11	.907	.032	.815	.217	76.2	79.5	71.8	7.7

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 1867.

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.	71.9	3.9	69.2	6.6	0.708	7.70	1.84	0.81
1	71.8	3.4	69.1	5.8	.713	.77	.60	.83
2	71.5	3.3	69.2	5.6	.708	.72	.54	.83
3	71.3	2.9	69.3	4.9	.711	.75	.34	.85
4	71.0	2.6	69.2	4.4	.708	.75	.18	.87
5	70.7	2.5	68.7	4.5	.697	.61	.21	.86
6	70.4	2.4	68.5	4.3	.692	.59	.12	.87
7	70.6	2.7	68.4	4.9	.690	.54	.30	.85
8	71.9	4.3	68.9	7.3	.701	.63	2.03	.79
9	73.0	6.0	68.8	10.2	.699	.56	.94	.72
10	73.7	8.4	67.8	14.3	.677	.27	4.24	.63
11	73.9	10.7	66.4	18.2	.646	6.91	5.48	.56
Noon.	74.3	12.5	66.8	20.0	.655	.97	6.24	.53
1	74.6	13.7	66.4	21.9	.646	.85	.95	.50
2	74.6	14.4	66.0	23.0	.638	.75	7.33	.48
3	74.5	15.1	65.4	24.2	.626	.62	.71	.46
4	74.3	15.0	65.3	24.0	.623	.60	.61	.46
5	74.0	13.4	66.0	21.4	.638	.78	6.67	.50
6	73.5	10.5	66.1	17.9	.640	.84	5.33	.53
7	73.2	8.5	67.2	14.5	.664	7.13	4.24	.63
8	72.6	6.9	67.8	11.7	.677	.30	3.36	.69
9	72.5	5.9	68.4	10.0	.690	.47	2.84	.73
10	72.1	5.1	68.5	8.7	.692	.51	.44	.76
11	71.9	4.3	68.9	7.3	.701	.63	.03	.79

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	128.0	...	S. S. W. & N. W.		Clear. Foggy from 4 to 8 A. M.
2	127.5	...	S. S. W. & variable.		Clear to 1. P. M. Scatd. \i to 6 P. M. Clear afterwards. Slightly foggy at 5 & 6 A. M.
3	130.0	...	S. S. W. & variable.		Clear.
4	131.0	...	S. & S. S. W.		Clear.
5	131.0	...	S. & S. S. W.		Clear to 5 A. M. Scatd. \i to 7 P. M., clear afterwards.
6	124.4	...	S. W. & S. by W.		Clear to 10 A. M. Scatd. \i afterwards. Lightning to N. at 9 P. M.
7	130.0	...	Variable.		Clear to 6 A. M. Scatd. \⌣' to noon. Scatd. \i to 5 P. M., clear afterwards.
8	127·0	...	W. by S. & E. by S.		Clear to 2 A. M. Scatd. \⌣i &\i to 5. M. P., clear afterwards.
9	131.0	0.10	S. S. E. & variable.		Clear to 5 P. M. Scatd. ⌒i to 5 P. M. Overcast afterwards. Lightning at 7,8 & 11 P. M. Thunder at 8 P. M. Light rain from 7 to 10 P. M.
10	129.5	...	N. W. & variable.		Clear to 2 A. M. Scatd. \⌣i to 8 P. M. Overcast afterwards. Lightning. Thunder, & slight rain at 9 & 10 P. M.
11	129.4	...	S. S. W. &W.S. W.		\⌣i to 5 A. M. Scatd. \⌣i afterwards.
12	132.0	...	W. by S. & variable.		Clear to 11 A. M., clouds of different kinds afterwards.
13	122.0	...	S. by W. & S. S. W.		Scatd. ⌒i to 3 P. M. Scatd. \i to 6 P. M., clear afterwards. Slightly foggy at 6 & 7 A. M.
14	130.0	...	S. & S. S. W.		Scatd. ⌒i to 5 A. M. Scatd \⌣i to 10 A. M. Scatd. \i afterwards.
15	132.6	0.02	S. S. W.		Clear to 5 P. M. Overcast afterwards. High wind at 8 & 9 P. M. Slight rain at 9 P. M.
16	...	...	S. & W.		Clear nearly the whole day.
17	...	...	S.		Scatd. \⌣i to 3 A. M., clear afterwards.
18	...	...	S. & S. E.		Scatd. \i nearly the whole day.
19	...	...	S. & S. W.		Scatd. \i to 9 A. M. Clear to 3 P. M. ⌒i afterwards. Thunder at 6 & 7 P. M. Lightning from 6 to 8 P. M. Slight rain at 7 P. M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
20	...	0.01	S. S. E. & variable.	...	Overcast to 5 A. M. Scatd. ⌒i afterwards. Lightning to E at 9 P. M. Light rain at 2½ A. M. & 5½ P. M.
21	122.0	...	S. S. W. & variable.		Scatd \i to 4 A. M. Scatd. ⌒i afterwards.
22	137.5	0.14	S. S. E. & S. W.		Scatd. ⌒i to 5 P. M. Overcast afterwards. High wind at 8 & 11 P. M. Lightning at 7 & 8 P. M. Rain at 8, 10 & 11 P.M.
23	127.5	...	N. W. & S.		Thin clouds to 8 A. M. \⌒i to 5 P. M. Scatd. \i afterwards.
24	128.0	1.15	N. W. & N. N. E.		\i to 5 A. M. ⌒i & \⌒i to 7 P. M. \⌒_i afterwards. High wind. Lightning & Thunder at 4 P. M. Rain at 4 & 5 P. M.
25	122.5	...	N. W. & N.		Scatd. \i to 3 A. M. Overcast to 7 A. M. \⌒i to 5 P. M., clear afterwards.
26	132.0	...	S. W. & S. by W.		Clear to 6 A. M. Scatd. \i to 1 P. M. Scatd. \⌒i to 5 P. M., clear afterwards. Lightning to W. at 10 & 11 P. M.
27	127.5	0.15	Varriable.		Scatd. ⌒i to 5 A. M. Scatd \i to 2 P. M. Overcast afterwards. High wind from 8 to 11 P. M. Lightning from 1 to 3 A. M. & at 10 P. M. Thunder at 7 & 10 P. M. Rain from 5 to 7 P. M. & at 10 & 11 P. M.
28	124.5	...	W.N.W. & variable		Chiefly \i
29	119.6		N. & N. W.		Clear to 5 A. M. \⌒i to 5 P. M., clear afterwards.
30	119.6	...	N. N. W.		Clear to 5 A. M. Scatd. \i to 9 A. M. Overcast afterwards. Slight rain at 4 & 5 P. M.
31	126.0	...	S. & S. W.		Clear.

\i Cirri, —i Strati, ⌒i Cumuli, \—i Cirro-strati, ⌒‿i Cumulo strati, \⌒‿i Nimbi, \⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.894
Max. height of the Barometer occurred at 10 A. M. on the 9th ...	30.080
Min. height of the Barometer occurred at 4&5 P. M. on the 21st&22nd	29.725
Extreme range of the Barometer during the month	0.355
Mean of the daily Max. Pressures	29.970
Ditto ditto Min. ditto	29.821
Mean daily range of the Barometer during the month	0.149

	o
Mean Dry Bulb Thermometer for the month	80.1
Max. Temperature occurred at 4 P. M. on the 3rd	94.2
Min. Temperature occurred at 5 A. M. on the 31st	68.6
Extreme range of the Temperature during the month	25.6
Mean of the daily Max. Temperature	89.9
Ditto ditto Min. ditto, ...	72.5
Mean daily range of the Temperature during the month... ...	17.4

Mean Wet Bulb Thermometer for the month	72.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	7.4
Computed Mean Dew-point for the month	67.5
Mean Dry Bulb Thermometer above computed mean Dew-point ...	12.6
	Inches.
Mean Elastic force of Vapour for the month	0.670

	Troy grain.
Mean Weight of Vapour for the month	7.23
Additional Weight of Vapour required for complete saturation ...	3.61
Mean degree of humidity for the month, complete saturation being unity	0.67

	Inches.
Rained 9 days,—Max. fall of rain during 24 hours	1.15
Total amount of rain during the month	1.57
Total amount of rain indicated by the Gauge attached to the anemometer during the month	1.36
Prevailing direction of the Wind...	S. & S. S. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Feb. 1867.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																					No. of days																											
Mid night							1												1		4				7		1		4		4		1						1				2				1	
1	1		1				1														4		1		4		2		4		5						1				2		2		1			
2	1		1						1										1		1				3		2		5		5		3										4					
3	1				1						1				1				1		2				3		2		4		3		3						1				5		1			
4	1														1		1		2		2		1		3		1		5		2				1		1		1		1		3		1			
5	2												1						3		3		1		3		1		2		4				1						1		[illegible]		1			
6	2						1						1				2	1	2		2		2		4		1		2		4		2		1						1		3		1			
7	2										1						2		2		2		2		3		2		4		4		1		1		1				1		2		1			
8	1		1		1						1								1		4		2		5				3		5				1		2				1		2		1			
9	1						1												1		1		1		4				4		5		5				2						5				1	
10	1						1		1												1		1		5				3		4		4		4				1		1		2		1		1	
11			1				1						1								1				1		1		3		5		5		3		2		1				3		3			
Noon.	2												2										1		3				5		2		2		6		2		1				3				1	
1					1		1		1		1		1								2				1		1		4		8		1		3				1		1		3					
2					1						1		1				1				1				1				2		3		4		2		2		1		3		6		1			
3	1		1												1		1				1				3		1		2		1		5		2		1		2		2		4		3			
4	2	1	1		1						1										3		1		2		1		2		4		2		2		2		2				4	1	1			
5	1				1	1									1				1		1				3		2		2		6	1			3		3		2				5	1				
6	2				2										1										4		1		10	1	4	1	1		3								2					
7	1						1								1				1						5		4		6		4	2	4	1	1								2		1			
8							1								1				1		1		1		9		4		5				2				1		1		1	1	3	1				
9	1	1	1												1						1		1		12	2	2		5		2		2										1		1			
10					1				1								1				1		3		8	2	2		7		2	1											2		1	1		
11					1												2				5	1	1		8	1	3		3		2						1						1		1			

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

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 the Barometer at 32° Faht.	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	29.795	29.883	29.718	0.165	82.4	95.2	73.0	22.2
2	.743	.819	.671	.145	84.6	96.6	75.2	21.4
3	.727	.818	.650	.168	85.6	98.0	75.8	22.2
4	.725	.802	.670	.132	85.5	96.8	76.3	20.5
5	.702	.754	.639	.115	87.4	101.2	77.8	23.4
6	.746	.815	.698	.117	88.7	102.5	77.6	24.9
7	.769	.868	.706	.162	88.0	98.5	80.0	18.5
8	.770	.852	.710	.142	86.3	98.0	77.2	20.8
9	.797	.885	.723	.162	86.3	97.9	77.4	20.5
10	.815	.886	.726	.160	82.9	97.4	75.8	21.6
11	.802	.872	.720	.152	81.0	93.0	71.4	21.6
12	.846	.936	.778	.158	81.8	91.0	74.0	17.0
13	.895	.954	.810	.144	80.1	88.0	73.4	14.6
14	.799	.881	.696	.185	82.8	92.8	73.4	19.4
15	.769	.839	.712	.127	85.3	95.8	78.2	17.6
16	.803	.919	.740	.179	84.0	92.7	76.2	16.5
17	.898	.962	.829	.134	79.7	88.4	71.2	17.2
18	.895	.969	.821	.148	82.1	92.2	75.0	17.2
19	.852	.942	.760	.182	84.5	96.6	74.5	22.1
20	.787	.858	.714	.144	85.8	97.4	76.4	21.0
21	.742	.802	.698	.104	84.1	97.8	77.4	20.4
22	.786	.845	.694	.151	84.6	95.6	76.4	19.2
23	.821	.901	.749	.152	85.1	94.6	76.0	18.6
24	.777	.830	.675	.155	85.4	93.6	78.6	15.0
25	.771	.827	.694	.133	85.2	93.6	79.5	14.1
26	.851	.930	.756	.174	84.6	91.8	78.1	13.7
27	.847	.915	.767	.148	85.9	97.0	76.6	20.4
28	.780	.868	.706	.162	87.5	97.4	79.6	17.8
29	.748	.829	.668	.161	89.2	99.6	81.2	18.4
30	.734	.803	.657	.146	89.6	99.4	81.4	18.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

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	74.2	8.2	68.5	13.9	0.692	7.44	4.17	0.64
2	74.6	10.0	67.6	17.0	.672	.19	5.20	.58
3	75.7	9.9	68.8	16.8	.699	.45	.31	.58
4	76.0	9.5	69.3	16.2	.711	.58	.14	.60
5	76.8	10.6	70.4	17.0	.736	.82	.63	.58
6	77.2	11.5	70.3	18.4	.734	.79	6.17	.56
7	75.6	12.4	68.2	19.8	.686	.28	.40	.53
8	73.2	13.1	64.0	22.3	.597	6.36	.66	.49
9	74.8	11.5	66.7	19.6	.653	.94	·08	.53
10	72.5	10.4	65.2	17.7	.621	.66	5.13	.57
11	73.7	7.3	68.6	12.4	.695	7.49	3.65	.67
12	75.0	6.8	70.2	11.6	.732	.86	.54	.69
13	73.6	6.5	69.0	11.1	.704	.59	.25	.70
14	74.7	8.1	69.0	13.8	.704	.54	4.21	.64
15	78.3	7.0	73.4	11.9	.811	8.66	3.98	.69
16	73.6	10.4	66.3	17.7	.644	6.89	5.28	.57
17	72.0	7.7	66.6	13.1	.651	7.02	3.70	.66
18	74.4	7.7	69.0	13.1	.704	.56	.95	.66
19	74.9	9.6	68.2	16.3	.686	.34	5.01	.59
20	75.4	10.4	68.1	17.7	.684	.28	.55	.57
21	75.2	8.9	69.0	15.1	.704	.53	4.68	.62
22	75.5	9.1	69.1	15.5	.706	.53	.86	.61
23	77.4	7.7	72.0	13.1	.776	8.28	.29	.66
24	79.0	6.4	74.5	10.9	.840	.98	3.70	.71
25	78.8	6.4	74.3	10.9	.835	.92	.69	.71
26	78.6	6.0	74.4	10.2	.838	.97	.42	.72
27	78.4	7.5	73.1	12.8	.803	.56	4.31	.67
28	79.5	8.0	74.7	12.8	.846	.99	.50	.67
29	79.8	9.4	74.2	15.0	.832	.82	5.34	.62
30	80.7	8.9	75.4	14.2	.865	9.17	.16	.64

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

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.	29.802	29.949	29.721	0.228	79.6	84.6	74.6	10.0
1	.793	.939	.711	.228	79.1	84.4	73.8	10.6
2	.781	.923	.705	.218	78.6	83.7	73.0	10.7
3	.774	.916	.687	.229	78.0	83.0	72.8	10.2
4	.769	.900	.675	.225	77.5	82.0	71.4	10.6
5	.783	.895	.680	.215	77.0	81.5	71.4	10.1
6	.801	.915	.709	.206	76.9	81.4	71.2	10.2
7	.824	.955	.718	.237	78.5	82.6	73.5	9.1
8	.847	.960	.741	.219	82.0	87.0	76.0	11.0
9	.862	.969	.749	.220	85.3	90.4	78.6	11.8
10	.864	.964	.754	.210	88.3	93.6	81.6	12.0
11	.854	.963	.748	.215	90.5	96.2	81.8	14.4
Noon.	.832	.954	.727	.227	92.6	98.3	83.5	14.8
1	.803	.923	.691	.232	94.2	100.4	86.4	14.0
2	.773	.892	.670	.222	95.1	102.0	87.4	14.6
3	.744	.860	.653	.207	95.0	102.5	86.6	15.9
4	.730	.835	.649	.186	93.8	102.0	87.4	14.6
5	.726	.829	.639	.190	91.2	100.6	79.0	21.6
6	.734	.838	.657	.181	88.4	96.8	77.4	19.4
7	.751	.854	.668	.186	86.2	92.6	78.8	13.8
8	.775	.873	.691	.182	84.0	89.9	77.0	12.9
9	.797	.900	.710	.190	82.7	88.6	76.6	12.0
10	.807	.930	.724	.206	81.6	86.0	75.8	10.2
11	.804	.936	.723	.213	80.6	85.4	75.8	9.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

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.	74.9	4.7	71.6	8.0	0.766	8.27	2.42	0.77
1	74.8	4.3	71.8	7.3	.771	.33	.20	.79
2	74.5	4.1	71.6	7.0	.766	.28	.10	.80
3	74.3	3.7	71.7	6.3	.768	.33	1.86	.82
4	74.2	3.3	71.9	5.6	.773	.38	.66	.84
5	74.0	3.0	71.9	5.1	.773	.40	.49	.85
6	73.9	3.0	71.8	5.1	.771	.37	.49	.85
7	74.7	3.8	72.0	6.5	.776	.38	.97	.81
8	76.0	6.0	71.8	10.2	.771	.28	3.19	.72
9	76.5	8.8	70.3	15.0	.734	7.84	4.80	.62
10	77.0	11.3	70.2	18.1	.732	.76	6.94	.56
11	77.0	13.5	68.9	21.6	.701	.40	7.32	.50
Noon.	77.2	15.4	68.0	24.6	.681	.16	8.47	.46
1	77.5	16.7	67.5	26.7	.670	.03	9.33	.43
2	77.6	17.5	67.1	28.0	.661	6.92	.87	.41
3	77.7	17.3	67.3	27.7	.666	.96	.78	.42
4	78.2	15.6	68.8	25.0	.699	7.33	8.85	.45
5	77.3	13.9	69.0	22.2	.706	.42	7.60	.49
6	76.9	11.5	70.0	18.4	.727	.71	6.13	.56
7	76.8	9.4	70.2	16.0	.732	.79	5.20	.60
8	76.2	7.8	70.7	13.3	.744	.97	4.20	.66
9	75.6	7.1	70.6	12.1	.741	.95	3.77	.68
10	75.4	6.2	71.1	10.5	.753	8.10	.24	.71
11	75.1	5.5	71.2	9.4	.756	.15	2.86	.74

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	127.5	...	S. S. W. & S. W.	1.4	Clear.
2	129.0	...	S. by W. & S.S. W.	2.7	Chiefly clear. Lightning to S & S E at 8 P. M.
3	130.0	...	S. W. & S. S. E.	1.2	Clear.
4	134.8	...	S. S. E. & S. S. W.	1.4	Chiefly clear.
5	132.8	...	S. S. W. & S. S. E.	1.4	Clear.
6	134.0	...	N. W. & variable.	0.4	Chiefly clear.
7	134.0	...	W. & variable.	3.2	Clear to 7 A. M. Stratoni to 11 A. M. Scatd. \⌣i afterwards.
8	132·2	...	Variable.	2.7	Scatd \i to 6 A. M. Scatd. \⌣i afterwards.
9	132.5	...	S. W. & variable.	0.5	Clear to 4 A. M. Scatd. \i to 8 A. M. Scatd. \⌣i afterwads. Lightning to W. & N. at 9 & 10 P. M.
10	130.0	0.04	E. S. E. & variable.	22.0	Clear to 4 A. M. Stratoni to 4 P. M. Overcast afterwards, high wind & slight rain at 5 & 6 P. M. Thunder at 6 & 7 P. M. Lightning to S at 7 & 8 P. M.
11	125.0	0.05	S. S.W. & S. & S.S.E.	4.4	\⌣i to 4 A. M., clear to 10 A. M. Scatd. ⌒i to 5 P. M. Overcast to 8 P. M., clear afterwards. Thunder, Lightning & slight rain at 6 & 7 P. M. High wind at 1¾ P. M.
12	126.0	...	S. E. & S. S. W.	2.6	Clear to 7 A. M. Scatd. \⌣i to 7 P. M. Overcast afterwards. Light rain at 4½ & 9 P. M.
13	122.0	...	S. W. & variable.	0.2	\i to 6 A. M. Stratoni to 10 A. M. Scatd. \⌣i to 3 P. M. Scatd. ⌒i afterwards.
14	126.0	...	S. S. E. & N. W.	0.3	Clear to 9 A. M. Scatd. ⌒i to 5 P. M., clear afterwards.
15	126.0	...	S. W. & S.	1.4	Scuds from S to 8 A. M. Clouds of different kinds afterwards.
16	129.9	...	Variable.	5.3	Scatd. \i to 7 A. M. Scatd. \⌣i afterwards. High wind at 9½ P. M.
17	125.0	0.13	S. W. & variable	10.0	Overcast to 6 A. M. Scatd. \⌣i to 5 P. M., clear afterwards. High wind at 2½ A. M. Rain at 1 & 3 A. M.
18	127.5	...	S. S. W. & S. W.	2.0	\⌣i nearly the whole day. Light rain at 6½ P. M.
19	129.0	...	S. W. & W. S. W.	0.7	Clear nearly the whole day.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
20	132.2		S. W. & W. N. W.	...	\i to 2 A. M., clear to 10 A. M. Scatd. \i to 7 P. M., clear afterwards. Light rain at 6 P. M.
21	130.5	0.05	S. W. & W. S. W.	6.8	Clear to 2 P. M., clouds of different kinds afterwards. High wind at 4½ P. M., Slight rain at 5 & 6 P. M.
22	125.0	...	Variable.	1.3	\i to 4 A. M., clear to 3 P. M. ⌒i afterwards. Lightning to N. E. from 7 to 9 P. M.
23	128.0	...	S. S. E. & S. E.	0.4	Scatd. \i to 6 A. M. Scatd. ⌒i to 7 P. M., clear afterwards. Light rain at 5½ P. M.
24	126.0	...	S. & S. W.	3.9	Chiefly clear. High wind & Lightning at 8 & 9 P. M.
25	135.0	...	S. W. & S.	4.0	Clear to 4 A.M. Scatd.\i to 2 P. M. \⌒i afterwards. High wind from 7½ to Noon & at 8 P. M. Thunder at 3 P. M. Lightning to W. at 8 P. M.
26	116.0	...	S. W.	4.0	Scatd. \i & _i to 7 A. M. Stratoni to 4 P. M. \i afterwards. High wind & Light rain at 9½ P. M.
27	130.0	...	S. by W. & S.	1.4	Chiefly clear.
28	130.4	...	S. W. & S. S. W	1.0	Clear to 6 A. M. Scatd. \i to 5 P. M., clear afterwards.
29	132.0	...	S. S. W. & variable.	1.0	Clear to 2 A. M. Scatd. \i to 10 A. M. Scatd.\i to 7 P. M., clear afterwards.
30	130.0	...	S. S. W.& S. W.	0.9	\i to 1 P. 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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.793
Max. height of the Barometer occurred at 9 A. M. on the 18th ...	29.969
Min. height of the Barometer occurred at 5 P. M. on the 5th ...	29.639
Extreme range of the Barometer during the month	0.330
Mean of the daily Max. Pressures	29.869
Ditto ditto Min. ditto	29.719
Mean daily range of the Barometer during the month	0.150

	°
Mean Dry Bulb Thermometer for the month	84.9
Max. Temperature occurred at 3 P. M. on the 6th	102.5
Min. Temperature occurred at 6 A. M. on the 17th	71.2
Extreme range of the Temperature during the month	31.3
Mean of the daily Max. Temperature	95.7
Ditto ditto Min. ditto, ...	76.5
Mean daily range of the Temperature during the month... ...	19.2

Mean Wet Bulb Thermometer for the month	76.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	8.9
Computed Mean Dew-point for the month	69.8
Mean Dry Bulb Thermometer above computed mean Dew-point ...	15.1
	Inches.
Mean Elastic force of Vapour for the month	0.722

	Troy grain.
Mean Weight of Vapour for the month	7.71
Additional Weight of Vapour required for complete saturation ...	4.78
Mean degree of humidity for the month, complete saturation being unity	0.62

	Inches.
Rained 10 days,—Max. fall of rain during 24 hours	0.13
Total amount of rain during the month	0.27
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.21
Prevailing direction of the Wind...	S. W. & S. S. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
Midnight					1				1		1								3		3		2		6		2		6		5																	
1	1	1															2		3		2		1		6		1		8		5										1							
2													2				1		2		4		1		3		1		9		5				1				1									
3							1										1		1		5				4		2		5		8		1		1		1	1										
4							1										1		1		5		1		6		2		5		5		1		1													
5																	1		3		6		2		2		2		5		6		1						1									
6			1														1		4		4		1				4		9		4		1		1													
7															1		1		2				2		6		1		4		9		3				1											
8									1										1		2				1		3		6		9		2		4						1							
9													1												2				9		8		3		1		3				1		2					
10																			1				1		2		1		6		9		2		4				1		2		1					
11																							1		2		1		5		10		1		2		1		2		3		2					
Noon.																									2		1		3		8		2		3		3		5		2		1					
1																									1				3		9		5		2		1		3		2		4					
2							1																						4		10		1		5		2		1		2		4					
3													1						1				1		2				6		6		3				4		1		3		2					
4																			1		1		1		6		1		3		8	1	3				4						2					
5																			1		1				11	1			6		5						1				2		3	1				
6											1		1	1							1				4	1	1		10	1	5		1		1				1		2	1	1	1	1			
7	1	1											2								2		1		5		1		7	1	5		1				2				1		1	1	1			
8									1								2		1		4		1		5		2		5		5		1				2				1							
9													2						1		7		1	1	5				6		3		2	1					1		1						1	
10																	1		1		8				4	1	1		5		5						1		1				1		2	1		
11					1		2												2		5		1		6		1		4		5		1				1		1									

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1867.

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 the Barometer at 32° Faht.	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	29.735	29.803	29.649	0.154	88.3	99.8	78.3	21.5
2	.750	.834	.651	.183	88.2	99.0	80.8	18.2
3	.753	.834	.678	.156	87.6	99.0	78.0	21.0
4	.727	.802	.636	.166	89.6	100.6	82.2	18.4
5	.681	.746	.589	.157	90.2	103.9	81.0	22.9
6	.676	.740	.605	.135	89.0	100.2	81.0	19.2
7	.653	.717	.581	.136	88.4	97.4	81.0	16.4
8	.661	.737	.575	.162	88.0	97.6	81.2	16.4
9	.636	.692	.564	.128	88.0	96.0	82.2	13.8
10	.725	.825	.653	.172	87.3	95.0	80.8	14.2
11	.773	.838	.692	.146	81.7	94.5	76.6	17.9
12	.741	.802	.671	.131	76.9	79.3	76.0	3.3
13	.674	.729	.608	.121	78.2	86.4	72.5	13.9
14	.680	.732	.623	.109	81.5	90.0	74.6	15.4
15	.681	.745	.611	.134	85.6	94.0	77.4	16.6
16	.660	.720	.608	.112	83.4	88.4	80.2	8.2
17	.674	.729	.601	.128	86.1	96.4	77.8	18.6
18	.660	.715	.589	.126	89.5	101.0	81.2	19.8
19	.638	.719	.545	.174	88.8	99.2	80.0	19.2
20	.644	.696	.589	.107	89.2	98.8	81.0	17.8
21	.668	.730	.599	.131	89.3	98.6	82.6	16.0
22	.641	.704	.536	.168	87.7	98.4	81.0	17.4
23	.579	.632	.507	.125	87.6	95.4	81.2	14.2
24	.561	.613	.489	.124	90.0	99.0	83.0	16.0
25	.488	.541	.419	.122	91.5	99.0	86.0	13.0
26	.433	.481	.374	.107	92.5	102.2	86.0	16.2
27	.451	.511	.401	.110	92.5	106.0	85.5	20.5
28	.494	.552	.407	.145	62.2	103.8	86.0	17.8
29	.529	.585	.441	.144	91.6	100.7	85.4	15.3
30	.555	.614	.469	.145	89.5	99.2	81.0	18.2
31	.593	.642	.507	.135	88.4	101.6	81.2	20.4

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1867.

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	77.0	11.3	70.2	18.1	0.732	7.76	6.04	0.56
2	78.1	10.1	72.0	16.2	.776	8.23	5.53	.60
3	78.2	9.4	72.6	15.0	.790	.40	.12	.62
4	81.2	8.4	76.2	13.4	.887	9.41	4.92	.66
5	79.6	10.6	73.2	17.0	.806	8.52	6.07	.58
6	80.8	8.2	75.9	13.1	.879	9.32	4.76	.66
7	81.4	7.0	77.2	11.2	91.6	.73	.11	.70
8	80.4	7.6	75.8	12.2	.876	.31	.37	.68
9	81.7	6.3	77.9	10.1	.937	.96	3·72	.73
10	80.2	7.1	75.9	11.4	.879	.36	4.05	.70
11	74.4	7.3	69.3	12.4	.711	7.64	3.73	.67
12	73.7	3.2	71.5	5.4	.763	8.30	1.56	.84
13	74.5	3.7	71.9	6.3	.773	.38	.87	.82
14	76.6	4.9	73.2	8.3	.806	.68	2.63	.77
15	79.6	6.0	75.4	10.2	.865	9.24	3.52	.72
16	79.9	3.5	77.4	6.0	.922	.89	2.07	.83
17	79.2	6.9	74.4	11.7	.838	8.93	4.02	.68
18	79.9	9.6	74.1	15.4	.830	.80	5.49	.62
19	80.1	8.7	74.9	13.9	.851	9.02	4.98	.64
20	80.0	9.2	74.5	14.7	.840	8.90	5.26	.63
21	81.5	7.8	76.8	12.5	.905	9.57	4.64	.67
22	81.3	6.4	77.5	10.2	.925	.84	3.72	.73
23	81.5	6.1	77.8	9.8	.934	.93	.59	.73
24	83.3	6.7	79.3	10.7	.979	10.36	4.14	.71
25	83.0	5.5	82.7	8.8	1.090	11.51	3.64	.76
26	85.9	6.6	81.9	10.6	.063	.19	4.40	.72
27	85.4	7.1	81.1	11.4	.037	10.92	.67	.70
28	75.3	6.9	81.2	11.0	.010	.96	.49	.71
29	84.1	7.5	79.9	12.0	0.989	.43	.76	.69
30	81.8	7.7	77.2	12.3	.916	9.71	.58	.68
31	80.3	8.1	75.4	13.0	.865	.18	.63	.66

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1867.

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.	29.650	29.802	29.435	0.367	83.0	87.8	76.0	11.8
1	.641	.785	.434	.351	82.7	87.6	75.4	12.2
2	.632	.761	.419	.342	82.2	87.4	74.5	12.9
3	.624	.758	.415	.343	81.9	87.2	73.6	13.6
4	.622	.760	.422	.338	81.7	86.8	72.6	14.2
5	.636	.770	.436	.334	81.3	86.6	72.5	14.1
6	.650	.775	.443	.332	81.3	86.6	73.0	13.6
7	.667	.793	.439	.354	82.5	87.3	73.6	13.7
8	.685	.820	.463	.357	85.5	89.8	74.0	15.8
9	.697	.834	.481	.353	88.1	93.0	74.3	18.7
10	.696	.831	.471	.360	90.6	96.2	75.7	20.5
11	.685	.822	.477	.345	92.7	98.7	77.0	21.7
Noon.	.670	.801	.462	.339	94.5	101.2	77.4	23.8
1	.646	.775	.440	.335	95.5	103.0	77.0	26.0
2	.619	.742	.414	.328	96.5	105.6	77.7	27.9
3	.594	.705	.398	.307	96.6	106.0	77.8	28.2
4	.572	.692	.380	.312	95.7	103.6	79.3	24.3
5	.570	.713	.375	.338	94.0	103.9	79.2	24.7
6	.589	.736	.374	.362	90.3	98.0	76.2	21.8
7	.606	.778	.393	.385	87.8	95.4	77.0	18.4
8	.627	.801	.415	.386	86.5	92.0	76.6	15.4
9	.648	.836	.433	.403	85.3	90.6	76.4	14.2
10	.659	.838	.450	.388	84.5	88.5	76.6	11.9
11	.655	.820	.443	.377	83.6	88.4	76.6	11.8

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 1867.

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.	79.1	3.9	76.4	6.6	0.893	9.58	2.24	0.81
1	78.9	3.8	76.2	6.5	.887	.52	.20	.81
2	78.9	3.3	76.6	5.6	.899	.65	1.89	.84
3	78.9	3.0	76.8	5.1	.905	.73	.71	.85
4	78.9	2.8	76.9	4.8	.908	.76	.61	.86
5	78.8	2.5	77.0	4.3	.910	.81	.43	.87
6	78.9	2.4	77.2	4.1	.916	.87	.37	.88
7	79.5	3.0	77.4	5.1	.922	.91	.73	.85
8	80.7	4.8	77.3	8.2	.919	.82	2.90	.77
9	81.2	6.9	77.1	11.0	.913	.70	4.02	.71
10	81.8	8.8	76.5	14.1	.896	.48	5.28	.64
11	81.8	10.9	75.3	17.4	.862	.08	6.60	.58
Noon.	82.0	12.5	74.5	20.0	.840	8.81	7.70	.53
1	82.3	13.2	74.4	21.1	.838	.77	8.22	.52
2	82.4	14.1	73.9	22.6	.824	.60	.88	.49
3	82.2	14.4	73.6	23.0	.817	.52	9.00	.49
4	82.1	13.6	73.9	21.8	.824	.61	8.47	.50
5	81.9	12.1	74.6	19.4	.843	.85	7.42	.54
6	80.8	9.5	75.1	15.2	.857	9.06	5.57	.62
7	80.2	7.6	75.6	12.2	.871	.25	4.35	.68
8	80.1	6.4	76.3	10.2	.890	.50	3.60	.73
9	79.6	5.7	75.6	9.7	.871	.29	.35	.74
10	79.6	4.9	76.2	8.3	.887	.51	2.84	.77
11	79.3	4.3	76.3	7.3	.890	.55	.48	.79

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	133.5	...	S. S. W. & S. W.	0.5	Clear to 9 A. M. Scatd. \i to 8 P. M. Stratoni afterwards. Lightning at 9 P. M.
2	129.4	...	S. W.	4.0	Clear to 5 A. M. Scatd. \i to 5 P. M. Overcast afterwards. High wind at 6 P. M. Thunder & Lightning from 7 to 9 P. M. Slight rain at 9 P. M.
3	133.5	...	W. & S. W.	1.4	Clear to 5 A. M. Scatd. \i to 7 P. M., clear afterwards.
4	132.0	...	S. S. W. & S. S. E.	1.2	Clear to 3 A. M. Scatd. \i to 1 P. M. \i & ⌒i afterwards. Slight rain at 4½ P. M.
5	133.7	...	S. W. & variable.	5.0	Clear to 1 P. M. Scatd. ⌒i to 6 P. M., clear afterwards. High wind at 5 P. M.
6	130.0	...	S. S. W. & S.	2.4	Clear nearly the whole day. High wind at 6½ P. M.
7	127.5	...	S. S. W. & S.	3.5	Scatd \i to 3 A. M. Clear to 7 P. M. Overcast afterwards. Lightning to N at 8 P. M. High wind & slight rain at 9½ P. M.
8	127·5	...	S. S. E. & S. S.W.	3.2	Overcast to 5 A. M. Scuds to 10 A. M., Clear to 5 P. M., Scatd. \i afterwards.
9	127.8	...	S. S. E. & S. S. W.	4.6	Clear to 3 A. M. ⌒i & \i afterwards. High wind from 8 to 11 A. M.
10	128.0	0.08	S. E. & S. W.	2.9	\i nearly the whole day. Rain at 12¾ A. M.
11	...	...	S. S. E. & N. E.	4.8	Clear to 4 A. M. \i to 10 A. M. ⌒i & \⌣i to 4 P. M. Overcast afterwards. Thunder at noon, 1 & 5 P. M. Lightning at 1 & 7 P. M. Slight rain at 12¾ A. M. High wind at 12½ A. M.
12	...	0.04	S. E.	0.3	Stratoni to 7 A. M. Overcast afterwards. Light rain from 8 A. M. to 3 P. M. & at 10 & 11 P. M.
13	121.0	0.52	S. E. & variable.	...	Overcast to 10 A. M. Scatd. ⌒i afterwards. Rain from midnight to 4 A. M. & at 7 & 8 A. M.
14	124.0	...	N. N. W. & N. W.	...	Clouds of different kinds to 9 A. M. \i & \⌣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 May 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
15	131.4	...	E. by N. & N. E.	0.2	Clear to 3 A. M. Stratoni to 7 A. M. Scatd. ⌒i afterwards
16	...	0.28	Variable.	3.9	Clear to 3 A. M. Scatd. \i to 7 A. M. ⌒—i to 5 P. M. Overcast afterwards. Rain & high wind at 11 A. M.
17	128.6	...	S. W. & S.	1.5	\⌒i to noon. Scatd. ⌒i to 6 P. M. Clear afterwards.
18	133.0	...	S. W. & N. N. W.	0.2	Clear to 10 A. M. Scatd. ⌒i to 2 P. M., clear afterwards.
19	131.4	...	W. & S.	0.2	Clear to 7 A. M. Scatd. ⌒i to 5 P. M., clear afterwards.
20	131.0	...	W. by S. & E.S.E.	0.4	Clear to 10 A. M. Scatd. ⌒i to 5 P. M. Scatd. \i afterwards.
21	137.8	...	S. by E. & S.	0.2	Scatd. \⌒i to 2 A. M. Clear to 6 A. M. Scatd. ⌒i to 5 P. M., clear afterwards.
22	...	0.45	S. S. E. & E. S. E.	6.5	Scatd. \⌒i to 3 P. M. ⌒—i afterwards. Thunder & Rain at 6 P. M. High wind at 5½ P. M.
23	124.5	...	E. S. E. & E. N. E.	0.5	Stratoni to 7 A. M. Scatd. ⌒i to 2 P. M. Scatd. \i & \—i afterwards.
24	129.0	...	S. E. & S. S. E.	3.0	Stratoni to 2 A. M. \i to 11 A. M. Scatd. ⌒i to 6 P. M., clear afterwards.
25	129.5	...	S. S. W. & S.	1.7	Clear to 2 A. M. Scuds from S to 7 A. M. Scatd. clouds to 8 P. M. Clear afterwards.
26	131.0	...	S. & S. S. E.	2.8	Stratoni to 9 A. M. Scatd. \⌒i to 2 P. M. Scatd. ⌒i to 6 P. M. clear afterwards.
27	135.0	...	S. & S. S. E.	3.1	Scatd \⌒i to 8 A. M. clear afterwards
28	133.0	...	S. S. E. & S.	2.5	Clear to 3 A. M. Scuds from S to 6 A. M. clear to 5 P. M. Stratoni afterwards.
29	131.0	...	S. S. E.	3.0	Stratoni nearly the whole day.
30	133.0	...	S. S. E. & S.	3.3	Scatd. \⌒i to 9 A. M. Scatd ⌒i afterwards. High wind at 6¾ P. M. Lightning to N at 7 & 8 P. M.
31	131.0	1.09	Variable	14.9	Clear to 7 A. M. Scatd. ⌒i to 5 P. M. Overcast to 8 P. M. Stratoni afterwards. High wind at 6 P. M. Rain from 6 to 8 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, \—i Cirro-strati, ⌒ i Cumulo strati, ⌒—i Nimbi, \⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1867.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.639
Max. height of the Barometer occurred at 10 P. M. on the 11th ...	29.838
Min. height of the Barometer occurred at 6 P.M. on the 26th ...	29.374
Extreme range of the Barometer during the month	0.464
Mean of the daily Max. Pressures	29.702
Ditto ditto Min. ditto	29.563
Mean daily range of the Barometer during the month	0.139

	°
Mean Dry Bulb Thermometer for the month	87.7
Max. Temperature occurred at 3 P. M. on the 27th	106.0
Min. Temperature occurred at 5 A. M. on the 13th	72.5
Extreme range of the Temperature during the month	33.5
Mean of the daily Max. Temperature	97.4
Ditto ditto Min. ditto, ...	80.7
Mean daily range of the Temperature during the month... ...	16.7

Mean Wet Bulb Thermometer for the month	80.4
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	7.3
Computed Mean Dew-point for the month	76.0
Mean Dry Bulb Thermometer above computed mean Dew-point ...	11.7
	Inches.
Mean Elastic force of Vapour for the month	0.882

	Troy grain.
Mean Weight of Vapour for the month	9.37
Additional Weight of Vapour required for complete saturation ...	4.19
Mean degree of humidity for the month, complete saturation being unity	0.69

	Inches.
Rained 10 days,—Max. fall of rain during 24 hours	1.09
Total amount of rain during the month	2.46
Total amount of rain indicated by the Gauge attached to the anemometer during the month	2.33
Prevailing direction of the Wind... ...	S., S. S. E. & S. S. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1867.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																					No. of days																											
Mid night													1						7	1	4				8		2		1		4				1										1			
1									1								1		6	1	5		4		4				2		2				2										1		1	
2					1						1				1				5	1	6		3		5				2		1		1		1		1								1			
3							1				1				1				4	1	5		2		6		1		3		1				1		2								1			
4			1								2								6	1	4		2		3		2		4		1				1		2								1			
5					1						1						1		5		4		1		7		1		2				1		1		2						2					
6									1						1		2		5		5		2		6				4		2						1						2					
7					1		1		1				1				4		1		4		1		6		1		7	1	2				1													
8					2	1							1		1		1				6	1	2		4		1		6		3		3				1											
9					1		2		1	1							1		1		3		2		8				5		4		2				1											
10			1												2	1					2		2		5				6		6		1				1				1		1		2		1	
11	1	1							1				1						5	1					5		1		4		5		3				1		1		2				1			
Noon.							1		1		1						2	1	2		1		1		5		1		5		4		1				1		1		2		1		1			
1							1		2				2	1			2		1	1	2		3		2		1	1	3		5		1		1		1				2		2					
2	1						3						1				2		2	1	2				3		1		3		7		1				3				1		1					
3	1				1		2										2		3	1	3		1		4		1		4		4		1		1		1		1						1			
4							1		1						2		2		3		2		2		1		3		5		5						2								2			
5							2						2				1		4		4	1	1		5				5		3						2		1						1			
6							2		1						1		2	1	4		3				6				6		3						1				1	1			1			
7									2				2		1				5	1	6		3		6		2		1		1						1				1							
8					1								2				2		3		9	1	1		5				5				1				1											
9							8						1						2		8		1		7	1	2		2		1		1				1											
10							1						1	1	1		1		4	1	6		2		4		1		3		2		2				1											
11	1								1				1				2		5	1	5		2		4				3		2				1		1											

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1867.

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 the Barometer at 32° Faht.	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	29.589	29.654	29.513	0.141	89.1	98.8	81.0	17.8
2	.587	.654	.521	.133	90.3	99.6	83.6	16.0
3	.612	.696	.507	.189	87.3	98.0	78.5	19.5
4	.586	.653	.515	.138	88.3	98.5	79.8	18.7
5	.554	.615	.496	.119	90.2	97.4	84.4	13.0
6	.539	.586	.467	.119	88.9	99.2	79.4	19.8
7	.648	.756	.555	.201	80.5	86.0	73.8	12.2
8	.647	.701	.573	.128	83.5	91.2	78.0	13.2
9	.638	.699	.564	.135	84.5	92.8	78.5	14.3
10	.656	.730	.582	.148	86.5	95.0	79.6	15.4
11	.658	.722	.589	.133	85.9	92.0	81.2	10.8
12	.616	.665	.550	.115	86.1	94.5	80.8	13.7
13	.609	.639	.563	.076	84.1	90.4	81.2	9.2
14	.629	.669	.583	.086	82.4	88.0	80.0	8.0
15	.647	.684	.600	.084	82.3	87.2	80.2	7.0
16	.621	.686	.543	.143	82.5	87.0	80.0	7.0
17	.506	.594	.419	.175	83.7	90.0	79.8	10.2
18	.400	.455	.325	.130	83.8	87.2	80.2	7.0
19	.391	.446	.316	.100	85.3	91.2	81.4	9.8
20	.437	.521	.401	.120	84.3	89.0	81.4	7.6
21	.532	.593	.480	.113	82.3	86.0	80.5	5.5
22	.569	.609	.529	.080	81.4	85.4	78.0	7.4
23	.585	.632	.532	.100	84.4	90.4	81.0	9.4
24	.579	.629	.525	.104	86.0	92.0	82.4	9.6
25	.634	.707	.589	.118	85.9	92.3	83.0	9.3
26	.657	.696	.596	.100	83.7	88.6	80.0	8.6
27	.584	.661	.507	.154	85.0	92.2	81.6	10.6
28	.494	.541	.413	.128	84.6	93.0	78.8	14.2
29	.497	.561	.411	.150	83.8	92.2	79.0	13.2
30	.576	.626	.536	.090	81.5	84.6	80.0	4.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1867.

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	82.9	6.2	79.2	9.9	0.976	10.35	3.77	0.73
2	83.8	6.5	79.9	10.4	.998	.56	4.07	.72
3	79.7	7.6	75.1	12.2	.857	9.12	.29	.68
4	81.0	7.3	76.6	11.7	.899	.54	.26	.69
5	84.1	6.1	80.4	9.8	1.014	10.72	3.87	.74
6	81.6	7.3	77.2	11.7	0.916	9.71	4.33	.69
7	75.9	4.6	72.7	7.8	.792	8.54	2.44	.78
8	78.9	4.6	75.7	7.8	.873	9.36	.64	.78
9	79.4	5.1	75.8	8.7	.876	.37	·98	.76
10	80.1	6.4	76.3	10.2	.890	.50	3.60	.73
11	80.6	5.3	76.9	9.0	.908	.68	.19	.75
12	80.8	5.3	77.1	9.0	.913	.74	.21	.75
13	80.3	3.8	77.6	6.5	.928	.93	2.28	.81
14	79.9	2.5	78.1	4.3	.943	10.14	1.47	.87
15	80.3	2.0	78.9	3.4	.967	.41	.17	.90
16	80.2	2.3	78.6	3.9	.958	.30	.34	.89
17	80.9	2.8	78.9	4.8	.967	.37	.70	.86
18	81.2	2.6	79.4	4.4	.983	.54	.56	.87
19	81.2	4.1	78.3	7.0	.949	.14	2.50	.80
20	80.5	3.8	77.8	6.5	.934	9.99	.29	.81
21	79.7	2.6	77.9	4.4	.937	10.08	1.50	.87
22	79.2	2.2	77.7	3.7	.931	.02	.25	.89
23	80.9	3.5	78.4	6.0	.952	.19	2.12	.83
24	82.3	3.7	79.7	6.3	.992	.59	.32	.82
25	82.4	3.5	79.9	6.0	.998	.65	.22	.83
26	81.4	2.3	79.8	3.9	.995	.66	1.41	.88
27	81.7	3.3	79.4	5.6	.983	.49	2.04	.84
28	80.6	4.0	77.8	6.8	.934	9.99	.40	.81
29	80.5	3.3	78.2	5.6	.946	10.13	1.97	.84
30	80.0	1.5	78.9	2.6	.967	.41	0.90	.92
31								

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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 1867.

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.	29.587	29.693	29.394	0.299	82.4	87.5	79.6	7.9
1	.577	.675	.379	.296	82.1	87.0	79.2	7.8
2	.568	.661	.373	.288	81.9	87.0	79.0	8.0
3	.562	.657	.365	.292	81.6	87.0	78.8	8.2
4	.561	.668	.360	.308	81.4	87.0	78.4	8.6
5	.576	.689	.370	.319	81.1	87.0	78.2	8.8
6	.589	.703	.383	.320	81.3	86.8	78.0	8.8
7	.602	.721	.398	.323	82.3	88.4	78.0	10.4
8	.614	.730	.403	.327	84.2	89.6	77.0	12.6
9	.623	.756	.401	.355	86.4	91.8	74.0	17.8
10	.621	.736	.410	.326	87.6	94.2	73.8	20.4
11	.608	.696	.404	.292	88.5	96.2	74.4	21.8
Noon.	.593	.684	.396	.288	89.3	97.6	75.6	22.0
1	.572	.670	.383	.287	89.9	98.6	79.8	18.8
2	.549	.679	.365	.314	89.8	99.6	80.0	19.6
3	.534	.649	.344	.305	89.7	99.4	80.0	19.4
4	.522	.625	.325	.300	89.1	99.2	80.8	18.4
5	.522	.620	.335	.285	87.8	97.2	81.6	15.6
6	.535	.620	.340	.280	85.8	93.6	81.4	12.2
7	.552	.639	.356	.283	84.3	91.0	80.0	11.0
8	.571	.664	.372	.292	83.5	89.0	79.4	9.6
9	.589	.681	.388	.293	83.1	88.0	79.4	8.6
10	.600	.686	.405	.281	82.7	87.8	78.8	9.0
11	.593	.672	.399	.273	82.5	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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1867.

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.	79.9	2.5	78.1	4.3	0.943	10.14	1.47	0.87
1	79.7	2.4	78.0	4.1	.940	.11	.40	.88
2	79.7	2.2	78.2	3.7	.946	.17	.27	.89
3	79.6	2.0	78.2	3.4	.946	.19	.15	.90
4	79.4	2.0	78.0	3.4	.940	.13	.14	.90
5	79.2	1.9	77.9	3.2	.937	.10	.07	.90
6	79.4	1.9	78.1	3.2	.943	.16	.08	.90
7	80.0	2.3	78.4	3.9	.952	.23	.35	.88
8	80.8	3.4	78.4	5.8	.952	.19	2.05	.83
9	81.3	5.1	77.7	8.7	.931	9.92	3.14	.76
10	81.5	6.1	77.8	9.8	.934	.93	.59	.73
11	81.9	6.6	77.9	10.6	.937	.94	.94	.72
Noon.	82.4	6.9	78.3	11.0	.949	10.05	4.16	.71
1	82.6	7.3	78.2	11.7	.946	.00	.46	.69
2	82.5	7.3	78.1	11.7	.943	9.97	.45	.69
3	82.4	7.3	78.0	11.7	.940	.95	.42	.69
4	82.0	7.1	77.7	11.4	.931	.88	.24	.70
5	81.6	6.2	77.9	9.9	.937	.96	3.64	.73
6	81.0	4.8	77.9	8.2	.937	10.00	2.95	.77
7	80.2	4.1	77.3	7.0	.919	9.84	.44	.80
8	80.2	3.3	77.9	5.6	.937	10.04	1.96	.84
9	80.2	2.9	78.2	4.9	.946	.15	.71	.86
10	80.0	2.7	78.1	4.6	.943	.12	.60	.86
11	79.9	2.6	78.1	4.4	.943	.14	.50	.87

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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* 1867.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	130.0	...	S. & variable.	0.6	Clear to 4 A. M. Scatd. ⌒i to 11 A. M. clear afterwards.
2	130.0	...	S. S. E.	1.0	Clear to 8 A. M. Scatd. ⌒i to 5 P. M. Clear afterwards. Lightning to N. W. at 11. P. M.
3	127.0	0.20	S. S. E. & variable.	4.0	Scatd. clouds to 9 A. M. Scatd. \i to 6 P. M. Overcast afterwards. High wind at 2 A. M. & 7 P. M. Lightning to N. W. at midnight. Rain at 7½ P. M.
4	...	...	S. & S. S. W.	2.0	Overcast to 4 A. M. Clear to 2 P. M. Scatd. \i to 7 P. M. Clear afterwards.
5	133.0	...	S. & S. S. W.	5.5	Chiefly clear. High wind at 10 P. M.
6	125.0	0.26	S. S. W. & S.	10.0	Clear to 4 A. M. Scatd. ⌒i to 6 P. M. Overcast afterwards. High wind at Noon & from 6½ to 10 P. M. Rain from 7 to 9 P. M.
7	114.0	0.32	Variable.	...	Overcast to 2 P. M. ⌒i & _i afterwards. High wind at 3 A. M. Rain from 8 to 10 A. M.
8	125·0	0.94	S. E. & E. S. E.	2.0	Stratoni to 4 A. M. Scatd. ⌒i to 5 P. M. Clouds of different kinds afterwards. Thunder at 6 & 7 P. M. Lightning to N. W. at 9 P. M. Rain at 7 A. M. & 6 P. M.
9	126.2	...	E. & S. E.	3.8	Clear to 8 A. M. Scatd. ⌒i to 6 P. M. Clear afterwards. High wind at 5½ P. M.
10	127.0	...	S. S. E. & E. by S.	0.9	Clear to 7 A. M. Scatd. ⌒i to 6 P. M., clear afterwards.
11	126.6	...	E., E. S. E. & S. E.	1.0	Clear to 7 A. M. Scatd. ⌒i to 11 A. M. Scatd. \i afterwards. Slight rain at 1 P. M.
12	130.0	...	S. E., E. &E. S. E.	1.2	Clear to 5 A. M. Scatd. ⌒i to 1 P. M. _i to 7 P. M. \i afterwards. Thin rain at 4½ P. M.
13	...	0.06	E. & E. S. E.	4.8	Clear to 7 A. M. _i to 1 P. M. Overcast to 8 P. M. Scatd. \i afterwards. High wind at 2 P. M. Light rain at 10½ A. M.
14	...	0.66	E,E. byN.&variable	0.2	Scatd. \i to 9 A. M. Overcast to 6 P. M. Stratoni to 9 P. M. Scatd. \i afterwards. Thunder at 1 & 4 P. M. Rain at 6½ A. M. & from 11½ A. M. to 4 P. M.
15	...	0.23	S. E. & E.	...	Scatd \i to 6 A. M. Overcast to 6 P. M. Stratoni afterwards. Rain

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
16	...	*0.23	S. & S. E.	...	Stratoni to 2 A. M. Overcast to 10 A. M. Clouds of different kinds afterwards. Rain at 3, 4, 9 & 10 A. M.
17	125.2	0.12	Variable.	...	Scatd. \i to 3 A. M. ⌒i to Noon Overcast to 4 P. M. _i afterwards. Rain from 1 to 3 P. M.
18	...	0.14	Variable.	...	Scatd. \i to 7 A. M. Overcast afterwards. Rain at 10 A. M. 4½ & 10½ P. M.
19	113.5	0.06	E. S. E. & S. E.	0.5	\⌣i to 5 A. M. ⌒i & _i to 5 P. M. Clear afterwards. Slight rain at midnight 1 A. M. & 1½ P. M.
20	128.0	0.04	S. E. & E. N. E.	3.4	Stratoni to 5 A. M. Overcast to 3 P. M. Scatd. ⌒i afterwards. Light rain at 6 A. M. 3, 4, 7½ & 9½ P. M.
21	...	...	S. S. E.& variable.	1.6	Scatd.\i to 4 A. M. Stratoni to 4 P. M. _i afterwards. Slight rain at 7½ & 10½ A. M.
22	...	1.10	S, S. S. E.&S. S. W.	1.5	Overcast nearly the whole day. Rain from midnight to 10 A. M. at Noon, 7 and 8 P. M.
23	...	0.06	S. S. W. & S. byW.	1.9	Clouds of different kinds. Rain at 5½ P. M.
24	124.0	...	S. W. & S. S. W.	0.4	\⌣i to 7 A. M. Stratoni to 7 P. M., clear afterwards.
25	134.0	...	S. & S, S. W.	0.3	Scatd. ⌒i to 9 A. M. Overcast to 8 P. M. Stratoni afterwards Light rain at 5 & 6½ P. M.
26	...	0.26	S. S. W. & S.	4.6	Overcast nearly the whole day. High wind at 5½ P. M. Rain at 1½, 7½ & 10 A. M., & from 6 to 8 P. M.
27	124.0	0.37	S, S. W. & S. S. W.	1.0	Stratoni to 5 A. M. Scatd. ⌒i to 2 P. M. Stratoni afterwards. Rain at 3½ & 7 P. M.
28	118.0	0.24	S. S. W. & W.S.W.	1.0	_i to 4 A. M. Stratoni to 4 P. M. Overcast afterwards. Rain from 5 to 10 P. M.
29	...	0.69	Variable.	...	Scatd. \⌣i to 7 A. M ⌒i to 2 P. M. Overcast to 8 P. M. Clear afterwards. Rain at 4 P. M.
30	...	0.14	S. E. & S. S. E.	1.05	Clear to 4 A. M.. \⌣i to 10 A. M. Overcast afterwards. Rain from 11 A. M. to 3 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌢i Cumulo strati, \⌣ Nimbi.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.576
Max. height of the Barometer occurred at 9 A. M. on the 7th ...	29.756
Min. height of the Barometer occurred at 4 P.M. on the 18th ...	29.325
Extreme range of the Barometer during the month	0.431
Mean of the daily Max. Pressures	29.636
Ditto ditto Min. ditto	29.511
Mean daily range of the Barometer during the month	0.125

	o
Mean Dry Bulb Thermometer for the month	84.9
Max. Temperature occurred at 2 P. M. on the 2nd	99.6
Min. Temperature occurred at 10 A. M. on the 7th	73.8
Extreme range of the Temperature during the month	25.8
Mean of the daily Max. Temperature	91.7
Ditto ditto Min. ditto, ...	80.2
Mean daily range of the Temperature during the month... ...	11.5

Mean Wet Bulb Thermometer for the month	80.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	4.2
Computed Mean Dew-point for the month	77.8
Mean Dry Bulb Thermometer above computed mean Dew-point ...	7.1
	Inches.
Mean Elastic force of Vapour for the month	0.934

	Troy grain.
Mean Weight of Vapour for the month	9.99
Additional Weight of Vapour required for complete saturation ...	2.50
Mean degree of humidity for the month, complete saturation being unity	0.80

	Inches.
Rained 23 days,—Max. fall of rain during 24 hours	1.10
Total amount of rain during the month	6.12
Total amount of rain indicated by the Gauge attached to the anemometer during the month	5.40
Prevailing direction of the Wind... ...	S. E., S. S. W. & S.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1867.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																			No. of days																													
Mid night													2		1		2		4		5	1			8		1	1	2		1																	
1									2				1				4		2		5				4		3	1	2		3	1																
2							1		2				5		1		2				4		1		3	1	2		3	1	1						1											
3									2		2		5		2		2				1				4	1	1		5		2																	
4							1		2		4		3		1		2		2		1		1	1	1		1		5		2																	
5							1		3		2		7		3				2		1		3	1	2		2		2		2																	
6									2		2		7	1	3				4		1		1		2	1	4		3		1																	
7									2		2	2	7		1		2		3		1				3	1	3		3		2		1															
8	1	1									1		5				3		4		3		1		1		2	1	5	1	1		1		1						1							
9					1	1	1						2				3		6		4	1			1		1		4	1	5		1				1											
10									1	1			2				3		7	2			1		4		1		5	2	3	1	2		1													
11													3				3	1	8		2				1	1			7		3		1				2											
Noon.											2		3		1		1		4	1	3		1		2				4	1	4		3								2	1						
1									1				2		2		2	2	4		2				1		1		8	1	4		1		1	1			1									
2													2	2	1		2		3	1	5		1		5		1		4		1		3	1	1				1									
3							1						2	2	1		2	1	7	2	3		2		5		1		4		2																	
4															1		3	1	7	2	4	1	2		3		4		4						1												1	1
5									1	1							2		5	2	3		1		6	2	3		7	1							1											
6													1				4		5	1	3		2		6		3	1	3		2	2					1											
7													1				4		4		6	1	2		3	1	1		5	2	1	1	1	1					1				1	1				
8							1	1					1		1		2		3	1	5		2		6	1	1		3	1	1	1					1	1	1									
9							1		1								2		5		5	1	2		5		2		3	1			1						1									
10									1								2		4	1	7		3	1	7		1		3																			
11													2				2		4		8		2	1	7				2												1							

397 A1

TABLE OF BAROMETRIC CURVES FOR EACH MONTH OF THE YEAR, FROM 1855 TO 1864. AS REGISTERED AT
AND OF MEAN RAIN FALL.

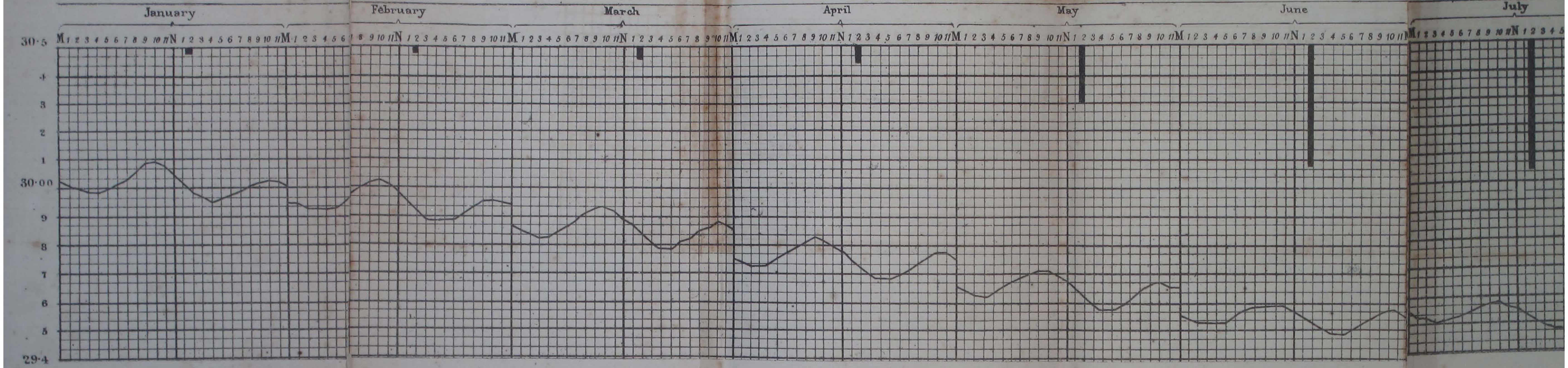
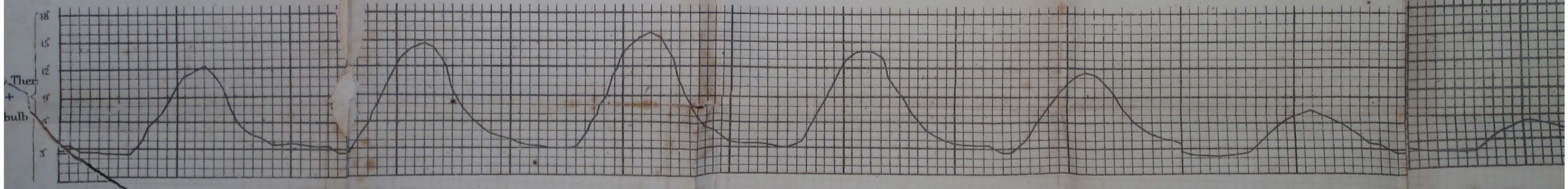


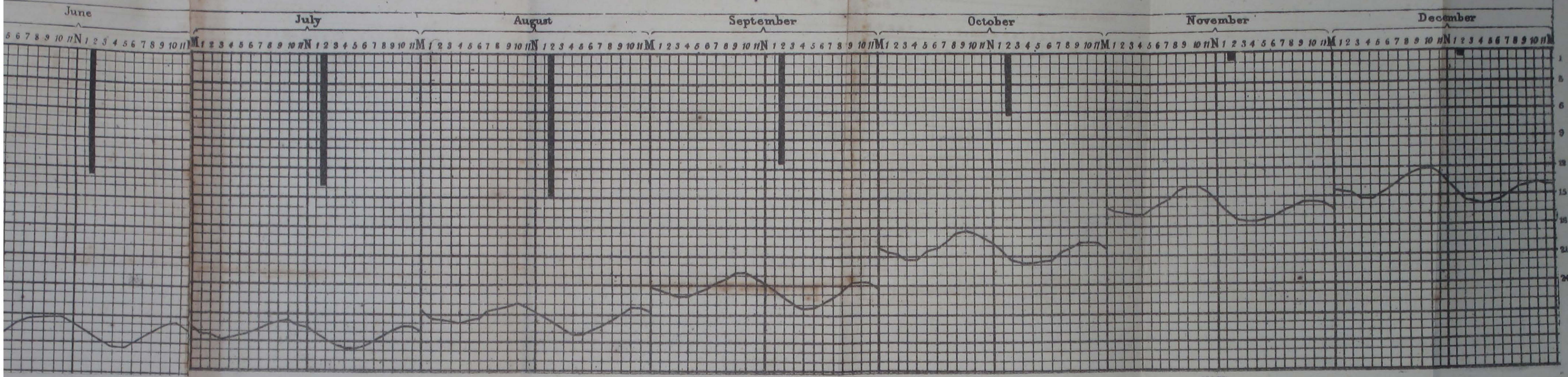
TABLE OF HYGROMETRIC CURVES FOR EACH MONTH OF THE YEAR, FROM 1855 TO 1864. AS REGISTERED A



N.B. The Readings are Reduced to the Standard temperature of 32° Fahr

39743

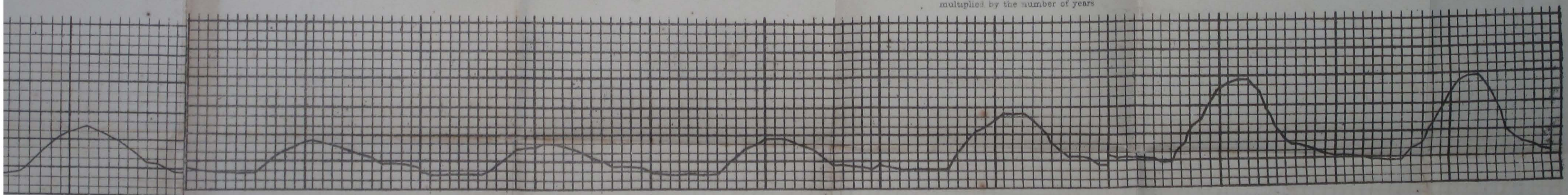
EAR, FROM 1855 TO 1864. AS REGISTERED AT THE SURVEYOR GENERAL'S OFFICE CALCUTTA.



NOTE.

The hourly means were obtained by taking the heights of Barometer or Thermometer, at the same hour each day of the same month for each of the ten years, adding them together and dividing the result by the number of days in the month multiplied by the number of years

EAR, FROM 1855 TO 1864. AS REGISTERED AT THE SURVEYOR GENERAL'S OFFICE CALCUTTA.



N.B. The Readings are Reduced to the Standard temperature of 32° Fahr:

James Gastrell Colonel
Deputy Surveyor General

396 B1

396

Calcutta

Table shewing the mean monthly readings (reduced to 32° Fahtˢ) and the mean hourly variations of the Barometer in the Surveyor General's Office for the 10 years 1856/65

	January	February	March	April	May	June	July	August	September	October	November	December
Mean Monthly readings	30.017	29.941	29.861	29.753	29.645	29.541	29.532	29.591	29.681	29.820	29.961	30.020
Mean hourly Variations from the monthly means.												
Midnight	+ .001	+ .003	+ .003	+ .008	+ .009	+ .013	+ .015	+ .019	+ .013	− .000	− .001	− .001
1 AM	− .005	− .004	− .008	− .004	− .001	+ .003	+ .002	+ .006	− .000	− .010	− .009	− .008
2 AM	− .013	− .014	− .019	− .015	− .013	− .007	− .007	− .005	− .011	− .018	− .017	− .017
3 AM	− .021	− .024	− .027	− .022	− .018	− .013	− .018	− .016	− .021	− .025	− .023	− .025
4 AM	− .023	− .028	− .030	− .020	− .015	− .016	− .016	− .017	− .021	− .023	− .025	− .026
5 AM	− .018	− .015	− .015	− .005	− .002	− .007	− .012	− .012	− .013	− .011	− .012	− .015
6 AM	− .001	+ .001	+ .004	+ .014	+ .016	+ .009	+ .004	+ .005	+ .004	+ .008	+ .007	+ .002
7 AM	+ .021	+ .023	+ .026	+ .034	+ .034	+ .023	+ .018	+ .019	+ .023	+ .028	+ .029	+ .024
8 AM	+ .052	+ .050	+ .057	+ .056	+ .051	+ .035	+ .032	+ .035	+ .043	+ .052	+ .054	+ .052
9 AM	+ .074	+ .073	+ .073	+ .070	+ .059	+ .042	+ .038	+ .044	+ .054	+ .063	+ .070	+ .072
10 AM	+ .078	+ .082	+ .077	+ .069	+ .058	+ .041	+ .039	+ .045	+ .055	+ .061	+ .067	+ .073
11 AM	+ .060	+ .068	+ .065	+ .067	+ .045	+ .034	+ .033	+ .037	+ .043	+ .043	+ .046	+ .054
Noon	+ .030	+ .041	+ .041	+ .037	+ .028	+ .019	+ .019	+ .021	+ .023	+ .017	+ .018	+ .023
1 PM	− .004	+ .007	+ .010	+ .008	+ .003	− .000	+ .001	+ .001	− .004	− .011	− .015	− .010
2 PM	− .029	− .024	− .022	− .022	− .024	− .021	− .020	− .023	− .030	− .037	− .037	− .035
3 PM	− .047	− .046	− .045	− .048	− .047	− .039	− .038	− .043	− .050	− .050	− .049	− .049
4 PM	− .054	− .056	− .057	− .069	− .067	− .055	− .051	− .057	− .059	− .051	− .052	− .053
5 PM	− .049	− .056	− .060	− .071	− .069	− .054	− .051	− .056	− .056	− .043	− .044	− .046
6 PM	− .042	− .050	− .052	− .060	− .056	− .044	− .041	− .046	− .043	− .036	− .033	− .035
7 PM	− .025	− .034	− .036	− .039	− .033	− .025	− .023	− .029	− .023	− .016	− .015	− .018
8 PM	− .008	− .013	− .014	− .016	− .009	− .003	− .002	− .004	+ .001	+ .003	+ .002	− .002
9 PM	− .004	+ .002	+ .003	+ .007	+ .009	+ .014	+ .016	+ .016	+ .020	+ .015	+ .012	+ .010
10 PM	− .008	+ .009	+ .012	+ .015	+ .019	+ .025	+ .029	+ .029	+ .027	+ .019	+ .016	+ .015
11 PM	− .003	+ .007	+ .010	+ .014	+ .016	+ .024	+ .029	+ .027	+ .024	+ .016	+ .010	+ .009

Sd/ J. T. Walker Lᵗ Collˡ

Supᵗ G. T. Survey

Photolithographed at the Surveyor General's Office,
Calcutta, June 1868.

***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July* 1867.**

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 the Barometer at 32° Faht.	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	29.591	29.631	29.524	0.107	82.8	89.4	80.0	9.4
2	.553	.608	.489	.119	81.1	87.2	78.2	9.0
3	.548	.627	.498	.129	77.1	79.4	74.8	4.6
4	.656	.708	.594	.114	81.6	88.6	76.0	12.6
5	.701	.740	.650	.090	83.2	87.2	80.2	7.0
6	.706	.748	.634	.114	84.6	91.2	81.4	9.8
7	.681	.731	.636	.095	84.2	87.5	79.6	7.9
8	.675	.722	.619	.103	83.2	88.6	79.0	9.6
9	.684	.730	.625	.105	83.1	88.0	79.0	9.0
10	.666	.708	.605	.103	84.1	89.3	80.4	8.9
11	.645	.690	.579	.111	84.5	90.2	82.0	8.2
12	.666	.715	.597	.118	85.2	90.0	81.4	8.6
13	.610	.663	.525	.138	85.4	91.6	82.0	9.6
14	.537	.599	.458	.141	86.0	93.5	81.4	12.1
15	.482	.536	.401	.135	87.3	93.7	83.0	10.7
16	.451	.494	.375	.119	86.7	92.4	83.0	9.4
17	.436	.486	.388	.098	85.1	90.2	82.0	8.2
18	.482	.525	.430	.095	84.5	89.4	81.7	7.7
19	.490	.541	.422	.119	84.0	88.4	80.5	7.9
20	.436	.481	.370	.111	84.7	90.2	82.2	8.0
21	.396	.444	.314	.130	85.5	91.2	81.4	9.8
22	.465	.536	.385	.151	81.7	86.0	79.6	6.4
23	.513	.557	.457	.100	83.5	87.2	80.4	6.8
24	.501	.544	.447	.097	83.9	88.5	81.2	7.3
25	.494	.537	.449	.088	82.6	86.0	81.0	5.0
26	.521	.559	.476	.083	83.0	87.8	80.6	7.2
27	.523	.567	.453	.114	83.8	88.6	80.0	8.6
28	.487	.534	.419	.115	83.2	86.0	81.2	4.8
29	.485	.561	.426	.135	81.7	85.0	78.5	6.5
30	.584	.641	.526	.115	82.1	87.5	78.4	9.1
31	.598	.650	.546	.104	82.9	88.2	79.0	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 July 1867.

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	80.7	2.1	79.2	3.6	0.976	10.48	1.27	0.89
2	79.7	1.4	78.7	2.4	.961	.37	0.80	.93
3	75.9	1.2	75.1	2.0	.857	9.30	.62	.94
4	78.7	2.9	76.7	4.9	.902	.70	1.64	.86
5	80.6	2.6	78.8	4.4	.964	10.36	.53	.87
6	81.3	3.3	79.0	5.6	.970	.37	2.02	.84
7	81.5	2.7	79.6	4.6	.989	.58	1.66	.86
8	80.6	2.6	78.8	4.4	.964	.36	.53	.87
9	79.8	3.3	77.5	5.6	.925	9.92	·94	.84
10	80.9	3.2	78.7	5.4	.961	10.31	.90	.84
11	81.5	3.0	79.4	5.1	.983	.51	.84	.85
12	82.0	3.2	79.8	5.4	.995	.64	.97	.84
13	82.4	4.0	79.6	6.8	.989	.54	2.52	.81
14	82.2	3.8	79.5	6.5	.986	.51	.40	.81
15	82.9	4.4	80.3	7.0	1.011	.76	.65	.80
16	81.9	4.8	79.0	7.7	0.970	.33	.85	.78
17	81.1	4.0	78.3	6.8	.949	.14	.43	.81
18	81.2	3.3	78.9	5.6	.967	.34	.01	.84
19	81.2	2.8	79.2	4.8	.976	.45	1.72	.86
20	81.6	3.1	79.4	5.3	.983	.51	.91	.85
21	81.6	3.9	78.9	6.6	.967	.32	2.40	.81
22	79.4	2.3	77.8	3.9	.934	.05	1.32	.88
23	80.9	2.6	79.1	4.4	.973	.45	.55	.87
24	81.1	2.8	79.1	4.8	.973	.42	.71	.86
25	80.6	2.0	79.2	3.4	.976	.50	.18	.90
26	80.0	3.0	77.9	5.1	.937	.06	.76	.85
27	80.6	3.2	78.4	5.4	.952	.21	.89	.84
28	80.4	2.8	78.4	4.8	.952	.21	.68	.86
29	79.6	2.1	78.1	3.6	.943	.14	.23	.89
30	80.1	2.0	78.7	3.4	.961	.35	.16	.90
31	80.8	2.1	79.3	3.6	.979	.51	.28	.89

All the Hygrometrical elements are computed by the Greenwich Constants

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1867.

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.	29.572	29.718	29.393	0.325	81.9	84.7	77.2	7.5
1	.562	.715	.393	.322	81.8	84.4	76.4	8.0
2	.553	.711	.385	.326	81.6	84.2	76.0	8.2
3	.545	.705	.399	.306	81.4	83.6	76.3	7.3
4	.539	.702	.411	.391	81.2	83.4	76.0	7.4
5	.549	.714	.406	.308	81.0	83.4	76.0	7.4
6	.560	.726	.413	.313	81.1	83.6	76.2	7.4
7	.577	.745	.416	.329	81.9	84.7	77.9	6.8
8	.587	.745	.436	.309	82.9	86.4	77.8	8.6
9	.596	.748	.443	.305	84.1	88.5	78.3	10.2
10	.596	.743	.439	.304	85.3	89.4	77.4	12.0
11	.590	.747	.416	.331	86.4	91.2	77.8	13.4
Noon.	.577	.726	.404	.322	87.0	91.8	76.8	15.0
1	.557	.695	.383	.312	87.3	92.8	76.0	16.8
2	.535	.679	.369	.310	87.1	93.7	74.8	18.9
3	.518	.678	.352	.326	86.5	93.2	75.8	17.4
4	.506	.659	.314	.345	86.1	92.8	75.8	17.0
5	.504	.650	.316	.334	85.4	91.3	76.2	15.1
6	.515	.670	.332	.338	84.1	90.6	76.4	14.2
7	.534	.689	.357	.332	83.4	87.6	76.6	11.0
8	.555	.704	.368	.336	83.0	85.4	76.6	8.8
9	.573	.719	.387	.332	82.7	85.8	77.0	8.8
10	.586	.735	.405	.330	82.4	85.6	77.0	8.6
11	.581	.732	.399	.333	82.0	85.0	77.4	7.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1867.

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.	80.2	1.7	79.0	2.9	0.970	10.44	1.00	0.91
1	80.1	1.7	78.9	2.9	.967	.41	0.99	.91
2	80.0	1.6	78.9	2.7	.967	.41	.93	.92
3	79.8	1.6	78.7	2.7	.961	.35	.92	.92
4	79.7	1.5	78.6	2.6	.958	.32	.89	.92
5	79.6	1.4	78.6	2.4	.958	.34	.80	.93
6	79.8	1.3	78.9	2.2	.967	.43	.74	.93
7	80.1	1.8	78.8	3.1	.964	.38	1.06	.91
8	80.6	2.3	79.0	3.9	.970	.42	.37	.88
9	81.1	3.0	79.0	5.1	.970	.40	.81	.85
10	81.5	3.8	78.8	6.5	.964	.29	2.35	.81
11	82.0	4.4	78.9	7.5	.967	.30	.76	.79
Noon.	82.0	5.0	79.0	8.0	.970	.33	.96	.78
1	82.0	5.3	78.8	8.5	.964	.25	3.16	.76
2	82.1	5.0	79.1	8.0	.973	.36	2.97	.78
3	81.7	4.8	78.8	7.7	.964	.27	.83	.78
4	81.6	4.5	78.4	7.7	.952	.15	.80	.78
5	81.1	4.3	78.1	7.3	.943	.08	.60	.80
6	80.9	3.2	78.7	5.4	.961	.31	1.90	.84
7	80.6	2.8	78.6	4.8	.958	.28	.68	.86
8	80.5	2.5	78.7	4.3	.961	.33	.49	.87
9	80.4	2.3	78.8	3.9	.964	.36	.36	.88
10	80.3	2.1	78.8	3.6	.964	.36	.25	.89
11	80.1	1.9	78.8	3.2	.964	.38	.09	.91

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	...	0.09	S.S.W. & variable.	3.7	Stratoni to 8 A. M. ⌒i to 1 P.M. Stratoni afterwards. Thunder at 3 P. M., slight rain at 5 & 10½ A. M. 1, 3 & 4 P. M. High wind at 2½ P. M.
2	...	1.37	S. S. W. & S. W.	1.0	Clear to 4 A.M. Stratoni to 8 A.M. Overcast afterwards. Rain from 1 to 4 P. M. & at 8 & 10½ P. M.
3	...	3.98	W. S. W.	12.0	Overcast. High wind at 2½ & 7½ A. M. Lightning at 1 A. M. Rain whole day.
4	119.0	*1.68	S. S. E.	1.0	Overcast to 6 A. M. \i & ⌒i to 6 P. M. Clear afterwards. Rain from midnight to 6 A. M.
5	...	0.05	S. & S. S. W.	...	Stratoni to 10 A. M. ⌒i afterwards, slight rain at midnight & at 9½ P. M.
6	119.5	0.21	S. S. W. & S. W.	5.0	Clear to 5 A. M. ⌒i to 3 P. M. Overcast afterwards. Thunder at 4 P. M. Rain at 4 & 5 P. M. High wind at 4¼ P. M.
7	...	0.75	S. S. W.	1.1	Overcast nearly the whole day. Rain at 11 P. M.
8	...	0.55	S. W. & S. S. W.	1.0	Overcast nearly the whole day. Rain at 6 P. M. & from 9 to 11 P. M.
9	129.0	0.23	S. S. W. & S.	3.8	Overcast to 5 A. M. \i to 7 P. M. Overcast afterwards. High wind at 8¾ P. M. Rain at midnight 1½ A.M. & from 8½ to 11 P.M.
10	...	...	S. S. W. & S. W.	0.7	Overcast to 10 A. M., clouds of different kinds afterwards.
11	122.0	...	S. S. W.	1.0	\⌣i to 6 A. M. \i to 11 A. M. Overcast to 5 P. M., clouds of different kinds afterwards.
12	126·4	0.05	W. S. W. & S. S.W.	0.2	Overcast to 5 A. M. \i to 9 A.M. ⌒i to 2 P.M. Overcast afterwards Slight rain from 1 to 4 A. M.
13	126.5	...	S. & S. S.W.	...	\i to 7 A. M. ⌒i to 3 P. M., stratoni to 7 P. M. \i afterwards.
14	125.0	1.02	S. S. W. & variable	2.0	Scuds from S, to 8 A. M., scatd. ⌒i to 4 P. M. Overcast afterwards. Rain from 5 to 7. P. M.
15	116.0	0.03	S. & S. E.	0.8	Stratoni to 5 A. M. \i to 8 A. M. ⌒i afterwards. Rain at 3½ P. M.
16	128.0	...	E. N. E. & E.	1.2	\i to 6 A. M. ⌒i & \⌣i to 5 P. M. \i afterwards.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
17	104.0	0.08	E. & E. S. E.	4.2	Stratoni to 10 A. M. ⌒i to 4 P. M. ╲i to 8 P. M., stratoni afterwards. Brisk gale at 1¼ P. M. Rain at 11 A. M. noon & 5 P. M.
18	...	0.19	E. S. E. & S. S. E.	5.7	Stratoni to noon ⌒i & ╲_i afterwards. High wind at 10½ A. M. Rain from 10 A. M., to 2 P. M., & at 6½ & 11 P. M.
19	...	0.25	S. S. E. & S. E.	...	╲i to 3 A M Overcast to 9 A M ╲_i to 2 P M ╲i to 5 P M ╲_i afterwards. Rain from 4 to 7½ A M.
20	129.0	...	S. S. E.	...	Stratoni to 7 A. M. ⌒i & stratoni afterwards.
21	128.0	0.04	E. & variable.	0.8	Scatd. ⌒i to 6 P. M. Overcast afterwards. Light rain at 2 A. M. 2½, 3½ P. M. & from 8 to 11 P. M.
22	...	0.26	S, W. & S. S. W.	6.4	Overcast to 1 P. M. ⌒i to 7 P. M. Clear afterwards. High wind from 10 A. M. to noon. Rain from midnight to 3 A. M. & from 8 A. M. to noon.
23	...	0.20	S. W, S. & S. by E.	0.2	╲i to 2 A M Overcast to noon ╲i afterwards. Rain at 3, 6, 11 & noon
24	...	0.12	S. by E, S. & S. S. W.	0.2	╲i to 7 P. M., clear afterwards. Rain from 6½ to 9 A M. & at 12½ A M
25	113.0	0.24	S. & S. S. W.	0.2	Scatd, clouds to 8 A. M. Overcast to 3 P. M, scatd., clouds to 7 P. M., clear afterwards. Rain after intervals.
26	124.0	0.60	S. S. W. & variable.	...	╲i to noon. Overcast to 5 P. M. Scatd. ╲_i afterwards. Rain from 2½ to 5 P. M.
27	...	0.11	S. W. & W. S. W.	1.5	Scatd. ╲_i to 2 A. M. clear to 6 A. M. Overcast afterwards. Lightning to N at 8 P. M. Rain at 3 P. M. & from 7 to 9 P. M.
28	...	0.05	S. W. & S. S. W.	0.3	Overcast. Rain at 8 & 9 A. M.
29	...	1.68	S. W. & S. S. W.	0.4	Overcast. Rain from 7½ A. M. to 1 P. M. & from 6 to 10 P. M.
30	...	0.23	S. & S. by E.	...	Overcast to noon ⌒i to 8 P. M. ╲i afterwards. Lightning to N W at 8 P. M. Rain from 3½ to 8 A M.
31	...	1.38	S. & S. S. W.	1.6	Clear to 3 A. M. Stratoni to 9 A. M. Overcast to 6 P. M. Stratoni afterwards. Thunder & Lightning at 2½ P. M. Rain at 10 A. M. & from 2 to 6 P. M.

╲i Cirri, —i Strati, ⌒i Cumuli, ╲_i Cirro-strati, ⌒—i Cumulo strati, ╲⌒ Nimbi.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.557
Max. height of the Barometer occurred at 9 A. M. on the 6th ...	29.748
Min. height of the Barometer occurred at 4 P.M. on the 21st ...	29.314
Extreme range of the Barometer during the month	0.434
Mean of the daily Max. Pressures	29.607
Ditto ditto Min. ditto	29.494
Mean daily range of the Barometer during the month	0.113

	o
Mean Dry Bulb Thermometer for the month	83.7
Max. Temperature occurred at 2 P. M. on the 15th	93.7
Min. Temperature occurred at 2 P. M. on the 3rd	74.8
Extreme range of the Temperature during the month	18.9
Mean of the daily Max. Temperature	88.6
Ditto ditto Min. ditto, ...	80.3
Mean daily range of the Temperature during the month... ...	8.3

Mean Wet Bulb Thermometer for the month	80.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.0
Computed Mean Dew-point for the month	78.6
Mean Dry Bulb Thermometer above computed mean Dew-point ...	5.1
	Inches.
Mean Elastic force of Vapour for the month	0.958

	Troy grain.
Mean Weight of Vapour for the month	10.28
Additional Weight of Vapour required for complete saturation ...	1.79
Mean degree of humidity for the month, complete saturation being unity	0.85

	Inches.
Rained 26 days,—Max. fall of rain during 24 hours	3.98
Total amount of rain during the month	15.44
Total amount of rain indicated by the Gauge attached to the anemometer during the month	13.54
Prevailing direction of the Wind... ...	S. S. W, S. W. & S.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night													1				2				5	1	1	
1					1								3								5		1	
2							2	1					2				1				4	1	1	
3									1		2		1				2				2		1	
4									1		2				1		1				1		1	
5									2		2	1	1				1				1			
6									3				2				1				2		1	
7							1		2				2				1		1		1		2	
8									3		1		1				1		1		1		1	1
9							1		2				2				2				1		2	
10							2		1				2				2		2	1	1		1	
11					1				1				1						3	2	4		2	
Noon.							1		1				1		1	1			5	1	4	1		
1							2	2					3				1		3	1	1		1	1
2									2		1		1		1		1	1	1		2	1	1	1
3																			5	1	4	3	5	
4									1						1				2	2	3	1	2	
5													1				1		2	1	2		1	
6									1	1	1		2						2		3			
7													1	1			3		1		4	1	3	
8											1		1	1			1		1		3		4	
9									1				1	1			1				4		3	
10									1								1		1		3		2	
11									1								1				4	1	4	

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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	4		7		5		3	1											1	1	1			
1	4		3		8		4	2											1					
2	4		2		10	1	3	1	1	1														
3	4		1		8	1	6	2	1				1	1										
4	7	2	1		8		5		1	1			1	1										
5	6	2	2		7		6		1				1	1										
6	4	2	1		7	1	8	1	1															
7	5	2			7		7		1	1														
8	5				6		9	3	1	1														
9	1		1		8	1	8	2	2	1														
10	4		1		1		10	3	3				1	1										
11	3	1	1		5	1	5		4								1	1						
Noon.	4	1			4	1	7	1	3	1														
1	9				4	1	6	2	1															
2	4				9		6	1	1		1	1												
3	5		2		6		2	1									1	1	1	1				
4	7	1	4		5		3	1					3	3										
5	4		6		6		2	1	2	1	1		1	1					1	1	1	1		
6	5		3		8	1	1	1			1		4	3										
7	3		2		9		1		1	1	1	1	1	1							1			
8	2		3		10		3	3	1															
9	4		4		7	1	5	3																
10	5		3	1	9	2	5	2																
11	4	1	4		7	1	5	2																

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1867.

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 the Barometer at 32° Faht.	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	29.581	29.628	29.523	0.105	83.0	89.5	80.0	9.5
2	.618	.667	.576	.091	83.6	88.5	80.2	8.3
3	.633	.676	.571	.105	82.7	87.0	80.0	7.0
4	.639	.691	.586	.105	82.8	86.8	80.0	6.8
5	.634	.691	.558	.133	83.3	89.7	80.4	9.3
6	.591	.639	.537	.102	83.3	88.6	79.5	9.1
7	.574	.622	.510	.112	84.7	89.0	81.0	8.0
8	.576	.622	.518	.104	82.5	86.5	80.0	6.5
9	.625	.687	.574	.113	82.5	89.4	78.0	11.4
10	.630	.691	.559	.132	83.6	89.5	80.0	9.5
11	.557	.599	.459	.140	84.0	88.0	81.0	7.0
12	.527	.582	.432	.150	83.7	88.8	80.5	8.3
13	.577	.635	.529	.106	81.9	88.0	79.2	8.8
14	.540	.616	.473	.143	79.0	80.8	77.5	3.3
15	.500	.538	.443	.095	78.2	80.0	76.5	3.5
16	.572	.656	.509	.147	79.0	82.2	76.3	5.9
17	.663	.714	.616	.098	81.9	85.5	78.5	7.0
18	.675	.732	.613	.119	83.6	87.1	81.7	5.4
19	.608	.656	.517	.139	82.5	87.2	79.8	7.4
20	.559	.611	.495	.116	80.5	82.5	77.9	4.6
21	.570	.634	.511	.123	81.8	86.6	78.4	8.2
22	.636	.691	.589	.102	82.5	86.0	80.5	5.5
23	.653	.704	.595	.109	84.4	89.3	81.4	7.9
24	.661	.733	.604	.129	81.7	83.6	77.0	6.6
25	.622	.668	.553	·115	81.6	86.5	78.0	8.5
26	.640	.696	.583	.113	83.4	87.5	79.8	7.7
27	.658	.700	.600	.100	84.9	90.0	81.0	9.0
28	.672	.726	.609	.117	84.9	90.5	81.0	9.5
29	.656	.718	.562	.156	85.0	90.0	81.5	8.5
30	.592	.653	.509	.144	85.8	91.6	82.0	9.6
31	.565	.628	.487	.141	85.8	91.4	82.0	9.4

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1867.

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	80.1	2.9	78.1	4.9	0.943	10.12	1.70	0.86
2	80.2	3.4	77.8	5.8	.934	.01	2.02	.83
3	79.9	2.8	77.9	4.8	.937	.06	1.66	.86
4	79.9	2.9	77.9	4.9	.937	.06	.69	.86
5	80.3	3.0	78.2	5.1	.946	.15	.78	.85
6	80.7	2.6	78.9	4.4	.967	.39	.54	.87
7	80.9	3.8	78.2	6.5	.946	.11	2.31	.81
8	79.7	2.8	77.7	4.8	.931	.00	1.64	.86
9	79.6	2.9	77.6	4.9	.928	9.97	·67	.86
10	80.6	3.0	78.5	5.1	.955	10.25	.78	.85
11	80.8	3.2	78.6	5.4	.958	.28	.89	.85
12	80.3	3.4	77.9	5.8	.937	.04	2.03	.83
13	79.4	2.5	77.6	4.3	.928	9.99	1.45	.87
14	77.8	1.2	77.0	2.0	.910	.85	0.65	.94
15	77.2	1.0	76.5	1.7	.896	.71	.54	.95
16	77.5	1.5	76.4	2.6	.893	.66	.84	.92
17	79.5	2.4	77.8	4.1	.934	10.05	1.39	.88
18	81.2	2.4	79.5	4.1	.986	.57	.46	.88
19	80.4	2.1	78.9	3.6	.967	.39	.25	.89
20	78.8	1.7	77.6	2.9	.928	.01	0.97	.91
21	79.3	2.5	77.5	4.3	.925	9.96	1.44	.87
22	80.0	2.5	78.2	4.3	.946	10.17	.47	.87
23	81.3	3.1	79.1	5.3	.973	.42	.89	.85
24	80.2	1.5	79.1	2.6	.973	.47	0.90	.92
25	79.4	2.2	77.9	3.7	.937	.08	1.26	.89
26	80.2	3.2	78.0	5.4	.940	.09	.87	.84
27	81.3	3.6	78.8	6.1	.964	.31	2.18	.83
28	81.5	3.4	79.1	5.8	.973	.40	.09	.83
29	81.2	3.8	78.5	6.5	.955	.21	.32	.82
30	81.0	4.8	77.6	8.2	.928	9.91	.92	.77
31	81.4	4.4	78.3	7.5	.949	10.12	.71	.79

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1867.

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.	29.626	29.698	29.523	0.175	81.3	83.5	78.8	4.7
1	.615	.690	.519	.171	81.0	83.6	77.0	6.6
2	.605	.678	.509	.169	80.8	83.6	76.8	6.8
3	.595	.670	.505	.165	80.6	83.5	76.5	7.0
4	.590	.688	.496	.192	80.4	83.5	76.5	7.0
5	.598	.694	.490	.204	80.1	83.5	76.3	7.2
6	.610	.698	.493	.205	80.2	83.4	76.6	6.8
7	.623	.704	.509	.195	80.9	83.0	76.8	6.2
8	.641	.724	.519	.205	81.9	85.5	77.0	8.5
9	.652	.732	.529	.203	83.3	87.0	77.8	9.2
10	.653	.733	.533	.200	84.8	87.5	77.0	10.5
11	.641	.720	.523	.197	85.4	89.4	77.0	12.4
Noon.	.626	.704	.506	.198	86.1	90.0	78.2	11.8
1	.605	.682	.488	.194	86.0	91.5	78.4	13.1
2	.582	.659	.473	.186	85.9	91.4	78.5	12.9
3	.561	.639	.450	.189	85.4	91.6	78.0	13.6
4	.548	.627	.432	.195	85.4	90.5	78.6	11.9
5	.548	.618	.445	.173	84.5	88.8	79.5	9.3
6	.561	.627	.452	.175	83.7	88.0	79.6	8.4
7	.579	.655	.478	.177	82.8	86.0	79.5	6.5
8	.603	.682	.500	.182	82.3	85.5	78.5	7.0
9	.623	.697	.510	.187	82.0	85.0	77.6	7.4
10	.638	.712	.536	.176	81.8	84.4	78.2	6.2
11	.635	.712	.530	.182	81.6	84.0	77.9	6.1

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1867.

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	1.5	78.4	2.6	.952	.25	.89	.92
2	79.3	1.5	78.2	2.6	.946	.19	.88	.92
3	79.3	1.3	78.4	2.2	.952	.27	.74	.93
4	79.2	1.2	78.4	2.0	.952	.27	.67	.94
5	79.0	1.2	78.2	1.9	.946	.21	.63	.94
6	79.1	1.1	78.3	1.9	.949	.24	.64	.94
7	79.5	1.4	78.5	2.4	.955	.31	.79	.93
8	79.8	2.1	78.3	3.6	.949	.20	1.24	.89
9	80.3	3.0	78.2	5.1	.946	.15	.78	.85
10	80.8	4.0	78.0	6.8	.940	.05	2.41	.81
11	81.1	4.3	78.1	7.3	.943	.08	.60	.80
Noon.	81.0	5.1	77.4	8.7	.922	9.83	3.12	.76
1	81.2	4.8	77.8	8.2	.934	.97	2.94	.77
2	81.1	4.8	77.7	8.2	.931	.94	.93	.77
3	80.8	4.6	77.6	7.8	.928	.91	.77	.78
4	81.0	4.4	77.9	7.5	.937	10.00	.68	.79
5	80.6	3.9	77.9	6.6	.937	.02	.33	.81
6	80.2	3.5	77.7	6.0	.931	9.98	.09	.83
7	80.0	2.9	78.0	4.8	.940	10.09	1.66	.86
8	79.8	2.5	78.0	4.3	.940	.11	.47	.87
9	79.8	2.2	78.3	3.7	.949	.20	.27	.89
10	79.7	2.1	78.2	3.6	.946	.17	.23	.89
11	79.6	2.0	78.2	3.4	.946	.19	.15	.90

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	125.0	0.71	S. & W.	2.9	Stratoni to 8 A. M. ⌒i to 3 P. M. Overcast to 8 P. M. \⌒_i afterwards. Rain at 2 & 5 P. M.
2	120.0	0.22	S. by E. & S. S. E.	...	Scatd. \i & ⌒i to 6 P. M. Scatd. _i afterwards. Rain from 11½ A. M. to 1 P. M.
3	120.5	0.79	S. S. E & E.	0.6	Clear to 4 A. M. Scatd. ⌒i to 11 A. M. Stratoni to 6 P. M., clear afterwards. Rain from 10½ to noon & at 3 P. M.
4	120.0	0.29	S. E. & S. S. E.	...	Clear to 5 A. M. Scatd. ⌒i & \i to 11 A. M., clouds of different kinds afterwards. Thunder at 1½ P. M. Rain at 11½ A. M. 2½ & 6 P. M.
5	122.2	0.52	S. S. E.	0.5	Stratoni to 5 A. M. ⌒i to 1 P.M. Overcast to 4 P. M. ⌒i to 8 P. M., clear afterwards. Rain at 2 & 3 P. M.
6	...	1.95	S. S. E. & S. W.	...	Overcast nearly the whole day. Thunder at 6 A. M. Rain at 2 A. M. & from 4 to 7 A. M.
7	129.2	...	S. S. E. &S. S. W.	...	Clear to 5 A. M. Scatd. \i to 11 A. M., clouds of different kinds afterwards.
8	...	...	S. S. E. & S. S. W.	...	Stratoni to 3 A. M. ⌒i to noon. Overcast to 4 P. M. \⌒_i afterwards. Slight rain at 9 & 10 P. M.
9	133·0	0.46	S. by W, S. & S. by E.	...	Scatd. _i to 5 A. M. Overcast to 10 A.M. ⌒i afterwards. Rain from 6½ to 9 A. M. & at 4½ P. M.
10	131.0	...	S. & S. S. E.	...	Scatd. \i & ⌒i nearly the whole day.
11	129.4	0.11	S. & S. by E.	0.2	Scatd. \i to 5 A.M. ⌒i to 3 PM \⌒i afterwards. Rain at 12½ A. M.
12	121.4	0.14	E. S. E. & E.	5.6	Scatd. \⌒i to 10 A. M. Scatd. ⌒i to 5 P. M., clouds of different kinds afterwards. High wind at 7½ P. M. Rain at 1½ & 11 A. M. 2 & from 4½ to 7 P. M.
13	123.0	0.40	E.S. E. & E. by S.	1.2	Stratoni to 4 A. M. Overcast to 9 A. M. ⌒i to 1 P. M. Overcast afterwards. Rain after intervals.
14	...	0.82	E. S. E, S. E.& S.	...	Overcast nearly the whole day. Rain from midnight to 5½ P. M. & at 9½ P. M.
15	...	4.64	W.& S. W.	1.4	Overcast. Rain nearly the whole day.

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Solar Radiation, Weather, &c.—*(Continued.)*

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
16	...	2.66	S. S. W.	3.7	Overcast. High wind at 9½ A. M. Rain after intervals.
17	120.0	0.26	S. S.W., S. W. & S.	0.5	Overcast to 10 A. M. Scatd. ╲i afterwards. Rain at 1, 2, & 4 A. M.
18	119.6	...	S. S. E. & S.	...	╲i to 3 A. M. Overcast to 3 P. M. ╲i to 7 P. M. Scatd. ╲_i afterwards. Slight rain at 4½ & 6½ A. M.
19	...	0.10	S. S. W. & S.S. E.	...	╲i to 7 A. M. ⌒i to noon. Overcast & ╲_i afterwards. Thunder at 2 P. M. Rain at 10½ A. M. & 4½ P. M.
20	...	0.19	W.S.W. & S. S.W.	...	╲i to 6 A. M. Overcast afterwards. Light rain at 9 A. M., from 11 A. M. to 3 P. M. & from 9 to 11 P. M.
21	134.8	0.16	S. by E, SSE & SW.	...	Overcast to 6 A. M. Scatd. ⌒i to 7 P. M. Clear afterwards. Rain at midnight 1, 3 & 4 A. M.
22	132.0	...	S. & S. S. E.	...	Scatd. ⌒i & ╲_i to 3 A. M. Scatd. ⌒i to 2 P. M. ╲i & ╲_i to 6 P. M., clear afterwards. Slight rain at 6 & 11 A. M.
23	130.5	...	S, S. W. & S. S. W.	...	Scatd. ╲i to 8 A. M. ∽i to 3 P. M. Scatd. clouds afterwards. Thunder at 3½ P. M. Lightning to W. at 8 P. M.
24	...	3.40	S. by E, S. & WS.W.	4.6	Stratoni to 2 A. M. Overcast to 7 P. M. Scatd. clouds afterwards. High wind at 6½ A. M. Thunder from 7 to 10 A. M. Lightning at 8 & 9 A. M. Rain from 7 to noon & at 2 P. M.
25	...	0.48	N.W, S.W. & S. S.E	...	Overcast to 10 A. M. ∽i to 3 P. M. ╲i to 6 P. M., clear afterwards. Rain from midnight to 4 & at 8 A. M.
26	134.4	0.20	S.S.E, SSW & S by W	0.4	Stratoni to 6 A. M. ⌒i to 7 P. M. clear afterwards. Rain at 5½, 9 & 12½ A. M.
27	127.0	...	S. & S. by W	0.2	Clear to 4 A. M. ╲i to 7 A. M. ╲i & ⌒i to 7 P. M. clear afterwards
28	126.0	...	S. & S. S. E.	0.2	Clear to 2 A. M. Scatd. clouds to 4 A. M. ╲i to 7 A. M. ⌒i to 7 P. M., clear afterwards. Lightning at 10 & 11 P. M. Slight at 4 & 8½ P. M.
29	132.4	...	S. & S. S. E.	...	Clear to 7 A. M. ⌒i afterwards.
30	137.0	...	S. & S. by W.	...	Clear to 5 A. M. ╲i & ⌒i to 7 P. M. clear afterwards.
31	127.0	...	S. by W. & S. S. E.	...	Clear to 5 A. M. ⌒i to 9 P. M. clear afterwards.

╲i Cirri, —i Strati, ⌒i Cumuli, ╲_i Cirro-strati, ∽i Cumulo strati, ╲⌒ Ni[mbi]

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.607
Max. height of the Barometer occurred at 10 A. M. on the 24th ...	29.733
Min. height of the Barometer occurred at 4 P.M. on the 12th ...	29.432
Extreme range of the Barometer during the month	0.301
Mean of the daily Max. Pressures	29.661
Ditto ditto Min. ditto	29.542
Mean daily range of the Barometer during the month	0.119

	o
Mean Dry Bulb Thermometer for the month	82.8
Max. Temperature occurred at 3 P. M. on the 30th	91.6
Min. Temperature occurred at 5 A. M. on the 16th	76.3
Extreme range of the Temperature during the month	15.3
Mean of the daily Max. Temperature	87.3
Ditto ditto Min. ditto, ...	79.7
Mean daily range of the Temperature during the month... ...	7.6

Mean Wet Bulb Thermometer for the month	80.1
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	2.7
Computed Mean Dew-point for the month	78.2
Mean Dry Bulb Thermometer above computed mean Dew-point ...	4.6
	Inches.
Mean Elastic force of Vapour for the month	0.946

	Troy grain.
Mean Weight of Vapour for the month	10.15
Additional Weight of Vapour required for complete saturation ...	1.60
Mean degree of humidity for the month, complete saturation being unity	0.86

	Inches.
Rained 24 days,—Max. fall of rain during 24 hours	4.64
Total amount of rain during the month	18.50
Total amount of rain indicated by the Gauge attached to the anemometer during the month	17.09
Prevailing direction of the Wind... ...	S. S. E., S. & S. S. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Augt. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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			2	1	1		4		7	1	11	1	2		1		2	2																
1									1	1							1		3		4	1	7	1	8		2		2		2	2											1	1				
2											1	1	1						3		6	2	3	1	9		2		2		2	1	1	1									1	1				
3									1					1	1	1				2		4		3		8		3		2		4	2					1	1					1	1				
4									1					2				1	1	1		5		1		9		2		3		3	3					1	1	1	1			1	1				
5													3		1		2	1			5					7		5	2	5	1	1							1	1					1					
6									1					1		1		3	1	1	1	3	1			8	1	4		5	2	1		1					1	1					1					
7							1		1							1	1	1		2		6		3	1	3		4	1	5	1			1					2	1					1	1				
8													2	1	1		2		2	1	7		4	1	3				1		5	1	3	1			1	1										
9									1								2		3	1	7		4	2	4				2		4		1	1	1	1	2	1										
10													2				3		3		7							2		8	1	2	1	2		1	1	1											
11													1	1	1		2	2	3	1	5		2		3				7	1	4		2	1			1	1										
Noon.													1		2	1	2		1	1	6		1	1	4		4		4		1		5	3														
1					1								1		1		1	1	2	1	4		3		6	2	2		3		3	1	4	1														
2													1				2	1	3	1	4	1	3	1	3		1		7	2	4	1	2	2			1											
3													2	1			2	1	3		5					4	1	1		7	1	5	2	1					1											
4													4		1				3	1	3		3	1	7	1	5		3		1		1																
5																	1		3	2	10	2	2		7	1			6	2	2																		
6													1	1							11	1	5	1	4	1	1		6		1		1	1			1											
7																	1		2		10	1	3		5		4		5	1							1											
8																	1	1	1		10		4		8				5	1			1					1											
9																	2	1	1		9		3		9	1	1		4	2			1	1			1											
10																	2				8		7		6		1		4	2	1	1	1	1			1											
11											1		1								8		6		7		3		3	1			1	1			1											

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1867.

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 the Barometer at 32° Faht.	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	29.577	29.636	29.489	0.147	86.8	92.5	82.8	9.7
2	.588	.632	.543	.089	84.0	88.6	81.5	7.1
3	.619	.670	.574	.096	82.5	88.9	79.8	9.1
4	.648	.708	.581	.127	82.3	88.0	79.9	8.1
5	.673	.734	.614	.120	80.6	84.3	78.5	5.8
6	.711	.771	.661	.110	80.1	82.5	78.0	4.5
7	.710	.794	.640	.154	83.4	88.5	79.0	9.5
8	.686	.758	.601	.157	84.3	89.5	80.0	9.5
9	.635	.701	.549	.152	85.2	90.8	80.9	9.9
10	.630	.695	.559	.136	86.0	92.0	81.5	10.5
11	.659	.722	.552	.170	86.0	89.6	82.0	7.6
12	.675	.731	.606	.125	86.4	92.5	81.9	10.6
13	.635	.691	.575	.116	84.7	92.2	81.5	10.7
14	.550	.617	.455	.162	85.2	92.4	81.5	10.9
15	.480	.537	.413	.124	81.6	86.6	78.5	8.0
16	.425	.491	.343	.148	80.8	84.6	78.5	6.1
17	.467	.551	.374	.177	81.5	84.5	79.8	4.7
18	.561	.628	.505	.123	82.0	86.6	79.5	7.1
19	.612	.676	.565	.111	83.2	86.0	80.0	6.0
20	.630	.672	.591	.081	81.5	86.5	77.4	9.1
21	.653	.711	.605	.106	79.8	83.0	77.0	6.0
22	.682	.745	.638	.107	79.8	85.0	76.0	9.0
23	.720	.781	.661	.120	81.8	88.2	76.5	11.7
24	.735	.804	.665	.139	83.6	88.6	78.6	10.0
25	.688	.750	.601	.149	85.2	90.7	80.5	10.2
26	.663	.711	.591	.120	86.3	91.7	82.0	9.7
27	.714	.786	.660	.126	85.4	92.0	80.0	12.0
28	.772	.840	.719	.121	83.4	90.7	80.5	10.2
29	.793	.848	.737	.111	81.8	85.5	79.8	5.7
30	.799	.844	.764	.080	79.1	81.5	78.0	3.5

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 1867.

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	82.2	4.6	79.4	7.4	0.983	10.47	2.47	0.79
2	81.0	3.0	78.9	5.1	.967	.37	1.80	.85
3	80.0	2.5	78.2	4.3	.946	.17	.47	.87
4	80.0	2.3	78.4	3.9	.952	.23	.35	.88
5	78.6	2.0	77.2	3.4	.916	9.89	.12	.90
6	78.9	1.2	78.1	2.0	.943	10.18	0.66	.94
7	80.1	3.3	77.8	5.6	.934	.01	1.95	.84
8	80.7	3.6	78.2	6.1	.946	.13	2.15	.83
9	80.6	4.6	77.4	7.8	.922	9.85	·76	.78
10	81.4	4.6	78.2	7.8	.946	10.09	.82	.78
11	81.6	4.4	78.5	7.5	.955	.18	.73	.79
12	81.9	4.5	78.7	7.7	.961	.24	.82	.78
13	81.1	3.6	78.6	6.1	.958	.26	.16	.83
14	82.3	2.9	80.3	4.9	1.011	.80	1.81	.86
15	79.7	1.9	78.4	3.2	0.952	.25	.09	.90
16	79.3	1.5	78.2	2.6	.946	.19	0.88	.92
17	80.2	1.3	79.3	2.2	.979	.55	.76	.93
18	80.4	1.6	79.3	2.7	.979	.53	.94	.92
19	81.4	1.8	80.1	3.1	1.005	.77	1.12	.91
20	79.7	1.8	78.4	3.1	0.952	.25	.06	.91
21	78.5	1.3	77.6	2.2	.928	.03	0.72	.93
22	77.4	2.4	75.7	4.1	.873	9.43	1.32	.88
23	78.8	3.0	76.7	5.1	.902	.70	.70	.85
24	80.8	2.8	78.8	4.8	.964	10.34	.69	.86
25	81.7	3.5	79.2	6.0	.976	.43	2.18	.83
26	82.6	3.7	80.0	6.3	1.001	1.68	.34	.82
27	81.4	4.0	78.6	6.8	0.958	.23	.45	.81
28	80.1	3.3	77.8	5.6	.934	.01	1.95	.84
29	79.1	2.7	77.2	4.6	.916	9.85	.55	.86
30	77.8	1.3	76.9	2.2	.908	.82	0.71	.93

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1867.

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.	29.658	29.792	29.450	0.342	81.5	84.5	77.0	7.5
1	.646	.779	.432	.347	81.3	84.2	77.0	7.2
2	.635	.773	.411	.362	81.0	84.0	76.5	7.5
3	.625	.764	.394	.370	80.7	83.8	76.5	7.3
4	.622	.769	.374	.395	80.5	83.4	76.4	7.0
5	.631	.774	.392	.382	80.4	84.2	76.4	7.8
6	.648	.787	.412	.375	80.4	84.0	76.0	8.0
7	.664	.800	.443	.357	81.0	84.5	76.0	8.5
8	.685	.836	.477	.359	82.3	85.7	76.8	8.9
9	.700	.845	.491	.354	84.1	87.7	78.4	9.3
10	.701	.846	.474	.372	85.0	89.3	79.0	10.3
11	.689	.848	.450	.398	85.6	90.0	78.5	11.5
Noon.	.666	.813	.395	.418	86.5	91.5	78.0	13.5
1	.642	.811	.398	.413	86.8	92.2	78.0	14.2
2	.618	.797	.376	.421	86.7	92.5	77.4	15.1
3	.598	.777	.362	.415	85.9	92.5	78.5	14.0
4	.590	.773	.343	.430	85.7	92.2	78.5	13.7
5	.592	.773	.354	.419	85.0	92.0	78.7	13.3
6	.608	.787	.378	.409	83.7	89.0	79.0	10.0
7	.627	.800	.398	.408	83.1	88.0	79.0	9.0
8	.650	.811	.408	.403	82.6	86.2	79.0	7.2
9	.668	.821	.414	.407	82.2	86.0	78.0	8.0
10	.678	.833	.420	.413	82.0	85.8	77.5	8.3
11	.674	.827	.432	.395	81.6	85.4	76.4	9.0

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 1867.

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.	
Midnight.	79.7	1.8	78.4	3.1	0.952	10.25	1.06	0.91
1	79.6	1.7	78.4	2.9	.952	.25	0.99	.91
2	79.5	1.5	78.4	2.6	.952	.25	.89	.92
3	79.3	1.4	78.3	2.4	.949	.24	.80	.93
4	79.2	1.3	78.3	2.2	.949	.24	.74	.93
5	79.0	1.4	78.0	2.4	.940	.15	.79	.93
6	79.1	1.3	78.2	2.2	.946	.21	.73	.93
7	79.6	1.4	78.6	2.4	.958	.34	.80	.93
8	80.3	2.0	78.9	3.4	.967	.41	1.17	.90
9	80.8	3.3	78.5	5.6	.955	.23	.98	.84
10	81.4	3.6	78.9	6.1	.967	.34	2.19	.83
11	81.4	4.2	78.5	7.1	.955	.21	.55	.80
Noon.	81.6	4.9	78.7	7.8	.961	.24	.86	.78
1	81.7	5.1	78.6	8.2	.958	.21	3.00	.77
2	81.3	5.4	78.1	8.6	.943	.04	.14	.76
3	81.0	4.9	77.6	8.3	.928	9.91	2.96	.77
4	81.0	4.7	77.7	8.0	.931	.94	.86	.78
5	80.7	4.3	77.7	7.3	.931	.96	.57	.80
6	80.6	3.1	78.4	5.3	.952	10.21	1.86	.85
7	80.5	2.6	78.7	4.4	.961	.33	.53	.87
8	80.3	2.3	78.7	3.9	.961	.33	.35	.88
9	80.2	2.0	78.8	3.4	.964	.38	.16	.90
10	80.0	2.0	78.6	3.4	.958	.32	.15	.90
11	79.7	1.9	78.4	3.2	.952	.25	.09	.90

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	131.4	...	S. & E. N. E.	...	\i to 6 A. M. ⌒i to 7 P. M., clear afterwards. Slight rain at 4½ P. M.
2	...	0.15	S., E. & E. by S.	0.3	Scatd. clouds to 4 A. M. \i to 9 A. M., overcast to 7 P. M., clear afterwards. Thunder at 11½ A. M. Rain at 10 & 11 A. M. & at 4½ & 5½ P. M.
3	...	0.96	E. N. E. & S. E.	3.0	\i to 5 A. M., overcast afterwards. High wind at 1¼ P. M. Thunder at 8½ A. M. & 1½ P. M. Lightning at 1½ P. M. Rain at 8¼ A. M. & from 1½ to 3½ P. M.
4	...	0.49	E., S. E. & S. W.	...	Clear to 2 A. M. Stratoni to 6 A. M. \i to 11 A. M. ⌒i to 2 P. M. overcast to 6 P. M. \i afterwards. Rain at 11½ A. M., from 3 to 6 P. M. & at 10½ P. M.
5	...	0.12	S. by E.	0.6	Clear to 4 A. M. Stratoni to 4 P. M. ⌒i afterwards. Rain at 8 A. M.
6	...	1.03	S. S. E.	...	Overcast to 5 P. M. Stratoni afterwards. Rain from 2 A. M. to 1 P. M.
7	134.0	0.10	S. W. & S. S. W.	0.1	Stratoni to 10 A. M. ⌒i to 5 P. M. \i afterwards. Rain at 4 A. M.
8	133·0	...	S. S. W. & S. W.	...	⌒i nearly the whole day.
9	126.0	...	S. S. W, & S. W.	...	Clear to 7 A. M. ⌒i to 7 P. M., clear afterwards.
10	135.0	...	S. S. W. & S. W.	...	Clear to 6 A. M. ⌒i to 6 P. M., clear afterwards.
11	...	...	S. W. & S. E.	...	⌒i & \i to 10 A. M. Stratoni afterwards.
12	131.0	...	S. by E. & S. S. E.	0.2	Stratoni to 5 A. M. ⌒i to 3 P. M., clouds of different kinds afterwards. Lightning at 7 & 8 P. M. Slight rain at 6 P. M.
13	129.5	0.89	S. S. E. & S. E.	4.0	Clear to 6 A. M., ⌒i to 2 P. M., overcast to 5 P. M., clouds of different kinds afterwards. High wind at 2¾ P. M. Lightning to W. at 7 P. M. Rain from 2½ to 4 P. M.
14	125.0	2.05	N. E. & W. by N.	6.9	\i to 5 A. M. ⌒i afterwards. High wind & rain at 2½ & 10½ P. M. Lightning to E at 10 P. M. Thunder at 10½ P. M.
15	...	0.54	E. N. E. & N. E.	0.4	Overcast nearly the whole day. Lightning to W from midnight to 2 A. M. Thunder at 1 A. M. Rain from 3 to 8 A. M. and at 3, 4 and 8 P. M.

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Solar Radiation, Weather, &c.—*(Continued.)*

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		℔	
16	...	0.84	N. E, E. & E. by S.	1.0	Overcast nearly the whole day. Rain at 6 & 8 A. M. & from 10½ A. M. to 4 P. M. & at 7 P. M.
17	...	0.36	S. E. &E. S. E.	0.2	Stratoni to 11 A. M., overcast afterwards. Rain at 5, 6 & 12 A. M. & at 11 P. M.
18	...	0.52	S. E. & S. S. E.	1.1	Overcast to 4 P. M., clouds of different kinds afterwards. Thunder at 10½ A. M. Lightning to S at 8 P.M. Rain at midnight, 3 & 11 A. M. & at 1, 2½ & 7 P. M.
19	...	0.70	S. W. & S. by E.	...	Overcast to 10 A. M., stratoni to 6 P. M. _i afterwards. Rain at midnight & 3½ A. M.
20	...	0.91	W. S. W. & S.	3.1	⌒i & \i to 8 A. M., stratoni to noon., overcast to 6 P. M., _i afterwards. High wind, thunder & Lightning at 3 P. M. Rain from 2 to 6 P. M.
21	...	1.79	W.N.W.&W. byN.	1.6	Overcast. Rain after intervals.
22	...	1.29	W. &W. S. W.	1.2	Overcast to 11 A. M. \⌒i to 6 P. M., clear to 8 P. M., overcast afterwards. Rain from 2 to 8 A. M. & from 9 to 11 P. M.
23	...	0.11	S. W., S. & S. S. E.	...	Overcast to 6 A. M. \⌒i to 11 A. M. \i & ⌒i afterwards. Lightning to W at 11 P. M. Rain at 2 & 3 A. M.
24	...	...	S. S. E, & S. E.	...	Clear to 2 A. M. ⌒i to 4 P. M., clear afterwards. Slight rain at 10½ A. M.
25	...	...	S.& S. W.	...	Cear to 4 A. M. \⌒i to 7 A. M. ⌒i to 5 P. M., clear afterwards. Slight rain at 1 P. M.
26	134.0	...	S. W. & W. S. W.	...	Clear to 7 A. M. ⌒i to 6 A. M., clear afterwards.
27	130.5	0.05	S. S. W. & S. S. E.	1.0	Clear to 6 A. M. ⌒i to 5 P.M., overcast afterwards Thunder at 4½ P. M. & from 7 to 9 P. M. Lightning at 7 P. M. Light rain at 4½ P. M.
28	132.0	...	S. S. E. &E. N. E.	...	_i to 4 A. M, \⌒i to 10 A. M. ⌒i to 1 P. M. _i to 4 P. M. overcast afterwards. Slight rain at 5½ & 9 P. M.
29	...	0.07	N. E. & E. S.E.	1.0	Clear to 5 A. M \⌒i to 9 A.M. overcast to 7 P. M. \i afterwards. Lightning to S from 8 to 11 P.M. Rain at 7½ & 10 A.M.
30	...	0.73	E. N. E. & E.	1.0	Clear to 5 A.M., overcast to 8 P. M., clear afterwards. Rain at 8 A. M. & from 11 A. M. to 4 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒_i Cumulo strati, \⌒ Nimbi, \⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.645
Max. height of the Barometer occurred at 11 A. M. on the 29th ...	29.848
Min. height of the Barometer occurred at 4 P. M. on the 16th ...	29.343
Extreme range of the Barometer during the month	0.505
Mean of the daily Max. Pressures	29.708
Ditto ditto Min. ditto	29.582
Mean daily range of the Barometer during the month	0.126

	o
Mean Dry Bulb Thermometer for the month	83.1
Max. Temperature occurred at 2 & 3 P. M. on the 1st & 12th... ...	92.5
Min. Temperature occurred at 6 & 7 A. M. on the 22nd	76.0
Extreme range of the Temperature during the month	16.5
Mean of the daily Max. Temperature	88.1
Ditto ditto Min. ditto, ...	79.7
Mean daily range of the Temperature during the month... ...	8.4

Mean Wet Bulb Thermometer for the month	80.3
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	2.8
Computed Mean Dew-point for the month	78.3
Mean Dry Bulb Thermometer above computed mean Dew-point ...	4.8
	Inches.
Mean Elastic force of Vapour for the month	0.949

	Troy grain.
Mean Weight of Vapour for the month	10.18
Additional Weight of Vapour required for complete saturation ...	1.68
Mean degree of humidity for the month, complete saturation being unity	0.86

	Inches.
Rained 25 days,—Max. fall of rain during 24 hours	2.05
Total amount of rain during the month	13.70
Total amount of rain indicated by the Gauge attached to the anemometer during the month	12.41
Prevailing direction of the Wind... ... S. W. & S. S. E.	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Sept. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night									2				3				1		2		6		2	1
1	1						1		2		2		2						1		4		2	
2							3		1		2		2								4	1	3	
3							3		2				2				2		1		1		3	
4							3		2				2				2		2				3	1
5							4	2	3		1		1				1	1	2				2	
6							4	1	4	1	1				1				2		2	1	2	
7							3	1	3		2		2				1		2		3	1	2	
8					1	1	1	1	3				2	1	1		3		3	1	3	1		
9							1		4				3	1			2		4	1	2	1		
10									1		1		4	1			7	1	3	1			1	
11							1		1	1			3	1			5		1		4	2	4	2
Noon.									3				2		1		2	1	4	2	3	2	3	
1					1		3		2		1		1	1			3		2		4	1	2	2
2	1				1		5						1				4	2	2		2		2	1
3							1	1	3	2			4	2	1		1		2		5	3	2	
4							1		2	1			1		1	1	2		5	3	3	2		
5							1	1	3	1	1	1	3				2		2		1		2	1
6							1		1				6	1			2		1		4	1	2	
7							1		1				1		2	1	2		3		4		3	
8							1	1					2		2				3		7		3	
9							1		1		1		1		1				3		7	1	2	
10									1		1		1		2				3		6		8	
11									2				2		1				4	1	6	1	2	1

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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	4		1		3		3		1						1									
1	4		1		3		4	1	1	1			1											
2	4		1		4		3	1	1	1									1	1				
3	4				5	1	3	1	2	2									1	1				
4	5	1			4		3		2	2											1	1		
5	3		1		5	1	4		1				1	1										
6	2		1		4		4		1				1	1			1	1						
7	2				4		3		2				1	1										
8	2	1	1		1		6		1				1	1					1					
9	1		1		4		2		3		1		1						1					
10					4		3		3				1	1	1		1							
11					3		3		2						1		1		1	1				
Noon.	1		1		1		5				1						2		1	1				
1			1		1		4	1	1		1				1		2	1						
2			4		2		1				2						2		1	1				
3			1		3		3		1				1				1		1					
4	2		1		3		5		1						1		1				1			
5	3		1		2		5		2	1					1		1	1						
6	2				1		6	1	2	1					2									
7	2	1			1		7		1						2	1								
8	2				1		6		1						1		1	1						
9	3		1		1		4		1						2		1	1						
10	1		2		8		4	1	1						2									
11	3		1		8		8	1	1						1									

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1867.

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 the Barometer at 32° Faht.	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	29.818	29.879	29.767	0.112	81.5	87.8	78.0	9.8
2	.850	.911	.799	.112	83.0	86.5	79.2	10.3
3	.879	.941	.821	.120	84.0	89.5	80.2	9.3
4	.874	.942	.793	.149	83.4	88.5	77.3	11.2
5	.861	.924	.809	.115	82.8	88.0	78.0	10.0
6	.852	.912	.794	.118	83.9	89.4	80.6	8.8
7	.852	.913	.796	.117	83.4	88.8	78.5	10.3
8	.852	.906	.802	.104	83.8	90.0	79.0	11.0
9	.876	.950	.789	.161	83.9	89.3	79.7	9.6
10	.874	.947	.799	.148	84.2	89.5	79.5	10.0
11	.847	.895	.802	.093	82.8	90.0	78.5	11.5
12	.825	.872	.755	.117	83.3	89.5	78.8	10.7
13	.859	.929	.811	.118	82.9	89.0	78.5	10.5
14	.890	.953	.841	.112	83.4	88.7	79.2	9.5
15	.911	.972	.851	.121	83.1	88.8	77.9	10.9
16	.916	30.008	.836	.172	81.2	87.0	76.2	10.8
17	.875	29.944	.817	.127	81.5	88.5	75.0	13.5
18	.862	.902	.803	.099	81.1	87.0	78.0	9.0
19	.908	.956	.870	.086	77.1	79.5	75.4	4.1
20	.934	.999	.886	.113	78.4	84.6	75.7	8.9
21	.880	.957	.800	.157	80.8	86.7	76.0	10.7
22	.844	.897	.767	.130	80.9	85.5	78.0	7.5
23	.880	.959	.816	.143	82.8	88.4	78.5	9.9
24	.936	.994	.870	.124	81.3	86.0	77.0	9.0
25	.939	30.005	.887	.118	79.3	83.6	77.0	6.6
26	.909	29.977	.842	.135	79.7	85.0	76.5	8.5
27	.914	.981	.865	.116	79.4	85.0	74.5	10.5
28	.912	.982	.865	.117	78.5	85.4	72.5	12.9
29	.916	.979	.875	.104	76.4	84.5	69.5	15.0
30	.895	.945	.848	.097	76.9	83.5	69.5	14.0
31	.836	.881	.779	.102	73.1	74.7	70.6	4.1

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 1867.

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	79.7	1.8	78.4	3.1	0.952	10.25	1.06	0.91
2	80.6	2.4	78.9	4.1	.967	.39	.43	.88
3	81.1	2.9	79.1	4.9	.973	.42	.75	.86
4	79.7	3.7	77.1	6.3	.913	9.80	2.16	.82
5	79.5	3.3	77.2	5.6	.916	.83	1.92	.84
6	79.9	4.0	77.1	6.8	.913	.78	2.35	.81
7	79.4	4.0	76.6	6.8	.899	.63	.33	.81
8	78.2	5.6	74.3	9.5	.835	8.94	3.16	.74
9	77.7	6.2	73.4	10.5	.811	.67	·46	.72
10	78.3	5.9	74.2	10.0	.832	.91	.33	.73
11	77.9	4.9	74.5	8.3	.840	9.03	2.72	.77
12	78.3	5.0	74.8	8.5	.849	.09	.84	.76
13	78.3	4.6	75.1	7.8	.857	.19	.60	.78
14	77.9	5.5	74.0	9.4	.827	8.88	3.08	.74
15	76.4	6.7	71.7	11.4	.768	.24	.62	.70
16	74.4	6.8	69.6	11.6	.717	7.71	.50	.69
17	74.8	6.7	70.1	11.4	.729	.85	.46	.69
18	77.8	3.3	75.5	5.6	.868	9.35	1.82	.84
19	76.2	0.9	75.6	1.5	.871	.44	0.48	.95
20	76.4	2.0	75.0	3.4	.854	.25	1.06	.90
21	77.4	3.4	75.0	5.8	.854	.20	.87	.83
22	78.2	2.7	76.3	4.6	.890	.59	.51	.86
23	78.3	4.5	75.1	7.7	.857	.19	2.56	.78
24	77.5	3.8	74.8	6.5	.849	.13	.11	.81
25	77.2	2.1	75.7	3.6	.873	.43	1.16	.89
26	76.2	3.5	73.7	6.0	.819	8.85	.87	.83
27	74.3	5.1	70.7	8.7	.744	.03	2.59	.76
28	71.5	7.0	66.6	11.9	.651	7.04	3.31	.68
29	69.2	7.2	64.2	12.2	.601	6.53	.19	.67
30	69.4	7.5	64.1	12.8	.599	.50	.36	.66
31	71.7	1.4	70.6	2.5	.741	8.10	0.69	.92

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1867.

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.	29.883	29.949	29.813	0.136	78.9	82.6	73.0	9.6
1	.873	.940	.795	.145	78.5	82.2	72.5	9.7
2	.865	.935	.790	.145	78.1	82.0	72.4	9.6
3	.858	.934	.783	.151	77.9	81.6	71.3	10.3
4	.857	.929	.802	.127	77.6	81.5	70.5	11.0
5	.872	.938	.815	.123	77.4	81.3	70.0	11.3
6	.889	.951	.821	.130	77.2	81.0	69.5	11.5
7	.905	.974	.840	.134	78.1	81.5	70.6	10.9
8	.924	.998	.855	.143	80.6	84.0	74.0	10.0
9	.937	30.008	.862	.146	82.6	86.8	74.7	12.1
10	.939	.003	.860	.143	83.9	87.2	74.5	12.7
11	.921	29.981	.842	.139	85.1	88.0	74.4	13.6
Noon.	.899	.965	.833	.132	85.3	89.4	73.4	16.0
1	.871	.937	.808	.129	85.3	90.0	73.0	17.0
2	.847	.912	.776	.136	85.4	89.5	73.0	16.5
3	.830	.892	.755	.137	85.6	90.0	73.0	17.0
4	.828	.887	.767	.120	84.9	89.6	72.4	17.2
5	.832	.901	.773	.128	84.2	89.0	72.2	16.8
6	.847	.921	.782	.139	82.3	86.6	71.6	15.0
7	.863	.919	.793	.126	81.3	85.0	71.0	14.0
8	.882	.939	.811	.128	80.6	84.5	70.8	13.7
9	.896	.950	.841	.109	79.9	84.0	71.0	13.0
10	.903	.959	.843	.116	79.4	83.5	71.0	12.5
11	.896	.955	.845	.110	79.0	82.8	70.6	12.2

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1867.

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.	
Midnight.	76.6	2.3	75.0	3.9	0.854	9.24	1.23	0.88
1	76.4	2.1	74.9	3.6	.851	.21	.14	.89
2	76.2	1.9	74.9	3.2	.851	.22	.00	.90
3	76.0	1.9	74.7	3.2	.846	.17	0.99	.90
4	75.9	1.7	74.7	2.9	.746	.17	.90	.91
5	75.7	1.7	74.5	2.9	.840	.12	.89	.91
6	75.7	1.5	74.6	2.6	.843	.14	.81	.92
7	76.4	1.7	75.2	2.9	.860	.31	.91	.91
8	77.2	3.4	74.8	5.8	.849	.15	1.86	.83
9	77.6	5.0	74.1	8.5	.830	8.91	2.77	.76
10	77.6	6.3	73.2	10.7	.806	.63	3.50	.71
11	77.8	7.3	72.7	12.4	.792	.47	4.10	.67
Noon.	77.6	7.7	72.2	13.1	.781	.33	.31	.66
1	77.4	7.9	71.9	13.4	.773	.26	.38	.65
2	77.4	8.0	71.8	13.6	.771	.21	.47	.65
3	77.5	8.1	71.8	13.8	.771	.21	.55	.64
4	77.4	7.5	72.1	12.8	.778	.31	.18	.67
5	77.4	6.8	72.6	11.6	.790	.45	3.79	.69
6	77.3	5.0	73.8	8.5	.822	.82	2.76	.76
7	77.1	4.2	74.2	7.1	.832	.96	.28	.80
8	77.0	3.6	74.5	6.1	.840	9.07	1.94	.82
9	76.8	3.1	74.6	5.3	.843	.11	.67	.85
10	76.7	2.7	74.8	4.6	.849	.17	.45	.86
11	76.5	2.5	74.7	4.3	.846	.16	.34	.87

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	...	0.81	S. by E. & variable.	0.2	⌒i to noon. Overcast to 3 P. M. Clouds of different kinds afterwards. Rain at 1 & 2 P. M.
2	127.0	...	S. by E. & S.	...	Clear to 5 A. M. \⌒i to 11 A. M. ⌒i to 8 P. M. Clear afterwards. Thunder at 2½ P. M. Slight rain at 5 P. M.
3	131.0	...	S. & S. S. W.	...	Clear to 7 A. M. ⌒i to 7 P. M. Overcast afterwards. Lightning from 8 to 10 P. M.
4	124.0	...	S. S.W. & variable.	3.7	_i to 5 A. M. \⌒i to 1 P. M. Clouds of different kinds afterwards. High wind at 9 P. M. Lightning from 7 to 9 P. M. Slight rain at 9 P. M.
5	...	...	S. W. & S. S. W.	...	Clear to 4 A. M. \⌒i to noon. ⌒i afterwards. Lightning at 8 & 11 P. M. Thunder & slight rain at 2½ P. M.
6	130.8	...	S. S. W. & S. W.	...	Clear to 5 A. M. ⌒i to 5 P. M. Clouds of different kinds afterwards.
7	132.6	...	W. S. W, & S.S. E.	...	_i & \i to 8 A. M. ⌒i afterwards.
8	128.4	...	N. W. & W. N. W.	...	Clear to 11 A. M. ⌒i to 4 P. M. Clear afterwards.
9	128.0	...	N. W. & N. N. W.	...	Clear to 6 A. M. \⌒i to 3 P. M. ⌒i to 8 P. M. Clear afterwards.
10	125.0	...	N. E. & E. N. E.	...	Clear to 9 A. M. ⌒i to 5 P. M. Clear afterwards.
11	...	...	S.	...	Clear to 8. A. M. ⌒i afterwards.
12	128.5	...	Variable.	...	_i & \⌒i to 9 A. M. ⌒i to 1 P. M. \⌒i to 7 P. M. ⌒i afterwards.
13	129.8	...	N. N. W.	...	\i to 8 A. M. ⌒i to 4 P. M. Clouds of different kinds afterwards.
14	127.4	...	N. E. & E. N. E.	...	Clear to 2 A. M. \⌒i to 6 A. M. ⌒i to 5 P. M. Clear afterwards.
15	126.0	...	E. N. E. & N. E.	...	Clear to 10 A. M. ⌒i to 3 P. M. \i afterwards.
16	125.5	...	E. N. E.	...	Clear nearly the whole day. Slightly foggy at 10 & 11 P. M.
17	120.0	...	N. N. E.	...	Clear to 10 A. M. \i to 6 P. M. Clear afterwards.
18	...	0.11	E. N. E.	...	_i to 7 A. M. ⌒i to 11 A. M. Overcast afterwards. Light rain at noon & 1 P. M. & from 9 to 11 P. M.

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Solar Radiation, Weather, &c.—*(Continued.)*

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
19	...	2.43	N. E.	1.0	Overcast. Thunder at 2½ P. M. Rain from midnight to 5 A. M. & from 10 A. M. to 6 P. M.
20	119.4	2.06	E. & variable.	0.6	Overcast to 8 A. M. \⌒i & ⌒i to 1 P. M. Overcast afterwards. Rain at midnight, 2 & 4½ A. M., 2 P. M., & from 4 to 9 P. M.
21	126.5	...	W.N.W.&W.S.W.	...	∽_i & \⌒i to 3 A. M. Overcast to 6 A. M. \⌒i to 1 P. M. ⌒i to 5 P. M., clear afterwards.
22	131.7	...	W. S. W.& variable	...	\⌒i to 6 A. M. ⌒i to 1 P. M. \⌒i to 6 P. M., clear afterwards. Slight rain at noon.
23	129.5	...	S. W. & E.S. E.	...	⌒i to 4 P.M., clear afterwards.
24	129.0	...	N.N. E. & variable.	2.0	Clear to 5 A. M. ⌒i to 7 P. M., clear afterwards.
25	...	0.73	N. E. & N. N. E.	...	Clear to 6 A. M. ⌒i to 10 A.M. Overcast to 2 P. M. Clouds of different kinds to 8 P. M., clear afterwards. Thunder at 12½ A. M. Rain at 10 A.M. & from noon to 2 P. M.
26	124.0	...	N. by W.& variable	...	Clear to 4 A. M. \⌒i to 9 A. M. ⌒i to 5 P. M. Clear afterwards. Slightly foggy from 9 to 11 P.M.
27	125.0	...	N. by W. & N byE.	...	Clear to 11 A. M. ⌒i to 8 P.M. Clear afterwards. Foggy from midnight to 4 A. M.
28	125.2	...	N. E. & N. N. E.	...	Clear to 1 A. M. _i to 4 A. M. Clear to 10 A. M. _i to 6 P. M. Clear afterwards.
29	125.4	...	N.E. & N.	...	Clear to 5 A. M. \i to 5 P. M. Clear afterwards.
30	123.2	...	N. N. E. & N. E.	...	Clear to 5 A. M. \i to 3 P. M. \⌒i & _i afterwards.
31	...	2.31	E. N. E. & N. E.	1.3	∽_i to 2 A. M. Overcast afterwards. Rain from 3 A. M. to 11 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ◠i Cumulo strati, ∽ Nimbi,

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.880
Max. height of the Barometer occurred at 9 A. M. on the 16th ...	30.008
Min. height of the Barometer occurred at 3 P.M. on the 12th ...	29.755
Extreme range of the Barometer during the month	0.253
Mean of the daily Max. Pressures	29.942
Ditto ditto Min. ditto	29.821
Mean daily range of the Barometer during the month	0.121

	o
Mean Dry Bulb Thermometer for the month	81.2
Max. Temperature occurred at 1 & 3 P. M. on the 8th & 11th... ...	90.0
Min. Temperature occurred at 6 A. M. on the 29th & 30th	69.5
Extreme range of the Temperature during the month	20.5
Mean of the daily Max. Temperature	86.8
Ditto ditto Min. ditto, ...	76.9
Mean daily range of the Temperature during the month... ...	9.9

Mean Wet Bulb Thermometer for the month	76.9
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	4.3
Computed Mean Dew-point for the month	73.9
Mean Dry Bulb Thermometer above computed mean Dew-point ...	7.3
	Inches.
Mean Elastic force of Vapour for the month	0.824

	Troy grain.
Mean Weight of Vapour for the month	8.88
Additional Weight of Vapour required for complete saturation ...	2.33
Mean degree of humidity for the month, complete saturation being unity	0.79

	Inches.
Rained 10 days,—Max. fall of rain during 24 hours	2.43
Total amount of rain during the month	8.45
Total amount of rain indicated by the Gauge attached to the anemometer during the month	8.01
Prevailing direction of the Wind... ... N. E. & E. N. E.	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Oct. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night			1		4		2	1	4	1							4				1		1	
1			1		3				5				1				3				1		1	
2					3	1	2		4	1					1		2		1		2		1	
3	1				2	1	3		3								3		1		2		1	
4					1	1	5	1	4				1		1		1		1		2		1	
5					4	1	5	1	3		1		1	1			1		1		1		1	
6	2				5		5	1	3		1		1						1		1		1	
7			1		5		5	1	4				2						2		1		2	
8					5		6	1	4		1		1				1		1		1		1	
9	1		1		5		7	1	4				2						1				1	
10	2				2		3		10	3			1						1					
11	1				2		8	1	3	1			3				1		1					
Noon.	1						6	1	3		1				1	1			3	1	1			
1	4	2					5		1										2	2	1	1		
2	3						3		1				2	1					2					
3	5		1				4		1	1	2		1				1				2	1		
4	2				2		4		2						1	1	2				1	1		
5	4				1		4	1	2	1							1		1		2	1		
6			2		1		8	1	1	1					1								1	
7	1		2		1		7		1	1			1		1				1				1	
8			2		2		5		4	1							1		1				1	
9			2		2		5	1	8	1			1		1				1				1	
10	1		1		2		4		5	2			2						1				1	
11	1		1		3		2		5	2					1		1				1		1	

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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	2				3		2		1								1		1		1		1	
1	2				3		2		1								1		2	1	1		1	
2	2				3		3		1								1		1		1		1	
3	2				2		2		1								1		2	1	1		1	
4	2				2		2		1								1		1		1		1	
5	3				1		3		1								1		1				1	
6	3						3		2				1				1						1	
7	1				1		2		2								1				1		1	
8					1		3		2				1						1		1		1	
9	1		1				2		3				1						1					
10	1		1		1		2		2		1						1		3					
11	1		1		2		1		2				1		1		1		2					
Noon.					2		3	1	2				1				2		3	1			1	
1	2						2		1		1		3				1		5		2		1	
2	1	1	1	1	2	1	4				2		1				2		2		3		2	1
3	2				2	1			3				2		1				2		2			
4	1				3		1		3	1	1								3		5			
5	1		1		2	1	2		2		1								2		4		1	
6	2	1	1		2		2		2								1		2		2		1	
7	1				3		2		3	1									1		2		1	
8	2				3		1		2								1	1	1		2		1	
9	1		1		2		1		2								1	1	2	1	2		1	
10	2				2		2		1								1		1		2		1	
11	2		1		2		2		1								1		2		1		1	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1867.

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 the Barometer at 32° Faht.	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	29.728	29.870	29.220	0.650	70.1	71.7	68.0	3.7
2	.561	.923	28.544	1.379	73.2	79.5	69.5	10.0
3	.975	30.039	29.894	0.145	77.5	82.5	71.4	11.1
4	30.017	.084	.983	.101	78.1	83.4	73.0	10.4
5	.007	.087	.947	.140	76.5	82.0	72.0	10.0
6	29.980	.056	.928	.128	74.8	80.7	69.6	11.1
7	30.012	.083	.964	.119	73.9	80.2	67.5	12.7
8	.041	.105	.986	.119	74.0	79.8	68.0	11.8
9	.046	.091	.980	.111	75.4	81.4	71.0	10.4
10	.011	.063	.951	.112	74.7	76.0	72.5	3.5
11	29.939	.004	.868	.136	75.5	81.0	72.0	9.0
12	.925	29.978	.881	.097	74.4	77.4	71.8	5.6
13	.993	30.053	.931	.122	74.8	78.8	71.0	7.8
14	.999	.072	.933	.139	76.3	81.9	72.5	9.4
15	.932	29.990	.856	.134	75.0	80.3	70.0	10.3
16	.931	.981	.879	.102	72.8	79.0	68.0	11.0
17	.987	30.055	.942	.113	73.3	81.6	66.4	15.2
18	30.063	.125	30.018	.107	75.0	82.2	68.5	13.7
19	.087	.153	.043	.110	75.4	82.0	69.5	12.5
20	.067	.124	.021	.103	74.3	80.5	68.7	11.8
21	.064	.124	.004	.120	74.6	82.0	69.0	13.0
22	.085	.142	.031	.111	74.3	81.4	68.0	13.4
23	.148	.216	.104	.112	74.7	83.0	67.4	15.6
24	.158	.231	.100	.131	73.9	81.4	68.2	13.2
25	.111	.187	.048	.139	72.9	80.0	67.0	13.0
26	.111	.175	.064	.111	72.1	79.5	65.5	14.0
27	.151	.228	.102	.126	72.4	79.8	66.0	13.8
28	.139	.217	.083	.134	71.9	78.4	66.0	12.4
29	.133	.205	.072	.133	71.0	79.2	64.5	14.7
30	.138	.215	.082	.133	69.9	76.7	63.5	13.2

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1867.

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	69.2	0.9	68.5	1.6	0.692	7.62	0.41	0.95
2	70.7	2.5	68.7	4.5	.697	.61	1.21	.86
3	73.3	4.2	70.4	7.1	.736	.99	2.05	.80
4	73.5	4.6	70.3	7.8	.734	.95	.27	.78
5	70.8	5.7	66.8	9.7	.665	.11	.64	.73
6	68.3	6.5	63.7	11.1	.591	6.45	.81	.70
7	66.8	7.1	61.8	12.1	.555	.06	.95	.67
8	68.6	5.4	64.8	9.2	.613	.71	.33	.74
9	72.0	3.4	69.6	5.8	.717	7.81	1·62	.83
10	73.5	1.2	72.7	2.0	.792	8.65	0.58	.94
11	73.0	2.5	71.2	4.3	.756	.23	1.23	.87
12	72.5	1.9	71.2	3.2	.756	.25	0.90	.90
13	72.8	2.0	71.4	3.4	.761	.30	.96	.90
14	73.6	2.7	71.7	4.6	.768	.35	1.34	.86
15	70.3	4.7	67.0	8.0	.659	7.18	2.13	.77
16	66.8	6.0	62.0	10.8	.559	6.11	.60	.70
17	67.1	6.2	62.1	11.2	.561	.13	.71	.69
18	69.1	5.9	65.0	10.0	.617	.73	.58	.73
19	69.3	6.1	65.0	10.4	.617	.73	.70	.71
20	68.1	6.2	63.8	10.5	.593	.46	.66	.71
21	68.8	5.8	64.7	9.9	.611	.66	.54	.72
22	68.3	6.0	64.1	10.2	.599	.54	.58	.72
23	68.0	6.7	63.3	11.4	.584	.37	.86	.69
24	68.0	5.9	63.9	10.0	.595	.50	.51	.73
25	66.5	6.4	61.4	11.5	.548	5.99	.74	.69
26	64.8	7.3	59.0	13.1	.506	.54	.99	.65
27	65.1	7.3	59.3	13.1	.511	.59	3.01	.65
28	64.9	7.0	59.3	12.6	.511	.59	2.89	.66
29	64.4	6.6	59.1	11.9	.508	.57	.68	.68
30	62.2	7.7	56.0	13.9	.458	.03	.95	.63

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1867.

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.	30.002	30.176	28.954	1.222	71.6	78.8	67.2	11.6
1	29.985	.163	.693	.470	71.2	78.0	66.4	11.6
2	.971	.149	.544	.605	70.7	77.5	65.6	11.9
3	.963	.139	.554	.585	70.2	76.0	65.5	10.5
4	.974	.146	.892	.254	69.6	74.8	65.2	9.6
5	30.006	.157	29.429	0.728	69.3	74.8	64.8	10.0
6	.022	.171	.588	.583	69.1	74.6	63.9	10.7
7	.044	.191	.666	.525	69.4	73.8	63.5	10.3
8	.069	.216	.724	.492	72.2	76.0	66.8	9.2
9	.086	.229	.762	.467	74.6	78.5	69.6	8.9
10	.087	.231	.788	.443	76.5	79.5	70.4	9.1
11	.068	.208	.788	.420	77.9	81.5	70.5	11.0
Noon.	.042	.176	.786	.390	78.7	82.5	70.5	12.0
1	.012	.148	.755	.393	79.3	82.7	71.4	11.3
2	29.990	.123	.722	.401	79.7	83.4	71.7	11.7
3	.979	.111	.706	.405	79.6	82.5	71.5	11.0
4	.978	.106	.690	.416	78.5	81.8	71.4	10.4
5	.989	.117	.708	.409	77.5	81.5	71.0	10.5
6	30.002	.136	.669	.467	75.8	81.0	71.0	10.0
7	.018	.160	.625	.535	74.7	81.0	70.5	10.5
8	.033	.171	.595	.576	73.8	80.5	69.5	11.0
9	.041	.189	.538	.651	73.1	80.2	68.5	11.7
10	.036	.199	.424	.775	72.5	80.0	67.0	13.0
11	.029	.186	.220	.966	72.1	79.5	66.5	13.0

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 1867.

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.	68.7	2.9	66.4	5.2	0.646	7.10	1.30	0.85
1	68.4	2.8	66.2	5.0	.642	.05	.25	.85
2	68.0	2.7	65.8	4.9	.634	6.97	.21	.85
3	67.6	2.6	65.5	4.7	.628	.91	.14	.86
4	67.2	2.4	65.3	4.3	.623	.87	.03	.87
5	67.0	2.3	65.2	4.1	.621	.85	0.98	.88
6	67.0	2.1	65.3	3.8	.623	.87	.91	.88
7	67.0	2.4	65.1	4.3	.619	.83	1.03	.87
8	68.5	3.7	65.5	6.7	.628	.88	.67	.81
9	69.2	5.4	65.4	9.2	.626	.82	2.38	.74
10	69.9	6.6	65.3	11.2	.623	.78	.97	.70
11	70.2	7.7	64.8	13.1	.613	.65	3.51	.66
Noon.	70.1	8.6	64.1	14.6	.599	.47	.94	.62
1	70.2	9.1	63.8	15.5	.593	.40	4.19	.60
2	70.2	9.5	63.5	16.2	.588	.34	.38	.59
3	69.9	9.7	63.1	16.5	.580	.25	.44	.59
4	69.6	8.9	63.4	15.1	.586	.33	.02	.61
5	70.0	7.5	64.7	12.8	.611	.62	3.42	.66
6	70.2	5.6	66.3	9.5	.644	7.01	2.53	.74
7	70.0	4.7	66.7	8.0	.653	.11	.12	.77
8	69.7	4.1	66.8	7.0	.655	.16	1.82	.80
9	69.4	3.7	66.4	6.7	.646	.07	.72	.80
10	69.2	3.3	66.6	5.9	.651	.12	.51	.83
11	68.8	3.3	66.2	5.9	.642	.03	.50	.82

All the Hygrometrical elements are computed by the Greenwich Constants.

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***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November* 1867.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	...	1.12	E. N. E. & N. N. E.	...	Overcast. High wind from 2 to 7 A. M. Gale from 6 to 11 P. M. Rain at 2, 3, 7, 8, 11 & noon & from 5 to 11 P. M.
2	...	*2.74	vane broken	...	Overcast to 1 P. M., \i to 8 P. M., clear afterwards. Heavy driving rain from midnight to 4 A. M. Drizzled from 5 to 10 A. M. Foggy at 7 & 8 P. M. A cyclone passed over Calcutta.
3	124.0	...		...	Clear to 1 A. M., _i to 5 A. M., \i to 4 P. M., clear afterwards. Slightly foggy at 4 & 5 A. M.
4	120.5	...		...	Clear to 7 A. M., \i to 6 P. M., clear afterwards. Foggy from 1 to 5 A. M. & from 7 to 11 P. M.
5	120.0	...		...	Clear. Foggy from midnight to 3 A. M.
6	120.5	...	N.	...	Clear.
7	120.0	...	N. & N. W.	...	Clear. Slightly foggy from 7 to 11 P. M.
8	119.0	...	N.	...	Clear to 5 A. M., \i to 6 P. M., clear to 9 P. M., \i afterwards. Slightly foggy from midnight to 2 A. M.
9	...	...	N. & E.	...	\i to 2 A.M., stratoni to noon, clouds of different kinds to 7 P. M., stratoni afterwards.
10	...	0.90	E.	...	Stratoni to 5 A. M., overcast afterwards. Rain fron 6 A. M. to 9 P. M.
11	...	...	E.	...	Overcast to 7 A. M., \i afterwards. Light rain at 5 & 6 A. M.
12	...	0.09	N. & N. N. E.	...	\i to 5 A. M., overcast to 4 P. M., \i afterwards. Slight rain from 11 A.M. to 1 P.M. & at 4 P.M.
13	...	...	N. & N. by E.	...	Scuds from N. to 4 A. M., \i to 7 P. M., clear afterwards. Light rain at 2½ P. M.
14	...	...	N. & N. N. W.	...	Overcast to 10 A. M., ⌒i afterwards.
15	121.0	...	N. N. W. & N. W.	...	Clear to 1 A. M., ⌒i to 7 P. M., clear afterwards. Foggy at 1 & 2 A. M.
16	110.0	...	Variable.	...	\i to 4 A.M., clear afterwards.
				...	Slightly foggy at 7 & 8 P. M.
17	116.2	...	S. S. W. & W. S. W		Clear.

*By Anemometer gauge.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
18	118.6	...	S.	...	Clear to 11 A. M., ⌒i to 3 P.M., \⌒i afterwards.
19	...	...	S. S. E. & E.	...	Clear to 7 A. M., ⌒i to 7 P.M., clear afterwards.
20	120.0	...	N. N. E. & N. E.	...	_i to 2 A.M., clear to 10 A.M., ⌒i to 5 P. M., clear afterwards.
21	123.0	...	N	...	Clear to 10 A. M., ⌒i to 5 P.M., clear afterwards.
22	122.0	...	N. & N. E.	...	Clear to 7 A. M., \i to 10 A.M., ⌒i to 5 P. M., clear afterwards. Foggy from 8 to 10 P. M.
23	116.0	...	N.	...	Clear to noon, ⌒i to 6 P. M., \i afterwards. Foggy from 4 to 7 A. M. & from 8 to 11 P. M.
24	117.0	...	N. E.	...	Clear to 5 A. M., \i & ⌒i to 6 P. M., clear afterwards.
25	116.2	...	N.& N.N. E.	...	Clear to 11 A.M., ⌒i to 5 P.M., clear afterwards.
26	...	...	N. E. &. N N. W.	...	Clear to 8 A. M., \i &⌒i to 5 P. M., clear afterwards.
27	117.5	...	N. & N. N. E.	...	Clear to 6 A. M., \i to 10 A. M, ⌒i to 6 P. M. clear afterwards.
28	115.5	...	N. & N. N. W.	...	Clear to 6 A.M., \i to 10 A. M. Stratoni to 1 P. M., \i & ⌒i to 5 P. M., clear afterwards.
29	114.0	...	variable	...	Clear to 5 A. M., \i to 6 P. M., clear afterwards. Slightly foggy from 8 to 11 P. M.
30	111.0	...	N.	...	Clear to 5 A. M., \i to 5 P. M., clear afterwards. Slightly foggy at midnight & from 5 to 7 A.M.

\ i Cirri, — i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒ i Cumulo strati, \⌒i Nimbi, \⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	30.018
Max. height of the Barometer occurred at 10 A. M. on the 24th ...	30.231
Min. height of the Barometer occurred at 2 A. M. on the 2nd ...	28.544
Extreme range of the Barometer during the month	1.687
Mean of the daily Max. Pressures	30.096
Ditto ditto Min. ditto	29.915
Mean daily range of the Barometer during the month	0.181

	°
Mean Dry Bulb Thermometer for the month	74.1
Max. Temperature occurred at 2 P. M. on the 4th	83.4
Min. Temperature occurred at 7 A. M. on the 30th	63.5
Extreme range of the Temperature during the month	19.9
Mean of the daily Max. Temperature	80.1
Ditto ditto Min. ditto, ...	68.9
Mean daily range of the Temperature during the month... ...	11.2

Mean Wet Bulb Thermometer for the month	69.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	5.1
Computed Mean Dew-point for the month	65.4
Mean Dry Bulb Thermometer above computed mean Dew-point ...	8.7
	Inches.
Mean Elastic force of Vapour for the month	0.626

	Troy grain.
Mean Weight of Vapour for the month	6.82
Additional Weight of Vapour required for complete saturation ...	2.25
Mean degree of humidity for the month, complete saturation being unity	0.75

	Inches.
Rained 6 days,—Max. fall of rain during 24 hours	2.74
Total amount of rain during the month	4.85
Total amount of rain indicated by the Gauge attached to the anemometer during the month	3.68
Prevailing direction of the Wind... ...	N. & N. N. E.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Nov. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night	5						1	1	1												1			
1	5								1												1			
2	3						2		1				1											
3	4						1		1	1			1											
4	5		1						1												1			
5	9		1						1				1											
6	11		1		3	1			2												2			
7	9		1		4		4		1	1											1		1	
8	12		1		4		3	1	1										1					
9	9		3		2		3		2				1	1	1				1					
10	9		1		3		10						1	1										
11	7		5		2		5		1	1			1						2	1				
Noon.	6		3	1	5	2	4		1				1								1			
1	7		4	1	4	1	1		1				1						1					
2	6		1		5	1	2						2											
3	9		1	1	3		3						2	1									1	
4	9		2	1			1						3				1	1						
5	8				5	1	2						2	1									1	
6	7				1	1	2						2	1										
7	4				1								2	1										
8	3				1	1							2	1										
9	3				1	1							2	1										
10	4				1	1							1											
11	4				1	1							1											

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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																			1					
3																			1					
4																			1					
5																								
6					1														4		1		1	
7					1														1		3			
8			1														1				2			
9													1		1						3			
10	1												1						1					
11	1										1										2			
Noon.					1														2		2			
1	1								1								1		2		3			
2	1				1		1										1		3		4			
3					1												1		4		2			
4			1						1						1				3		3		3	
5	1								1				1						4				1	
6	1								1				1						2		3			
7																					3			
8																							1	
9																							1	
10	1																							
11							1																	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1867.

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 the Barometer at 32° Faht.	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	30.125	30.201	30.071	0.130	69.4	76.5	63.6	12.9
2	.092	.163	.024	.139	70.9	78.2	64.0	14.2
3	.100	.173	.039	.134	71.0	77.5	65.2	12.3
4	.120	.193	.066	.127	71.5	78.2	65.0	13.2
5	.101	.189	.046	.143	70.0	77.6	63.4	14.2
6	.047	.115	29.987	.128	68.9	77.0	61.5	15.5
7	.021	.088	.961	.127	68.9	77.1	63.0	14.1
8	.048	.125	30.003	.122	67.0	75.0	60.5	14.5
9	.058	.124	.001	.123	66.5	76.0	58.5	17.5
10	.083	.173	.029	.144	66.4	74.2	59.0	15.2
11	.068	.163	.013	.150	64.7	72.5	57.5	15.0
12	.056	.131	.005	.126	65.3	74.8	58.0	16.8
13	.075	.165	.014	.151	67.3	75.5	59.8	15.7
14	.062	.139	.010	.129	66.7	73.2	61.5	11.7
15	.057	.110	29.997	.113	67.7	75.0	61.0	14.0
16	.102	.180	30.046	.134	67.4	74.6	60.0	14.6
17	.108	.169	.057	.112	69.1	78.2	62.0	16.2
18	.093	.173	.022	.151	68.7	76.5	61.5	15.0
19	.082	.148	.022	.126	68.3	77.0	60.5	16.5
20	.057	.126	29.992	.134	67.7	75.8	60.2	15.6
21	.042	.109	.986	.123	67.0	75.4	60.0	15.4
22	.057	.138	.998	.140	66.8	76.7	59.2	17.5
23	.099	.177	30.046	.131	66.9	75.2	60.0	15.2
24	.110	.182	.045	.137	66.6	75.5	59.0	16.5
25	.074	.151	.032	.119	66.3	73.5	60.5	13.0
26	.058	.138	.003	.135	67.8	76.4	60.0	16.4
27	.055	.121	.011	.110	70.1	78.2	62.0	16.2
28	.082	.153	.025	.128	69.6	78.0	62.5	15.5
29	.085	.157	.025	.132	68.1	75.5	61.4	14.1
30	.096	.180	.030	.150	66.8	74.7	60.0	14.7
31	.082	.144	.017	.127	66.0	73.4	58.5	14.9

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1867.

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	63.1	6.3	58.1	11.3	0.491	5.41	2.45	0.69
2	65.8	5.1	61.7	9.2	.554	6.08	.15	.74
3	65.3	5.7	60.7	10.3	.536	5.88	.37	.71
4	64.5	7.0	58.9	12.6	.504	.52	.86	.66
5	63.0	7.0	57.4	12.6	.480	.27	.73	.66
6	63.0	5.9	58.3	10.6	.494	.44	.30	.70
7	61.8	7.1	56.1	12.8	.459	.06	.68	.65
8	59.6	7.4	53.7	13.3	.423	4.69	.61	.64
9	59.3	7.2	53.5	13.0	.421	.67	.52	.65
10	58.7	7.7	52.5	13.9	.407	.51	.66	.63
11	57.4	7.3	51.6	13.1	.394	.38	.42	.64
12	59.3	6.0	54.5	10.8	.435	.83	.10	.70
13	61.4	5.9	56.7	10.6	.469	5.17	.20	.70
14	61.8	4.9	57.9	8.8	.488	.39	1.84	.75
15	61.8	5.9	57.1	10.6	.475	.24	2.22	.70
16	62.4	5.0	58.4	9.0	.496	.48	1.91	.74
17	63.3	5.8	58.7	10.4	.501	.53	2.25	.71
18	63.1	5.6	58.6	10.1	.499	.51	.18	.72
19	62.6	5.7	58.0	10.3	.489	.40	.20	.71
20	61.4	6.3	56.4	11.3	.464	.12	.34	.69
21	60.1	6.9	54.6	12.4	.437	4.84	.46	.66
22	60.5	6.3	55.5	11.3	.450	.99	.27	.69
23	61.0	5.9	56.3	10.6	.462	5.11	.17	.70
24	60.2	6.4	55.1	11.5	.444	4.92	.29	.68
25	60.6	5.7	56.0	10.3	.458	5.08	.07	.71
26	61.8	6.0	57.0	10.8	.473	.22	.26	.70
27	64.4	5.7	59.8	10.3	.520	.71	.32	.71
28	63.0	6.6	57.7	11.9	.485	.33	.57	.68
29	62.1	6.0	57.3	10.8	.478	.27	.28	.70
30	60.7	6.1	55.8	11.0	.455	.04	.22	.69
31								

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1867.

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.	30.080	30.134	30.024	0.110	64.6	68.3	60.5	7.8
1	.074	.125	.022	.103	64.0	68.0	59.5	8.5
2	.065	.113	.012	.101	63.4	67.2	59.0	8.2
3	.057	.101	29.999	.102	62.9	66.5	58.8	7.7
4	.053	.106	30.000	.106	62.3	66.5	58.7	7.8
5	.062	.110	.011	.099	61.8	66.4	58.2	8.2
6	.080	.134	.027	.107	61.2	65.2	57.5	7.7
7	.101	.151	.044	.107	61.0	65.5	57.5	8.0
8	.130	.176	.069	.107	65.9	69.2	60.0	9.2
9	.147	.196	.087	.109	67.2	71.8	62.5	9.3
10	.147	.201	.088	.113	70.1	74.5	65.5	9.0
11	.130	.176	.073	.103	72.5	76.3	69.3	7.0
Noon.	.097	.144	.042	.102	74.0	76.8	71.2	5.6
1	.062	.113	29.998	.115	75.1	78.2	72.0	6.2
2	.039	.085	.976	.109	75.6	78.2	71.0	7.2
3	.024	.083	.968	.115	75.7	78.2	72.0	6.2
4	.022	.071	.961	.110	74.5	77.7	71.5	6.2
5	.031	.080	.970	.110	73.3	76.3	70.5	5.8
6	.044	.097	.987	.110	71.0	74.5	67.0	7.5
7	.060	.113	30.007	.106	69.3	73.0	65.0	8.0
8	.076	.129	.025	.104	68.2	72.0	64.4	7.6
9	.086	.137	.037	.100	67.0	71.5	63.0	8.5
10	.092	.147	.042	.105	66.1	70.5	61.8	8.7
11	.087	.140	.030	.110	65.3	70.0	61.0	9.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1867.

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.	60.9	3.7	57.9	6.7	0.488	5.41	1.37	0.80
1	60.4	3.6	57.2	6.8	.476	.29	.36	.80
2	60.0	3.4	56.9	6.5	.472	.25	.28	.80
3	59.5	3.4	56.4	6.5	.464	.17	.26	.80
4	59.0	3.3	56.0	6.3	.458	.12	.19	.81
5	58.7	3.1	55.9	5.9	.456	.10	.11	.82
6	58.3	2.9	55.7	5.5	.453	.07	.03	.83
7	58.3	2.7	55.9	5.1	.456	.11	0.95	.84
8	61.6	4.3	58.2	7.7	.493	.46	1.60	.77
9	61.3	5.9	65.6	10.6	.467	.16	2.19	.70
10	62.5	7.6	56.4	13.7	.464	.09	.94	.63
11	63.1	9.4	55.6	16.9	.452	4.95	3.68	.57
Noon.	63.5	10.5	56.1	17.9	.459	5.01	4.03	.55
1	63.7	11.4	55.7	19.4	.453	4.94	.40	.53
2	64.1	11.5	56.0	19.6	.458	.97	.51	.52
3	63.9	11.8	55.6	20.1	.452	.92	.59	.52
4	63.7	10.8	56.1	18.4	.459	5.01	.17	.55
5	63.8	9.5	56.2	17.1	.461	.03	3.81	.57
6	64.0	7.0	58.4	12.6	.496	.43	2.82	.66
7	63.8	5.5	59.4	9.9	.513	.64	.19	.72
8	63.2	5.0	59.2	9.0	.509	.63	1.95	.74
9	62.7	4.3	59.3	7.7	.511	.65	.65	.77
10	62.0	4.1	58.7	7.4	.501	.56	.54	.78
11	61.4	3.9	58.3	7.0	.494	.48	.45	.79

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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 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	120.5	...	N. N. W. & N.	...	\i & \⌒i to 6 P. M., clear afterwards.
2	116.5	...	N. & N. N. W.	...	Clear to 10 A. M., ⌒i to 5 P. M., clear afterwards.
3	114.5	...	N.	...	Chiefly clear.
4	116.0	...	N. & N. N. W.	...	Chiefly clear.
5	115.0	...	N. & N. by W.	...	Clear
6	111.5	...	N.	...	Clear. Slightly foggy at midnight & from 7 to 11 P. M.
7	115.8	...	N.	...	Clear. Foggy at midnight & 1 A. M., & from 8 to 11 P. M.
8	112.0	...	N. N. W. & N.	...	Clear. Foggy at midnight & 1 A. M., & from 8 to 10 P. M.
9	114.0	...	N. & N. N. W.	...	Clear. Slightly foggy from 8 to 11 P. M.
10	113.5	...	N. & N. by W.	...	Clear to 7 A. M., ⌒i to 10 A.M., clear afterwards. Slightly foggy at midnight. & 1 A. M.
11	113.0	...	N. by W. & W. N. W.	...	Clear to 5 A. M., thin \i to 6 P. M., clear afterwards. Foggy from 8 to 11 P. M.
12	112.4	...	N. & N. W.	...	Clear to 5 A. M., \i to 3 P. M., _i to 6 P. M., clear afterwards. Foggy from midnight to 7 A. M., & from 7 to 10 P. M.
13	...	...	N.	...	\i to 11 A. M., ⌒i & \i afterwards.
14	108.0	...	N.	...	\i & \⌒i to 6 P. M., clear afterwards.
15	112.0	...	N. N. W. & N. W.	...	Scatd. ⌒i to 6 A. M., clear to 11 A. M., ⌒i to 3 P. M., clear afterwards. Foggy at 9 P. M.
16	114.0	...	N. W. & N.	...	Clear to noon, ⌒i to 5 P. M., clear afterwards.
17	113.0	...	N. & N. N.E.	...	\⌒i to 2 A.M., clear to 11 A.M., ⌒i to 2 P. M., clear afterwards.
18	114.0	...	N.	...	Clear nearly the whole day.
19	113.0	...	N.	...	Clear.
20	111.0	...	N.	...	Clear.
21	111.5	...	N.	...	Clear.
22	112.5	...	N.	...	Clear. Slightly foggy at 11 P. M.
23	111.2	...	N.	...	Clear. Slightly foggy from midnight to 6 A. M., & from 8 to 11 P. M.
24	112.0	...	N.	...	Clear.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1867.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
25	111.2	...	N.	...	\i to 5 A. M., \i & ∖⌒i to 6 P. M., clear afterwards. Light rain at 1½ P. M.
26	111.8	...	N.	...	Clear to noon, \i & ∖_i to 5 P. M., clear afterwards. Slightly foggy from 8 to 11 P. M.
27	112.0	...	N.	...	Clear. Slightly foggy at midnight & 1 A. M.
28	113.0	...	N. E.	...	Chiefly clear.
29	111.0	...	N. E.	...	Chiefly clear.
30	111.5	...	N.	...	Chiefly clear. Slightly foggy at 7 & 8 P. M.
31	...	...	N.	...	Clear to noon, ⌒i to 5 P. M., clear afterwards. Foggy from 7 to 11 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, ∖_i Cirro-strati, ⌒—i Cumulo strati, ∖⌒—i Nimbi, ∖⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1867.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	30.077
Max. height of the Barometer occurred at 10 A. M. on the 1st ...	30.201
Min. height of the Barometer occurred at 4 P. M. on the 7th ...	29.961
Extreme range of the Barometer during the month	0.240
Mean of the daily Max. Pressures	30.152
Ditto ditto Min. ditto	30.020
Mean daily range of the Barometer during the month	0.132

	o
Mean Dry Bulb Thermometer for the month	67.9
Max. Temperature occurred at 2 P. M. on the 2nd, 4th, 17th & 27th	78.2
Min. Temperature occurred at 6 & 7 A. M. on the 11th	57.5
Extreme range of the Temperature during the month	20.7
Mean of the daily Max. Temperature	75.9
Ditto ditto Min. ditto, ...	60.9
Mean daily range of the Temperature during the month... ...	15.0

Mean Wet Bulb Thermometer for the month	61.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.2
Computed Mean Dew-point for the month	56.7
Mean Dry Bulb Thermometer above computed mean Dew-point ...	11.2
	Inches.
Mean Elastic force of Vapour for the month	0.469

	Troy grain.
Mean Weight of Vapour for the month	5.17
Additional Weight of Vapour required for complete saturation ...	2.34
Mean degree of humidity for the month, complete saturation being unity	0.69

	Inches.
Drizzled 1 day,—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 anemometer during the month	Nil
Prevailing direction of the Wind... ...	N. & N. N. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Dec. 1867.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.
Mid night	4													
1	7													
2	6													
3	5													
4	4		1											
5	5		1											
6	18		1		1									
7	16						1							
8	16		1		1		3							
9	15		1		1		3							
10	12		1		5		1							
11	17		2		1		2							
Noon.	13		2		2		5							
1	16		2		2		2							
2	14		1		1		2		1					
3	15		1		2		1							
4	23				2		1							
5	20				2		1							
6	16						3							
7	8													
8	6													
9	4													
10	4													
11	4													

Hour.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.
Mid night																						
1																						
2																						
3																						
4																						
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10																						
11																						
Noon.																						
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2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						

Hour.	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											1	
3											1	
4											1	
5											1	
6					1		5		4			
7							5		8		1	
8					1		4		3		2	
9					1		4		5		1	
10							3		6		3	
11					1		3		5			
Noon.	1				1		3		3		1	
1					1		3		3		2	
2							3	1	8		1	
3			1				3		5		3	
4							2				3	
5							2		3		3	
6							2		2		3	
7							1		1		2	
8					1				1			
9					1				1			
10							1					
11							1		1			

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1868.

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 the Barometer at 32° Faht.	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	30.097	30.161	30.040	0.121	65.5	73.5	58.0	15.5
2	.120	.185	.071	.114	64.2	71.8	58.2	13.6
3	.088	.176	.008	.168	63.0	72.2	55.4	16.8
4	.048	.125	29.987	.138	65.4	74.5	57.4	17.1
5	29.996	.094	.928	.166	67.8	77.5	59.0	18.5
6	.988	.064	.935	.129	70.3	79.5	64.7	14.8
7	30.001	.072	.955	.117	71.8	78.5	66.5	12.0
8	.030	.120	.988	.132	69.9	76.3	65.4	10.9
9	.003	.077	.918	.129	67.0	75.0	59.5	15.5
10	.027	.111	.972	.139	66.2	74.7	58.5	16.2
11	.072	.166	30.019	.147	65.4	74.5	58.0	16.5
12	.101	.177	.037	.140	66.3	76.0	58.2	17 8
13	.101	.184	.053	.131	68.2	76.5	61.0	15.5
14	.103	.171	.052	.119	69.7	78.2	62.7	15.5
15	.122	.207	.047	.160	67.9	76.4	60.5	15.9
16	.071	.164	29.996	.168	66.9	75.4	59.5	15.9
17	.014	.109	.951	.158	66.6	76.0	60.4	15.6
18	.013	.083	.964	.119	67.0	76.5	58.8	17.7
19	.035	.126	.975	.151	68.2	76.7	60.5	16.2
20	.075	.151	30.017	.134	68.8	77.2	61.6	15.6
21	.078	.166	.012	.154	67.4	76.2	59.2	17.0
22	.039	.122	29.969	.153	68.1	78.3	58.8	19.5
23	29.962	.045	.877	.168	69.8	79.9	59.6	20.3
24	.984	.071	.916	.155	70.9	79.0	63.0	16.0
25	30.022	.085	.968	.117	70.2	79.9	62.0	17.9
26	.037	.128	.983	.145	70.2	78.0	62.5	15.5
27	29.992	.086	.907	.179	71.2	79.2	64.4	14.8
28	.913	.017	.879	.138	73.1	80.0	67.5	12.5
29	30.015	.106	.966	.140	72.0	80.0	65.5	14.5
30	.011	.091	.938	.153	70.3	80.0	62.5	17.5
31	.001	.088	.950	.138	65.9	69.7	62.0	7.7

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1868.

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	59.9	5.6	55.4	10.1	0.449	4.98	2.00	0.71
2	58.0	6.2	52.4	11.8	.405	.51	.18	.67
3	57.2	5.8	52.0	11.0	.400	.46	1.99	.69
4	59.0	6.4	53.9	11.5	.426	.73	2.22	.68
5	64.2	3.6	61.3	6.5	.546	6.03	1.45	.81
6	67.1	3.2	64.5	5.8	.607	.68	.40	.83
7	67.5	4.3	64.1	7.7	.599	.56	.89	.78
8	63.0	6.9	57.5	12.4	.481	5.30	2.68	.66
9	59.1	7.9	52.8	14.2	.411	4.55	·75	.62
10	58.6	7.6	52.5	13.7	.407	.51	.61	.63
11	58.2	7.2	52.4	13.0	.405	.50	.45	.65
12	59.8	6.5	54.6	11.7	.437	.84	.31	.68
13	62.3	5.9	57.6	10.6	.483	5.32	.26	.70
14	63.2	6.5	58.0	11.7	.489	.38	.55	.68
15	60.0	7.9	53.7	14.2	.423	4.69	.82	.63
16	59.7	7.2	53.9	13.0	.426	.72	.56	.65
17	60.3	6.3	55.3	11.3	.447	.96	.25	.69
18	59.5	7.5	53.5	13.5	.421	.66	.64	.64
19	61.0	7.2	55.2	13.0	.445	.92	.66	.65
20	61.8	7.0	56.2	12.6	.461	5.07	.64	.66
21	59.4	8.0	53.0	14.4	.414	4.58	.81	.62
22	60.3	7.8	54.1	14.0	.429	.74	.81	.63
23	61.7	8.1	55.2	14.6	.415	.90	3.05	.62
24	62.6	8.3	56.0	14.9	.458	5.02	.21	.61
25	62.9	7.3	57.1	13.1	.475	.22	2.83	.65
26	62.5	7.7	56.3	13.9	.462	.08	.97	.63
27	63.3	7.9	57.0	14.2	.473	.19	3.11	.63
28	66.8	6.3	61.8	11.3	.555	6.07	2.72	.69
29	64.9	7.1	59.2	12.8	.509	5.58	.92	.66
30	61.9	8.4	55.2	15.1	.445	4.90	3.18	.61
31	62.5	3.4	59.8	6.1	.520	5.76	1.30	82

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1868.

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.	30.038	30.136	29.954	0.182	65.1	70.5	59.8	10.7
1	.033	.139	.940	.199	64.3	70.0	58.7	11.3
2	.025	.138	.933	.205	63.6	70.0	59.0	11.0
3	.017	.124	.921	.203	62.8	69.0	57.5	11.5
4	.012	.119	.913	.206	62.3	68.5	56.8	11.7
5	.023	.136	.922	.214	61.8	67.5	56.2	11.3
6	.038	.154	.934	.220	61.3	67.6	55.7	11.9
7	.059	.170	.946	.224	61.2	67.6	55.4	12.2
8	.085	.192	.969	.223	63.2	70.0	57.6	12.4
9	.110	.207	30.000	.207	66.5	72.7	61.0	11.7
10	.119	.198	.017	.181	69.5	74.5	63.2	11.3
11	.102	.177	.013	.164	72.2	76.5	65.0	11.5
Noon.	.074	.156	29.985	.171	74.1	78.0	68.5	9.5
1	.037	.121	.936	.185	75.2	78.7	66.5	12.2
2	.007	.109	.909	.200	76.1	80.0	68.0	12.0
3	29.989	.074	.891	.183	76.6	80.0	68.7	11.3
4	.982	.073	.879	.194	75.6	79.0	69.4	9.6
5	.986	.078	.877	.201	74.5	78.5	69.7	8.8
6	.996	.094	.890	.204	72.3	76.5	67.6	9.9
7	30.015	.112	.910	.202	70.2	74.7	65.0	9.7
8	.034	.132	.945	.187	68.9	73.5	64.0	9.5
9	.045	.142	.959	.183	67.9	72.8	62.5	10.3
10	.049	.153	.967	.186	66.8	72.5	61.7	10.8
11	.044	.151	.960	.191	65.9	71.6	60.6	11.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1868.

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.	
Midnight.	61.0	4.1	57.7	7.4	0.485	5.38	1.51	0.78
1	60.4	3.9	56.9	7.4	.472	.25	.47	.78
2	59.9	3.7	56.6	7.0	.467	.21	.36	.79
3	59.2	3.6	56.0	6.8	.458	.11	.30	.80
4	58.6	3.7	55.3	7.0	.447	.00	.31	.79
5	58.3	3.5	55.1	6.7	.444	4.97	.24	.80
6	57.9	3.4	54.8	6.5	.440	.91	.21	.80
7	58.0	3.2	55.1	6.1	.444	.98	.12	.82
8	59.0	4.2	55.2	8.0	.445	.97	.52	.77
9	60.6	5.9	55.9	10.6	.456	5.05	2.14	.70
10	61.8	7.7	55.6	13.9	.452	4.98	.90	.63
11	62.9	9.3	55.5	16.7	.450	.93	3.62	.58
Noon.	63.5	10.6	56.1	18.0	.459	5.01	4.06	.55
1	63.7	11.5	55.6	19.6	.452	4.92	.45	.53
2	64.1	12.0	55.7	20.4	.453	.92	.71	.51
3	64.3	12.3	55.7	20.9	.453	.91	.86	.50
4	63.7	11.9	55.4	20.2	.449	.88	.60	.52
5	63.9	10.6	56.5	18.0	.465	5.07	.11	.55
6	64.1	8.2	57.5	14.8	.481	.27	3.31	.61
7	63.5	6.7	58.1	12.1	.491	.40	2.65	.67
8	63.2	5.7	58.6	10.3	.499	.51	.23	.71
9	62.6	5.3	58.4	9.5	.496	.47	.04	.73
10	62.1	4.7	58.3	8.5	.494	.46	1.80	.75
11	61.5	4.4	58.0	7.9	.489	.42	.64	.77

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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* 1868.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
1	112.0	...	N. N. W. & N.	...	Clear. Slightly foggy at midnight.
2	112.0	...	N.	...	Clear.
3	...	...	N. & N. N. W.	...	Clear.
4	110.7	...	N. W.	...	Clear.
5	112.2	...	N. W. & S W.	...	Clear to 7 A. M., \-i to 3 P. M., clear afterwards.
6	114.5	...	W. & S. W.	...	Chiefly clear. Foggy from 2 to 9 A. M.
7	111.5	...	N. N. W.	...	Stratoni to 7 A. M., clear afterwards. Foggy at midnight & from 7 to 10 P. M.
8	112.0	...	N.	...	\-i to 8 A. M., clear to 2 P. M., \i to 5 P. M., _i afterwards. Foggy at 1 A. M., & from 9 to 11 P. M.
9	112.0	...	N. N. E. & N.	...	Chiefly clear. Slightly foggy at midnight.
10	112.0	...	N.	...	Clear to 11 A. M., \i to 4 P.M., clear afterwards. Foggy from 7 to 10 P. M.
11	114.0	...	N. N. W. & N.	...	Clear to 6 A. M., \-i to 6 P. M., clear afterwards. Slightly foggy at 8 & 9 P. M.
12	111.5	...	N.	...	Clear to 5 A. M., \-i & \i to 10 A. M., \i & _i to 5 P. M., clear afterwards.
13	108.5	...	N.	...	\-i to 4 A. M., \i to 10 A. M., stratoni afterwards.
14	111.0	...	N.	...	\i & \-i to 7 A. M., clear afterwards.
15	113.0	...	N.	...	Clear.
16	108.6	...	N.	...	Clear
17	112.8	...	N.	...	Clear. Slightly foggy at 2 & 3 A. M.
18	112.0	...	N.	...	Chiefly clear.
19	116.0	...	N.	...	Clear to 11 A. M., \-i to 6 P. M., clear afterwards.
20	112.4	...	N.	...	Clear to 5 A. M., \-i to 9 A.M., clear afterwards.
21	112.8	...	N. & N. E.	...	Clear.
22	114.7	...	N.	...	Clear.
23	114.4	...	N.	...	Clear to 3 P. M., \-i to 6 P.M., stratoni afterwards.
24	113.2	...	N.	...	\-i to 5 P. M., clear afterwards.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Prevailing direction of the Wind.	Max. Pressure of Wind.	General aspect of the Sky.
	o	Inches		lb	
25	114.4	...	N.	...	Clear to noon, scatd. ⌒i to 5 P. M., clear afterwards.
26	113.4	...	N. & N. E.	...	Clear.
27	111.4	...	N.	...	Clear to 3 A. M., ╲⌒i to 7 P. M., stratoni afterwards.
28	120.0	...	N. W. & N.	...	Stratoni to 6 A. M., scatd. ⌒i to 5 P. M., clear afterwards.
29	114.3	...	N.	...	Clouds of different kinds to 5 P. M., clear afterwards.
30	117.0	...	N. E. & N. N. E.	...	Clear to 5 A. M., scatd. ╲i & ╲⌒i to 9 A. M., ╲⌒i afterwards. Strong wind at 6½ P. M.
31	...	0.05	N.	...	Stratoni to 10 A. M., overcast to 5 P. M., clear afterwards. Slightly foggy at 8 & 9 P. M. Drizzled at 6½ & 11 A. M. & at 1 P. M.

⟋i Cirri, —i Strati, ⌒i Cumuli, ⎵i Cirro-strati, ⌒–i Cumulo strati, ╲⌒–i Nimbi ╲⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January 1868.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	30.038
Max. height of the Barometer occurred at 9 A. M. on the 15th ...	30.207
Min. height of the Barometer occurred at 5 P. M. on the 23rd. ...	29.877
Extreme range of the Barometer during the month	0.330
Mean of the daily Max. Pressures	30.120
Ditto ditto Min. ditto	29.978
Mean daily range of the Barometer during the month	0.142

	o
Mean Dry Bulb Thermometer for the month	68.3
Max. Temperature occurred at 2 & 3 P. M. on the 28th, 29th, & 30th	80.0
Min. Temperature occurred at 7 A. M. on the 3rd.	55.4
Extreme range of the Temperature during the month	24.6
Mean of the daily Max. Temperature	76.6
Ditto ditto Min. ditto, ...	61.0
Mean daily range of the Temperature during the month... ...	15.6

Mean Wet Bulb Thermometer for the month	61.6
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.7
Computed Mean Dew-point for the month	56.2
Mean Dry Bulb Thermometer above computed mean Dew-point ...	12.1
	Inches.
Mean Elastic force of Vapour for the month	0.461

	Troy grain.
Mean Weight of Vapour for the month	5.08
Additional Weight of Vapour required for complete saturation ...	2.52
Mean degree of humidity for the month, complete saturation being unity	0.67

	Inches.
Rained 1 day,—Max. fall of rain during 24 hours	0.05
Total amount of rain during the month	0.05
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.02
Prevailing direction of the Wind... ...	N.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Jan. 1868.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.
Mid night	4				1																			
1	4				1																			
2	4				1																			
3	2				1																			
4	2				1																			
5	3				1																			
6	17				3		1																	
7	17	1			1		4																	
8	20		1		1		3																	
9	19		1		1		3																	
10	18		1		2		3																	
11	19		3		1		1																	
Noon.	17		1		4		2																	
1	16		1		3		2																	
2	21		1		2																			
3	23				1																			
4	17		3		1																			
5	19				2																			
6	16		1		2		1																	
7	2																							
8	2																							
9	1																							
10	2																							
11	2																							

Hour.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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						1																	
2																								
3																					2			
4																					2			
5																					1			
6	1						1												2		3			
7													1						3		4		1	
8													1						2		3			
9													1						2		4			
10													1						2		3		1	
11									1								1		2		2		1	
Noon.							2												1		4			
1			1				1												2		3		2	1
2							2												2		3			
3							1						1						2		3			
4					1		1												3		4		1	
5					1		1										1		3		4			
6					1		1												4		4		1	
7																			1		1			
8																					2			
9																					2			
10																					1			
11																					1			

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1868.

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 the Barometer at 32° Faht.	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	29.987	30.079	29.928	0.151	66.9	73.5	61.0	12.5
2	.988	.070	.918	.152	66.3	76.5	57.4	19.1
3	.969	.034	.906	.128	65.0	70.0	62.0	8.0
4	.997	.070	.939	.131	66.3	72.5	61.0	11.5
5	30.017	.097	.948	.149	66.0	74.0	58.5	15.5
6	29.994	.080	.921	.159	66.9	76.4	58.5	17.9
7	.999	.064	.948	.116	68.4	77.8	59.5	18.3
8	30.045	.135	.975	.160	69.9	77.5	63.5	14.0
9	.067	.155	30.010	.145	70.5	78.5	64.0	14.5
10	.055	.124	.001	.123	69.9	76.8	62.0	14.8
11	.035	.106	29.969	.137	71.2	79.2	63.6	15.7
12	29.995	.069	.949	.120	72.8	81.7	67.0	14.7
13	.942	.001	.882	.119	75.4	84.3	69.3	15.0
14	30.006	.083	.954	.129	76.2	83.6	71.2	12.4
15	.064	.146	30.021	.125	74.9	82.5	67.5	15.0
16	.059	.142	29.997	.145	73.2	81.4	65.5	15.9
17	29.993	.067	.922	.145	72.8	83.0	64.0	19.0
18	.963	.028	.894	.134	74.1	83.0	65.2	17.8
19	.922	.025	.844	.181	73.0	80.5	67.5	13.0
20	.838	29.893	.743	.150	75.9	84.6	70.2	14.4
21	.873	.962	.810	.152	78.0	88.5	70.5	18.0
22	.933	30.009	.869	.140	79.6	87.0	73.0	14.0
23	.859	29.935	.756	.179	76.7	86.7	71.5	15.2
24	.745	.811	.694	.117	76.8	82.5	71.6	10.9
25	.855	.930	.794	.136	75.4	82.6	69.0	13.6
26	.922	30.013	.870	.143	73.1	80.0	68.0	12.0
27	.920	.005	.855	.150	71.2	80.7	62.6	18.1
28	.872	29.944	.771	.173	72.3	83.7	61.5	22.2
29	.807	.892	.723	.169	72.6	82.8	64.5	18.3

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 February 1868.

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	60.1	6.8	54.7	12.2	0.438	4.85	2.43	0.67
2	58.8	7.5	52.8	13.5	.411	.55	.60	.64
3	60.1	4.9	56.2	8.8	.461	5.12	1.75	.75
4	60.3	6.0	55.5	10.8	.450	4.99	2.16	.70
5	58.7	7.3	52.9	13.1	.412	.58	.50	.65
6	60.1	6.8	54.7	12.2	.438	.85	.43	.67
7	61.5	6.9	56.0	12.4	.458	5.06	.56	.66
8	64.2	5.7	59.6	10.3	.516	.68	.30	.71
9	64.3	6.2	59.3	11.2	.511	.61	·52	.69
10	63.0	6.9	57.5	12.4	.481	.30	.68	.66
11	65.6	5.6	61.1	10.1	.543	.96	.34	.73
12	68.0	4.8	64.2	8.6	.601	6.57	.14	.75
13	70.5	4.9	67.1	8.3	.661	7.20	.23	.76
14	71.7	4.5	68.5	7.7	.692	.53	.13	.78
15	66.4	8.5	60.4	14.5	.530	5.77	3.51	.62
16	62.6	10.6	54.1	19.1	.429	4.69	4.13	.53
17	63.3	9.5	55.7	17.1	.453	.96	3.75	.57
18	64.9	9.2	58.5	15.6	.498	5.42	.65	.60
19	67.5	5.5	63.1	9.9	.580	6.34	2.42	.73
20	71.7	4.2	68.8	7.1	.699	7.60	1.97	.79
21	71.3	6.7	66.6	11.4	.651	.05	3.14	.69
22	71.2	8.4	65.3	14.3	.623	6.74	.95	.63
23	71.9	4.8	68.5	8.2	.692	7.53	2.27	.77
24	72.9	3.9	70.2	6.6	.732	.94	1.89	.81
25	67.4	8.0	61.8	13.6	.555	6.04	3.39	.64
26	62.4	10.7	53.8	19.3	.425	4.65	4.14	.53
27	60.5	10.7	51.9	19.3	.398	.38	3.92	.53
28	61.8	10.5	53.4	18.9	.419	.59	.99	.54
29	63.3	9.3	55.9	16.7	.456	.98	.68	.58

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1868.

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.	29.966	30.078	29.774	0.304	68.5	76.5	62.0	14.5
1	.957	.066	.801	.265	68.0	76.5	61.5	15.0
2	.945	.057	.761	.296	67.4	76.3	60.7	15.6
3	.935	.050	.746	.304	67.1	76.0	60.0	16.0
4	.929	.052	.722	.330	66.5	76.0	59.0	17.0
5	.938	.060	.709	.351	66.1	75.5	58.0	17.5
6	.953	.073	.717	.356	65.7	74.5	57.5	17.0
7	.974	.095	.737	.358	65.6	73.5	57.4	16.1
8	30.003	.119	.741	.378	67.8	75.0	60.0	15.0
9	.020	.135	.758	.377	70.9	78.8	63.7	15.1
10	.030	.155	.772	.383	73.7	80.6	64.5	16.1
11	.016	.136	.774	.362	75.9	83.5	66.7	16.8
Noon.	29.984	.111	.751	.360	77.6	85·3	68.2	17.1
1	.956	.078	.730	.348	78.7	86.5	69.5	17.0
2	.924	.042	.708	.334	79.7	86.5	70.0	16.5
3	.905	.031	.695	.336	80.2	88.5	69.7	18.8
4	.896	.022	.694	.328	79.7	87.3	68.5	18.8
5	.901	.026	.697	.329	78.8	86.5	67.4	19.1
6	.914	.036	.708	.328	76.1	84.4	65.5	18.9
7	.929	.053	.730	.323	73.9	81.4	64.0	17.4
8	.952	.068	.761	.307	72.4	80.0	63.5	16.5
9	.967	.080	.781	.299	71.1	78.0	62.5	15.5
10	.973	.090	.798	.292	70.1	77.0	62.0	15.0
11	.971	.083	.800	.283	69.3	76.5	62.5	14.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1868.

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.	64.5	4.0	61.3	7.2	0.546	6.03	1.62	0.79
1	64.6	3.4	61.9	6.1	.557	.16	.37	.82
2	64.2	3.2	61.6	5.8	.552	.10	.29	.83
3	63.9	3.2	61.3	5.8	.546	.05	.27	.83
4	63.6	2.9	61.3	5.2	.546	.06	.13	.84
5	63.2	2.9	60.9	5.2	.539	5.98	.12	.84
6	62.7	3.0	60.3	5.4	.528	.87	.15	.84
7	62.6	3.0	60.2	5.4	.527	.85	.15	.84
8	63.6	4.2	60.2	7.6	.527	.79	.69	.77
9	64.7	6.2	59.7	11.2	.518	.69	2.54	.69
10	65.3	8.4	59.4	14.3	.513	.60	3.36	.63
11	65.8	10.1	58.7	17.2	.501	.45	4.12	.57
Noon.	66.0	11.6	57.9	19.7	.488	.27	.80	.52
1	66.2	12.5	57.4	21.3	.480	.18	5.23	.50
2	66.5	13.2	57.3	22.4	.478	.15	.57	.48
3	66.6	13.6	57.1	23.1	.475	.11	.77	.47
4	66.5	13.2	57.3	22.4	.478	.15	.57	.48
5	66.3	12.5	57.5	21.3	.481	.20	.24	.50
6	66.4	9.7	59.6	16.5	.516	.60	4.03	.58
7	66.3	7.6	61.0	12.9	.541	.90	3.11	.66
8	65.9	6.5	60.7	11.7	.536	.86	2.74	.68
9	65.4	5.7	60.8	10.3	.537	.90	.38	.71
10	65.0	5.1	60.9	9.2	.539	.93	.10	.74
11	64.9	4.4	61.4	7.9	.548	6.04	1.79	.77

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	WIND. Prevailing direction.	Max. Pressure	Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	112.0	...	N. N. W.	...	...	Chiefly clear. Foggy from 8 to 11 P. M.
2	112.0	...	N. N. E.	...	...	Chiefly clear.
3	...	...	N. E.	...	...	Overcast to noon, ⌒_i to 5 P. M., ⌒i afterwards. Light rain at 7 & 8 A. M., & at noon.
4	114.0	...	N. and variable.	...	...	\i to 10 A. M., ⌒i to 5 P. M., clear afterwards. Light rain at 3 A. M.
5	113.0	...	N. & N N. W.	...	...	Clear. Foggy from 8 to 11 P. M.
6	111.8	...	N. W. & N. N. W.	...	...	Clear. Foggy at midnight & 1 A. M., & from 8 to 11 P. M.
7	120.8	...	N.	...	...	Clear to 10 A. M., \i to 3 P. M., clear to 7 P. M., scatd. clouds afterwards. Slightly foggy from midnight to 5 A. M., at 7 & 8 A. M., & from 7 to 10 P. M.
8	114.5	...	N. E. & N.	...	...	Chiefly scatd. \i
9	122.0	...	N. E. & N.	...	...	\i to 8 A. M., clear to 11 A. M., ⌒i to 5 P. M., clear afterwards.
10	119.0	...	N. W. & S. W.	...	...	Clear to 3 A. M., scatd. \i to 7 P. M., clear afterwards.
11	119.0	...	S.S.W.&W.byN.	...	...	Clear to 9 A. M., scatd. ⌒i to 4 P.M., clear afterwards. Slightly foggy at 8 A. M.
12	112.6	...	W.	...	...	Clear to 4 A. M., overcast to 10 A. M., scatd. ⌒i to 6 P. M., clear afterwards. Foggy from 3 to 6 A. M., & at 8 P. M.
13	120.0	...	S. W.	...	...	Clear to 2 A. M., scatd. ⌒i to 5 P. M., clear afterwards.
14	126.6	...	Variable.	...	...	Scatd. \i & stratoni to 10 A. M., ⌒i to 6 P. M., clear afterwards. Slightly foggy at 8 P.M.
15	123.0	...	Variable.	...	...	Chiefly clear.
16	120.0	...	N. N. W. & N.	...	...	Clear.
17	119.0	...	W. & N. W.	...	...	Clear.
18	121.0	...	N. W. & W.	...	...	Chiefly clear. Slightly foggy at 8 A. M.
19	117.6	...	W.	...	...	Clear to 4 A.M., stratoni to 10 A. M., overcast to 1 P. M., scatd. \i to 8 P. M., clear afterwards.
20	125.8	...	S.	...	...	Clear to 2 A. M., stratoni to 6 A. M., \i to 11 A. M., ⌒i to 6 P. M., clear afterwards. Lightning at 7, 10 & 11 P. M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
21	125.5	...	S. & W.	...	131.1	Chiefly clear.
22	123.8	...	N.	...	72.7	Clouds of different kinds to 7 A. M., clear to 11 A.M., \i to 6 P. M., clear afterwards.
23	120.0	...	S.	...	98.4	Stratoni to 8 A. M., scatd. clouds to 4 P. M., overcast with Thunder and Lightning afterwards. High wind at 6 P. M. Slight rain at 5, 6, 9 & 11 P. M.
24	122.5	0.18	Variable.	...	186.2	Overcast to 1 A. M., scatd. clouds afterwards. Thunder at midnight. Lightning to E. Rain with hail at 1 A. M.
25	121.6	...	N.	...	91.5	Clear.
26	117.0	...	N.	...	72.5	Chiefly clear.
27	118.5	...	N. & N. W.	...	55.0	Clear.
28	121.8	...	N. W. & W.	...	52.0	Clear.
29	...	...	N.	...	54.1	Clear.

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\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 February 1868.

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 9th ...	30.155
Min. height of the Barometer occurred at 4 P. M. on the 24th. ...	29.694
Extreme range of the Barometer during the month	0.461
Mean of the daily Max. Pressures	30.033
Ditto ditto Min. ditto	29.890
Mean daily range of the Barometer during the month	0.143

	o
Mean Dry Bulb Thermometer for the month	72.1
Max. Temperature occurred at 3 P. M. on the 21st.	88.5
Min. Temperature occurred at 7 A. M. on the 2nd.	57.4
Extreme range of the Temperature during the month	31.1
Mean of the daily Max. Temperature	80.4
Ditto ditto Min. ditto, ...	65.2
Mean daily range of the Temperature during the month... ...	15.2

Mean Wet Bulb Thermometer for the month	65.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	7.1
Computed Mean Dew-point for the month	59.3
Mean Dry Bulb Thermometer above computed mean Dew-point ...	12.8
	Inches.
Mean Elastic force of Vapour for the month	0.511

	Troy grain.
Mean Weight of Vapour for the month	5.59
Additional Weight of Vapour required for complete saturation ...	2.94
Mean degree of humidity for the month, complete saturation being unity	0.66

	Inches.
Rained 4 days,—Max. fall of rain during 24 hours	0.18
Total amount of rain during the month	0.18
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.13
Prevailing direction of the Wind... ...	N. & N. N. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Feb. 1868.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.
Mid night							1									
1							1									
2	1						1									
3	1						1									
4	1						1									
5							1									
6	10				1		1									
7	12						1	1					1			
8	10		1		1		1						1			
9	9		2		2		1						1			
10	9		1		3		1				1					
11	6				3				1							
Noon.	5		1		4											
1	4				1		2									
2	4				1		3									
3	5				1		3									
4	5				2		1						1		1	
5	4						2		1	1						
6	7						3									
7	2						1									
8	2															
9	1						1									
10	1						1									
11	1						1									

Hour.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.
Mid night									1						1	
1									1						1	
2									1				1		1	
3									1				1		1	
4									1		1				1	
5									1				1		1	
6					1				4				2		2	
7					2				3				1			
8									4		1		1		1	
9									2				1		4	
10									2		1		1		3	
11									2		1				2	
Noon.							1								1	
1									2							
2							1		1						1	
3									2						1	
4									2							
5	1								1				2			
6	1				1				1				1			
7									1						1	
8															1	
9															1	
10															1	
11															1	

Hour.	W. S. W.	Rain on.	W. by S.	Rain on.	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		2			
1											1		1			
2											1					
3											1					
4											1					
5											1				1	
6	1				1						1		3			
7	2		1		1						3		2			
8	1				2						2		3			
9					3						2		2			
10					2						3		2			
11	1		1		2				1		3		5		1	
Noon.	1		2		4		1		2		4		3			
1			1		4		1		1		4		8		1	
2					3		1		1		9		3		1	
3			2		1		3				5		5		1	
4			1		2		1		3		7		3			
5			1		1				4		7		4		1	
6					2		2		3		3		2		3	
7									1		1		2			
8													3			
9													2		1	
10													2		1	
11													3			

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1868.

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 the Barometer at 32° Faht.	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	29.809	29.875	29.748	0.127	74.5	86.0	63.5	22.5
2	.893	.968	.831	.137	76.2	85.5	67.0	18.5
3	.931	30.005	.879	.126	77.8	89.2	69.5	19.7
4	.885	29.978	.814	.164	78.3	90.8	68.5	22.3
5	.782	.868	.719	.149	79.9	92.7	71.5	21.2
6	.810	.904	.747*	.157	78.4	89.0	69.5	19.5
7	.807	.868	.738	.130	74.9	83.0	68.5	14.5
8	.857	.923	.798	.125	71.6	81.0	62.7	18.3
9	.935	30.018	.881	.137	74.7	86.0	65.0	21.0
10	.907	29.989	.799	.190	75.6	86.1	68.0	18.1
11	.915	.995	.849	.146	73.0	82.0	65.7	16.3
12	30.010	30.105	.954	.151	73.9	83.0	64.5	18.5
13	29.974	.050	.907	.143	75.8	87.0	65.5	21.5
14	.891	29.962	.814	.148	79.3	90.0	72.0	18.0
15	.846	.924	.780	.144	80.9	90.5	74.6	15.9
16	.918	.991	.849	.142	79.9	88.8	73.0	15.8
17	.974	30.052	.883	.169	81.3	92.0	72.2	19.8
18	.969	.037	.899	.138	77.5	88.0	68.5	19.5
19	.890	29.979	.799	.180	79.1	89.0	71.0	18.0
20	.887	.971	.831	.140	80.7	91.0	72.4	18.6
21	.912	.985	.845	.140	82.5	93.5	74.5	19.0
22	.909	30.011	.828	.183	83.5	95.3	74.5	20.8
23	.857	29.920	.805	.115	84.2	95.5	74.4	21.1
24	.848	.924	.790	.134	84.3	94.5	75.5	19.0
25	.873	.955	.808	.147	84.5	94.9	76.0	18.9
26	.860	.938	.784	.154	83.2	95.0	76.0	19.0
27	.843	.898	.796	.102	83.0	92.0	77.0	15.0
28	.851	.937	.775	.162	84.0	95.7	74.8	20.9
29	.859	.938	.781	.157	84.7	96.7	75.0	21.7
30	.847	.907	.793	.114	83.4	91.5	77.3	14.2
31	.885	.962	.826	.136	84.9	94.5	76.5	18.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1868.

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	65.7	8.8	59.5	15.0	0.515	5.61	3.57	0.61
2	69.1	7.1	64.1	12.1	.599	6.51	.15	.67
3	71.2	6.6	66.6	11.2	.651	7.05	.08	.70
4	70.1	8.2	64.4	13.9	.605	6.55	.73	.64
5	70.6	9.3	64.1	15.8	.599	.46	4.32	.60
6	69.9	8.5	63.9	14.5	.595	.43	3.88	.62
7	68.7	6.2	64.4	10.5	.605	.59	2.69	.71
8	60.1	11.5	50.9	20.7	.385	4.22	4.18	.50
9	66.7	8.0	61.1	13.6	.543	5.91	3.32	.64
10	68.6	7.0	63.7	11.9	.591	6.43	.05	.68
11	64.3	8.7	57.3	15.7	.478	5.22	.54	.60
12	63.4	10.5	56.0	17.9	.458	4.99	4.02	.55
13	66.2	9.6	59.5	16.3	.515	5.60	3.94	.59
14	73.6	5.7	69.6	9.7	.717	7.74	2.85	.73
15	75.2	5.7	71.2	9.7	.756	8.13	.97	.73
16	74.8	5.1	71.2	8.7	.756	.15	.63	.76
17	74.9	6.4	70.4	10.9	.736	7.92	3.32	.71
18	68.7	8.8	62.5	15.0	.568	6.16	.88	.61
19	69.6	9.5	62.9	16.2	.576	.22	4.31	.59
20	72.5	8.2	66.8	13.9	.655	7.06	3.98	.64
21	73.5	9.0	67.2	15.3	.664	.13	4.51	.61
22	74.4	9.1	68.0	15.5	.681	.29	.71	.61
23	72.9	11.3	65.0	19.2	.617	6.61	5.63	.54
24	73.5	10.8	65.9	18.4	.636	.81	4.47	.60
25	74.9	9.6	68.2	16.3	.686	7.34	5.01	.60
26	76.7	6.5	72.1	11.1	.778	8.34	3.55	.70
27	73.0	10.0	66.0	17.0	.638	6.84	4.98	.58
28	70.8	13.2	61.6	22.4	.552	5.90	6.27	.49
29	76.2	8.5	70.2	14.5	.732	7.81	4.61	.63
30	77.5	5.9	73.4	10.0	.811	8.69	3.27	.73
31	72.3	12.6	63.5	21.4	.588	6.27	6.22	.50

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1868.

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.	29.889	30.023	29.782	0.241	74.5	81.5	67.7	13.8
1	.879	.005	.772	.233	73.8	80.5	67.0	13.5
2	.867	29.989	.759	.230	73.2	80.0	66.5	13.5
3	.858	.980	.747	.233	72.8	79.5	66.0	13.5
4	.856	.990	.762	.228	72.2	78.5	65.0	13.5
5	.870	30.004	.776	.228	71.8	77.5	64.0	13.5
6	.889	.025	.794	.231	71.4	77.3	63.0	14.3
7	.910	.042	.814	.228	71.9	78.2	62.7	15.5
8	.937	.076	.846	.230	74.9	80.0	66.7	13.3
9	.955	.101	.857	.244	78.5	84.0	69.8	14.2
10	.960	.105	.863	.242	81.7	88.6	73.4	15.2
11	.948	.093	.848	.245	84.6	91.5	75.5	16.0
Noon.	.923	.065	.828	.237	86.6	92.9	77.0	15.9
1	.895	.033	.795	.238	88.1	94.0	78.4	15.6
2	.864	29.993	.769	.224	89.2	95.2	80.0	15.2
3	.840	.973	.732	.241	89.6	96.0	80.5	15.5
4	.828	.958	.722	.236	89.3	96.7	81.0	15.7
5	.827	.954	.719	.235	88.1	95.5	79.0	16.5
6	.834	.963	.722	.241	85.1	91.5	76.5	15.0
7	.849	.967	.730	.237	81.9	88.0	74.4	13.6
8	.872	.979	.750	.229	79.7	86.2	71.5	14.7
9	.891	.995	.762	.233	77.8	84.5	70.5	14.0
10	.900	30.011	.769	.242	76.5	82.6	69.6	13.0
11	.897	.031	.763	.268	75.5	81.0	68.2	12.8

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 1868.

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.	70.6	3.9	67.9	6.6	0.679	7.40	1.78	0.81
1	70.4	3.4	68.0	5.8	.681	.44	.54	.83
2	70.1	3.1	67.6	5.6	.672	.35	.47	.83
3	69.8	3.0	67.4	5.4	.668	.32	.39	.84
4	69.5	2.7	67.3	4.9	.666	.30	.25	.85
5	69.2	2.6	67.1	4.7	.661	.25	.20	.86
6	68.9	2.5	66.9	4.5	.657	.21	.14	.86
7	69.3	2.6	67.2	4.7	.664	.28	.20	.86
8	70.8	4.1	67.9	7.0	.679	.40	.88	.80
9	71.8	6.7	67.1	11.4	.661	.16	3.19	.69
10	72.0	9.7	65.2	16.5	.621	6.68	4.69	.59
11	72.0	12.6	63.2	21.4	.582	.22	6.17	.50
Noon.	72.2	14.4	63.6	23.0	.590	.27	.87	.48
1	72.4	15.7	63.0	25.1	.578	.13	7.59	.45
2	72.2	17.0	62.0	27.2	.559	5.92	8.24	.42
3	72.1	17.5	61.6	28.0	.552	.83	.50	.41
4	72.0	17.3	61.6	27.7	.552	.83	.38	.41
5	71.0	17.1	60.7	27.4	.536	.68	.04	.41
6	71.6	13.5	62.1	23.0	.561	.98	6.59	.48
7	71.5	10.4	64.2	17.7	.601	6.45	4.99	.56
8	70.9	8.8	64.7	15.0	.611	.60	.12	.62
9	70.9	6.9	66.1	11.7	.640	.93	3.20	.68
10	71.0	5.5	67.1	9.4	.661	7.19	2.56	.74
11	70.9	4.6	67.7	7.8	.674	.34	.12	.78

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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* 1868.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	124.6	...	Variable.	...	30.5	Clear to 11 A. M., scatd. ⌒i to 4 P.M., clear afterwards. Slightly foggy at 8 P. M.
2	128.8	...	S.	...	35.2	Clear to 10 A. M., scatd. ⌒i to 4 P. M., clear afterwards.
3	126.0	...		...	85.8	Clear.
4	127.5	...	S.	...	125.4	Clear to noon, scatd. \i to 6 P. M., clear afterwards.
5	130.0	...	S. & W.	...	159.3	Clear.
6	127.2	...	S. & variable.	...	130.4	Clear.
7	122.0	...	W.byS.& variable.	...	96.1	Scuds from S to 7 A. M., ⌒i afterwards.
8	122.0	...	N., W. S. W. & S.	...	126.4	Clear.
9	125.0	...	S. & S. by E.	...	84.2	Clear nearly the whole day.
10	125.0	...	S. & S. S. W.	...	127.2	Clouds of different kinds.
11	123.4	...	S.W.& variable.	...	204.6	Clear.
12	122.0	...	W. by S.	...	93.5	Clear.
13	127.0	...	W.S.W.&S.byW.	...	81.4	Clear.
14	129.5	...	S.S.W. & S.byW.	1.8	151.3	Chiefly clear.
15	130.0	...	S. S. W. & S.	2.0	267.9	Chiefly _i.
16	126.0	...	E. S. E.	0·1	120.4	Clear to 5 A. M., scatd. _i to 10 A. M., scatd. ⌒i to 6 P. M., clear afterwards.
17	130.0	0.16	Variable.	12·0	85.7	Clouds of different kinds to 8 A. M., scatd. ⌒i to 6 P. M., overcast afterwards. High wind, thunder & rain at 8 P. M. Lightning from 7 to 9 P. M.
18	...	...	N .W. & N. N. E.	2.0	174.0	Chiefly clear.
19	...	...	Variable.	0.6	96.6	Scatd. ⌒i to 3 A.M., cleartoll A. M., scatd ⌒i to 3 P. M., clear afterwards.
20	136.0	...	S. S. W. & S. by W.	0.8	140.9	Clear to 8 A. M., scatd. _i & ⌒i to 6 P. M., clear afterwards.
21	135.7	...	S. W. & S.by W.	0.3	166.0	Clear to 5 A. M., scatd. \i to 6 P. M., clear afterwards.
22	136.0	...	S. by W. & W.	0.4	117.2	Clear to 4 A. M., scatd. \i to 8 A. M., clear afterwards.
23	139.0	...	W.byN.&variable	0.2	97.0	Clear to 10 A. M., scatd. \i to 7 P. M., clear afterwards.
24	133.5	...	S.byW.& variable.	0.1	100.8	Clear to noon, \i to 6 P. M., clear afterwards.
25	135.0	...	S. by W.	...	75.0	Clear to 5 A. M., scatd. \i to 11 A. M., stratoni to 3 P. M., \i afterwards.
26	134.0	...	S. S. W. & S. by E.	...	126.7	Clear to 5 A. M., scatd. \i to 7 P. M., clear afterwards.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	WIND. Prevailing direction.	Max. Pressure	Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
27	130.0	...	S. by W. & N. N. W.	2.3	164.9	Stratoni nearly the whole day.
28	135.8	...	S. S. W.	0.2	140.0	Scatd. \i to 6 P. M., clear afterwards.
29	139.0	...	S S W, W & S by W	1.0	149.4	Clear to 11 A. M., scatd. \i afterwards.
30	118.0	...	S. S. W. & S. by W.	0.4	170.0	Clear to 5 A. M., stratoni afterwards.
31	132.4	...	S. S. W. & N. W.	0.7	162.5	Scatd. \i to 11 A. M., scatd. _i to 5 P. M., \\^i afterwards.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒–i Cumulo strati, \\⌒i Nimbi, \\^i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March 1868.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.885
Max. height of the Barometer occurred at 10 A. M. on the 12th ...	30.105
Min. height of the Barometer occurred at 5 P. M. on the 5th. ...	29.719
Extreme range of the Barometer during the month	0.386
Mean of the daily Max. Pressures	29.962
Ditto ditto Min. ditto	29.818
Mean daily range of the Barometer during the month	0.144

	o
Mean Dry Bulb Thermometer for the month	79.5
Max. Temperature occurred at 4 P. M. on the 29th.	96.7
Min. Temperature occurred at 7 A. M. on the 8th.	62.7
Extreme range of the Temperature during the month	34.0
Mean of the daily Max. Temperature	90.0
Ditto ditto Min. ditto, ...	71.1
Mean daily range of the Temperature during the month... ...	18.9

Mean Wet Bulb Thermometer for the month	71.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	8.5
Computed Mean Dew-point for the month	65.0
Mean Dry Bulb Thermometer above computed mean Dew-point ...	14.5
	Inches.
Mean Elastic force of Vapour for the month	0.617

	Troy grain.
Mean Weight of Vapour for the month	6.66
Additional Weight of Vapour required for complete saturation ...	4.00
Mean degree of humidity for the month, complete saturation being unity	0.63

	Inches.
Rained 1 day,—Max. fall of rain during 24 hours	0.16
Total amount of rain during the month	0.16
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.10
Prevailing direction of the Wind... ... S. S. W. & S.	

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***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March* 1868.**

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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						2				1				1		1		5		5		5		2																	
1					2												1				3		1		3		5		4		4				1													
2					1												1						1		4		3		7		2		2		1								1					
3					1														1				1		2		5		7		1		3		1								1					
4	1										1														3		4		6		1		2		1		1		1		1							
5	1																1								2		5		5		2		1		3				1		1							
6	3												1				1				1		1		4		4		8		1		1		1		3						1					
7	2		1						1										2				1		4		6		5		1		1		2		1		1		1						1	
8	2		1		1								1				1		1						5				7		4		3		1		1								2			
9	1		1		1				1										1				1		3		1		5		7		3				1						2		2			
10	2				3										1				1						4		2		4		4		3				2						3		1			
11	1				2												1				2		1		2		3		2		6		2		2		3						1		2			
Noon.					1		1								1								3		1		1		4		2		3		3		4		2						3		1	
1	3														1		1				1		1		3				2		3		4		2		3		1		2		1		1		1	
2	1						1												1		1		1		3				2		2		2		6		3		2		2		2		1			
3													1						1				3		4		1		3		2		5		1		2		2		2		3					
4																	1				2		2		4		4		1				3		1		6		1		2		1		1		1	
5	2																1		2				4		2				7						4		4		2				1		1			
6	1				1												1				1		2		7		1		6		1		2		1		4		1								1	
7			1		1												1		1		1		1		2		6		5		2				1		2		1						2			
8	1				1														1				3		4		5		5		1				1		1		1				1	1	2			
9							2		1												1		2		5		6		5		1												2		1			
10	1						1		1				2										3		6		5		5		2																	
11					1		2						1		2								1		5		7		5		2																	

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

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 the Barometer at 32° Faht.	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	29.928	30.016	29.861	0.155	84.7	94.8	76.5	18.3
2	.898	29.983	.823	.160	85.2	95.2	76.8	18.4
3	.846	.917	.773	.144	85.3	95.4	76.0	19.4
4	.869	.949	.802	.147	85.2	97.5	76.5	21.0
5	.920	.980	.841	.139	73.1	78.5	67.5	11.0
6	.897	.976	.803	.173	77.6	89.8	67.5	22.3
7	.842	.907	.741	.166	81.4	90.5	74.0	16.5
8	.796	.856	.712	.144	82.1	90.0	75.5	14.5
9	.776	.845	.686	.159	83.0	93.0	77.0	16.0
10	.765	.814	.674	.140	83.2	91.0	77.0	14.0
11	.746	.824	.652	.172	82.9	91.0	74.0	17.0
12	.737	.803	.644	.159	81.4	92.0	75.0	17.0
13	.742	.797	.684	.113	82.3	90.4	75.0	15.4
14	.740	.808	.671	.137	83.6	90.0	79.0	11.0
15	.781	.849	.721	.128	84.2	90.6	78.6	12.0
16	.784	.937	.664	.273	82.4	90.4	70.4	20.0
17	.801	.870	.733	.137	81.0	90.5	71.4	19.1
18	.762	.833	.696	.137	83.5	93.4	75.6	17.8
19	.714	.784	.632	.152	85.4	94.0	79.0	15.0
20	.684	.750	.615	.135	86.3	94.5	80.5	14.0
21	.683	.783	.608	.175	87.3	98.0	80.5	17.5
22	.650	.707	.569	.138	88.0	97.8	80.0	17.8
23	.736	.818	.681	.137	87.3	96.0	80.9	15.1
24	.798	.854	.693	.161	82.6	93.5	73.0	20.5
25	.810	.847	.749	·098	73.3	86.7	68.7	18.0
26	.783	.862	.700	.162	76.6	84.5	68.4	16.1
27	.733	.812	.656	.156	82.6	91.0	75.0	16.0
28	.663	.724	.571	.153	85.3	91.5	80.0	11.5
29	.639	.689	.578	.111	88.3	97.4	82.5	14.9
30	.706	.790	.646	.144	88.7	98.5	81.5	17.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

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	75.5	9.2	69.1	15.6	0.706	7.53	4.89	0.61
2	75.2	10.0	68.2	17.0	.686	.32	5.29	.58
3	71.8	13.5	62.3	23.0	.565	6.02	6.62	.48
4	74.0	11.2	66.2	19.0	.642	.85	5.76	.54
5	69.3	3.8	66.3	6.8	.644	7.05	1.74	.80
6	73.1	4.5	69.9	7.7	.725	.85	2.22	.78
7	76.4	5.0	72.9	8.5	.797	8.57	.70	.76
8	76.9	5.2	73.3	8.8	.809	.68	.83	.75
9	77.2	5.8	73.1	9.9	.803	.61	3·21	.73
10	78.0	5.2	74.4	8.8	.838	.99	2.90	.76
11	77.4	5.5	73.5	9.4	.814	.74	3.05	.74
12	75.4	6.0	71.2	10.2	.756	.13	.14	.72
13	77.9	4.4	74.8	7.5	.840	9.11	2.47	.79
14	78.8	4.8	75.4	8.2	.865	.28	.75	.77
15	78.4	5.8	74.3	9.9	.835	8.94	3.30	.73
16	76.9	5.5	73.0	9.4	.801	.60	.01	.74
17	74.0	7.0	69.1	11.9	.706	7.59	.55	.68
18	77.6	5.9	73.5	10.0	.814	8.72	.28	.73
19	80.5	4.9	77.1	8.3	.913	9.76	2.92	.77
20	81.5	4.8	78.1	8.2	.943	10.06	.96	.77
21	78.2	9.1	72.7	14.6	.792	8.42	4.99	.63
22	78.4	9.6	72.6	15.4	.790	.40	5.28	.61
23	76.9	10.4	70.7	16.6	.744	7.90	.51	.59
24	77.1	5.5	73.2	9.4	.806	8.66	3.02	.74
25	70.6	2.7	68.4	4.9	.690	7.54	1.30	.85
26	72.1	4.5	68.9	7.7	.701	.62	2.15	.78
27	77.0	5.6	73.1	9.5	.803	8.61	3.07	.74
28	81.3	4.0	78.5	6.8	.955	10.21	2.43	.81
29	83.2	5.1	80.1	8.2	1.005	.67	3.13	.77
30	81.4	7.3	77.0	11.7	0.910	9.65	4.31	.69

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

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.	29.786	29.926	29.643	0.283	78.7	84.0	67.5	16.5
1	.775	.915	.636	.279	78.2	83.5	67.6	15.9
2	.764	.904	.619	.285	77.8	83.0	68.0	15.0
3	.756	.902	.615	.287	77.6	82.7	68.2	14.5
4	.753	.922	.606	.316	77.4	82.5	68.5	14.0
5	.768	.929	.613	.316	77.3	83.0	67.8	15.2
6	.781	.940	.627	.313	77.4	83.0	67.6	15.4
7	.804	.968	.645	.323	78.4	83.5	68.5	15.0
8	.826	.992	.668	.324	81.1	86.0	70.5	15.5
9	.837	30.014	.685	.329	84.0	88.5	74.0	14.5
10	.838	.016	.689	.327	86.5	90.8	76.7	14.1
11	.827	.002	.682	.320	88.5	93.2	78.5	14.7
Noon.	.809	29.967	.667	.300	90.0	95.5	78.5	17.0
1	.784	.951	.640	.311	90.4	97.5	68.9	28.6
2	.752	.919	.620	.299	91.0	98.5	68.7	29.8
3	.724	.925	.584	.341	91.2	98.4	70.5	27.9
4	.708	.908	.569	.339	90.4	98.0	68.0	30.0
5	.705	.932	.571	.361	88.3	97.5	68.0	29.5
6	.722	.913	.576	.337	85.9	95.2	68.5	26.7
7	.742	.921	.608	.313	83.7	91.5	67.9	23.6
8	.762	.942	.633	.309	81.8	88.8	68.0	20.8
9	.782	.948	.639	.309	80.5	86.0	68.2	17.8
10	.789	.950	.665	.285	79.6	85.0	68.0	17.0
11	.790	.939	.671	.268	79.1	84.5	67.5	17.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

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.	
Midnight.	75.3	3.4	72.9	5.8	0.797	8.63	1.78	0.83
1	75.1	3.1	72.9	5.3	.797	.64	.61	.84
2	75.0	2.8	73.0	4.8	.801	.67	.46	.86
3	75.0	2.6	73.2	4.4	.806	.75	.32	.87
4	75.0	2.4	73.3	4.1	.809	.77	.24	.88
5	75.1	2.2	73.6	3.7	.817	.86	.12	.89
6	75.2	2.2	73.7	3.7	.819	.89	.12	.89
7	76.0	2.4	74.3	4.1	.835	9.05	.26	.88
8	77.1	4.0	74.3	6.8	.835	8.99	2.18	.81
9	77.9	6.1	73.6	10.4	.817	.75	3.42	.72
10	78.5	8.0	73.7	12.8	.819	.73	4.37	.67
11	78.8	9.7	73.0	15.5	.801	.48	5.40	.61
Noon.	78.8	11.2	72.1	17.9	.778	.22	6.28	.57
1	78.6	11.8	71.5	18.9	.763	.06	.61	.55
2	78.5	12.5	71.0	20.0	.751	7.92	7.01	.53
3	78.5	12.7	70.9	20.3	.748	.90	.12	.53
4	78.0	12.4	70.6	19.8	.741	.82	6.85	.53
5	77.3	11.0	70.7	17.6	.744	.89	5.91	.57
6	77.0	8.9	70.8	15.1	.746	.95	4.92	.62
7	76.8	6.9	72.0	11.7	.776	8.30	3.77	.69
8	76.5	5.3	72.8	9.0	.795	.55	2.85	.75
9	76.0	4.5	72.8	7.7	.795	.57	.41	.78
10	75.9	3.7	73.3	6.3	.809	.73	1.96	.82
11	75.8	3.3	73.5	5.6	.814	.79	.74	.84

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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 1868.

Solar Radiation, Weather, &c.

Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	WIND. Prevailing direction.	WIND. Max. Pressure	WIND. Daily Velocity.	General aspect of the Sky.
o	Inches		℔	Miles	
138.5	...	S. S. W. & S.	0.8	150.0	Clear to 8 A. M., scatd. _i to 5 P. M., clear afterwards.
135.0	...	S. S.W. & N.	8.5	175.8	Chiefly clear. Slightly foggy at 8 P. M.
135.7	...	W. N. W.	0.7	174.8	Scatd. \i to 8 A. M., clear afterwards.
138.5	0.30	W. & S.	18.0	106.4	Clear to 6 A. M., scatd. \i to 10 A. M., clear to 3 P. M., clouds of different kinds afterwards. High wind at 8¼ P. M. Lightning & Thunder from 7 to 9 P. M. Rain at 8 P. M.
...	0.87	S. E. & E. N. E.	3.0	162.1	Scatd. ⌒i & \⌒i to 11 A. M., overcast to 6 P. M., scatd. \⌒i afterwards. Strong wind at 7 & 8 A. M., & from 1 to 4 P. M. Lightning at 7 A. M. Thunder at 7 A. M., 1 P. M., & from 3 to 5 P. M. Rain at 7 & 10½ A. M., & at 3 & 4 P. M.
...	...	S. by W. & S.	1.1	178.4	Clear to 4 A. M., \⌒i to 7 A. M., scatd. ⌒i afterwards.
...	...	E. S. E. & S.	1.7	134.5	Clouds of different kinds to 7 A. M., scatd. ⌒i to 3 P. M., stratoni afterwards.
132.0	...	S.	2.5	198.1	Clear to 4 A. M., ⌒i to 2 P. M., overcast to 5 P. M., clouds of different kinds afterwards. Brisk wind from 8¼ A. M. to 6½ P. M. Lightning to N at 8 & 10 P. M.
137.0	...	Variable.	2.0	171.2	Scatd. ⌒i to 4 P. M., _i & stratoni afterwards. Brisk wind from 4¼ to 5¾ P. M. Lightning to S at 7 & 8 P. M.
134.5	...	S. S. W.	4.9	167.2	Clear to 8 A. M., scuds from S to noon, clear to 4 P. M., scatd. _i to afterwards. Brisk wind from 7 A. M. to 11½ P. M. Lightning to N at 7 & 9 P. M.
132.7	...	S. & S. S. W.	14.0	319.0	Clear to 4 A. M., scatd. ⌒i to 5 P. M., _i to 9 P. M., clear afterwards. High wind from midnight to 3 A. M., & from 9½ A. M. to 8½ P. M. Thunder at 7 P. M. Lightning at 7 and 8 P. M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Max. Pressure	Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
12	134.0	0.70	S.S.W. & S. S. E.	21.0	335.4	Scatd. \i to 5 A. M., scuds from S to 10 A. M., scatd. ⌒i to 4 P.M., clouds of different kinds afterwards. High wind from 9½ A. M. to 6½ P. M. Thunder at 5 & 6 P. M. Lightning from 6 to 8 P. M. Rain at 6 & 7 P. M.
13	129.8	...	S. S. & W.	3.0	248.7	Chiefly scatd. ⌒i. Brisk wind from 8 A. M. to 8 P. M.
14	131.2	...	S. & S. S. W.	4.5	315.4	Scuds from S to 6 P. M., clear afterwards. Brisk wind from 7 A. M. to 11½ P. M. Lightning to N at 9 & 10 P. M.
15	132.0	...	S. by E. & S.	4.0	295.5	Clear to 6 A. M., scuds from S to 10 A. M., scatd. ⌒i & scuds from S afterwards. High wind from 8 A. M. to 6½ P. M. Lightning at midnight & 9 P. M.
16	131.8	0.95	S. & S. by W.	6.6	292.7	Scuds from S to 10 A. M., scatd. ⌒i to 6 P.M., overcast afterwards. High wind from 7 A. M. to 9½ P. M. Thunder & lightning from 8 to 11 P. M. Rain at 8 & 9 P. M.
17	129.6	...	S.S.W.& variable.	3.8	344.2	Clouds of different kinds to 8 P. M., clear afterwards. Brisk wind from 2 A. M. to 7½ P. M., Lightning from 1to 4 A. M.
18	133.5	...	S. S. W. & S.	1.5	213.9	Clear. Brisk wind from 5 to 9 P. M.
19	132.3	...	S. & S. S. W.	1.3	292.4	Chiefly clear. Brisk wind from 6 to 7 P. M.
20	137.0	...	S. & S. S. W.	0.3	255.2	Clear to 3 A. M., clouds of different kinds afterwards.
21	138.0	...	S. & variable.	...	154.3	Scatd. _i to 4 A. M., stratoni to 10 A. M., scatd. \i to 1 P. M., scatd. \i to 7 P. M., clear afterwards. Slight rain at 6 A. M.
22	135.0	...	Variable.	...	141.3	Clear to 4 A. M., Scatd. \i to Noon, ⌒i to 8 P. M., clear afterwards. Slight rain at 1¾ P. M.
23	134.0	...	S. by E.& S.by W.	0.9	126.4	Chiefly clear. Brisk wind at 8¼ P. M. Slight rain at 10 A. M.

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Abstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

Solar Radiation, Weather, &c.,

Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
137.0	0.18	S. S. W.	24.8	148.4	Clear to 6 A. M., scatd. ⌒i to 2 P.M., overcast to 8 P.M., scatd. ⎵i afterwards. High wind from 1½ to 5¼ P. M. Thunder & lightning at 5 & 6 P. M. Slight rain from 5 to 8 P. M.
128.3	2.47	S. S. E.&E. S. E.	31.0	221.2	Clear to 6 A. M., scatd. ⌒i to noon, overcast afterwards. Storm from 12½ to 2 P. M. Thunder at 1 P. M. Rain from 1 to 6 P. M.
138.0	...	W. by S. &E. S.E.	...	136.3	Clear to 6 A. M., scatd. ⌒i to 4 P. M., clear afterwards.
137.8	...	S. by E. & S.	...	49.7	Clear to 5 A.M., scatd. ⌒i to 7 P. M., clear afterwards.
133.0	...	S. & S. S. W.	3.1	172.9	Scatd. ⌒i to 3 P. M., clear afterwards. Brisk wind from 8¼ A. M. to 4 P. M., & from 8½ to 9½ P. M. Lightning to N W at 8 & 9 P. M.
137.0	...	S.byW, SSW&S.	1.0	179.8	Stratoni to 5 A.M., scuds from S to 9 A. M., clear to 7 P. M., scuds from S afterwards. Brisk wind at 7½ A. M., & from 5½ to 7 P. M.
139.0	...	S. & S. by E.	1.4	311.5	Chiefly clear. Brisk wind from 8½ to 11¾ P M.

Cirri, —i Strati, ⌒i Cumuli, ⎵i Cirro-strati, ⌢i Cumulo strati, ⏝i Nimbi Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April 1868.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.774
Max. height of the Barometer occurred at 10 A. M. on the 1st. ...	30.016
Min. height of the Barometer occurred at 4 P. M. on the 22nd. ...	29.569
Extreme range of the Barometer during the month	0.447
Mean of the daily Max. Pressures	29.846
Ditto ditto Min. ditto	29.696
Mean daily range of the Barometer during the month	0.150

	o
Mean Dry Bulb Thermometer for the month	83.1
Max. Temperature occurred at 2 P. M. on the 30th.	98.5
Min. Temperature occurred at Midnight & 11 P. M. on the 5th & 6th.	67.5
Extreme range of the Temperature during the month	31.0
Mean of the daily Max. Temperature	92.2
Ditto ditto Min. ditto, ...	75.8
Mean daily range of the Temperature during the month... ...	16.4

Mean Wet Bulb Thermometer for the month	76.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.4
Computed Mean Dew-point for the month	72.2
Mean Dry Bulb Thermometer above computed mean Dew-point ...	10.9
	Inches.
Mean Elastic force of Vapour for the month	0.781

	Troy grain.
Mean Weight of Vapour for the month	8.36
Additional Weight of Vapour required for complete saturation ...	3.50
Mean degree of humidity for the month, complete saturation being unity	0.71

	Inches.
Rained 9 days,—Max. fall of rain during 24 hours	2.47
Total amount of rain during the month	5.47
Total amount of rain indicated by the Gauge attached to the anemometer during the month	3.77
Prevailing direction of the Wind... ... S. & S. S. W.	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April. 1868.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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						2		4		4		6		5		3		1																	
1																	1		1		2		6		7		3		2		3						1											
2																	1				2		3		10		1		6								1		1									
3																	2				2		4		4		5		6								1		1									
4							1										2		1				4		5		3		6								1		1				1					
5							1												1		2		4		6		3		6								1										1	
6									1								2		1				4		7	1	5		8								1										1	
7							1		1						1		1		1		1		1		5		8		7		1						1										1	
8			1		1				1						1		1				3				4		1		13		2						1				1							
9							1				1		1				1				2		1		4		2		11		4						1								1			
10	1		1										1	1					1		2				6		3		11		3				1													
11																	1	1					1		8		2		10		5						1						1		1			
Noon.									1												1		2		2		6		8		4		1				2						2				1	
1	1						1														2				5		3		8		2		1		2		2				1		1		1	1		
2	1								1								1	1							5		4		9		2		3						1		2	1			1			
3	2								1	1			1	1									2		9		1		7		1		1		2		2		1									
4	1																1	1			1				9	1	1		7		4		1		1				1		3							
5	1												1						1	1	2		1		9		2		8		1				1						2				1	1		
6			1				1						1	1					2		1	1	3		10		2		5		1	1	1		1						1							
7			1																2	1	2		4		12		1		4						1						1							
8			1												1				2		2		1		12		3	1	2		1				1	1	1				1							
9			1														2		4	1	1		2		11		4								1													
10															1				5		3		4		7		4				1				1													
11																			1		5		5		7		5		1		1				1													

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

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 the Barometer at 32° Faht.	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	29.739	29.814	29.685	0.129	87.3	96.0	81.0	15.0
2	.785	.855	.719	.136	86.0	93.3	79.8	13.5
3	.818	.891	.752	.139	86.9	95.4	81.0	14.4
4	.836	.923	.765	.158	86.6	95.2	80.0	15.2
5	.785	.859	.690	.169	86.7	95.3	80.3	15.0
6	.686	.767	.566	.201	87.7	98.0	80.0	18.0
7	.639	.697	.557	.140	87.1	96.3	81.0	15.3
8	.720	.879	.585	.294	85.0	94.2	73.5	20.7
9	.827	.892	.752	.140	76.3	87.5	72.5	15.0
10	.751	.840	.643	.197	80.6	90.2	71.5	18.7
11	.730	.790	.670	.120	79.0	90.0	71.4	18.6
12	.764	.820	.664	.156	80.2	88.5	72.0	16.5
13	.786	.846	.725	.121	84.2	91.5	78.0	13.5
14	.808	.866	.752	.114	81.3	89.0	75.0	14.0
15	.842	.898	.784	.114	83.6	91.2	78.0	13.2
16	.904	.959	.839	.120	83.1	92.4	79.0	13.4
17	.900	.989	.809	.180	82.1	90.2	76.2	14.0
18	.847	.896	.758	.138	82.7	91.5	75.0	16.5
19	.803	.873	.715	.158	82.1	91.5	75.0	16.5
20	.809	.906	.743	.163	81.9	89.0	75.0	14.0
21	.770	.832	.703	.129	83.7	91.5	77.5	14.0
22	.773	.858	.689	.169	84.9	93.0	77.0	16.0
23	.779	.869	.699	.170	84.5	92.6	76.7	15.9
24	.729	.789	.636	.153	84.2	94.2	79.0	15.2
25	.717	.780	.619	.161	86.1	94.7	78.0	16.7
26	.733	.795	.642	.153	86.5	96.0	79.4	16.6
27	.727	.778	.632	.146	86.6	95.5	79.3	16.2
28	.695	.764	.606	.158	87.9	95.5	81.5	14.0
29	.650	.714	.564	.150	86.7	95.8	80.5	15.3
30	.649	.702	.584	.118	87.2	94.5	81.0	13.5
31	.689	.777	.641	.136	84.1	94.5	77.7	16.8

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

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	81.5	5.8	78.0	9.3	0.940	10.01	3.40	0.75
2	80.6	5.4	76.8	9.2	.905	9.65	.26	.75
3	81.1	5.8	77.6	9.3	.928	.89	.36	.75
4	79.8	6.8	75.7	10.9	.873	.30	.84	.71
5	79.6	7.1	75.3	11.4	.862	.19	.99	.70
6	80.3	7.4	75.9	11.8	.879	.34	4.22	.69
7	81.1	6.0	77.5	9.6	.925	.84	3.49	.74
8	79.6	5.4	75.8	9.2	.876	.37	.16	.75
9	72.6	3.7	70.0	6.3	.727	7.90	1.79	.83
10	76.6	4.0	73.8	6.8	.822	8.85	2.16	.80
11	75.4	3.6	72.9	6.1	.797	.63	1.87	.83
12	75.5	4.7	72.2	8.0	.781	.41	2.47	.77
13	80.0	4.2	77.1	7.1	.913	9.78	.46	.80
14	76.9	4.4	73.8	7.5	.822	8.84	.40	.79
15	78.6	5.0	75.1	8.5	.857	9.17	.86	.76
16	78.1	5.0	74.6	8.5	.843	.03	.83	.76
17	77.8	4.3	74.8	7.3	.849	.13	.38	.79
18	77.1	5.6	73.2	9.5	.806	8.64	3.08	.74
19	77.0	5.1	73.4	8.7	.811	.71	2.80	.76
20	77.3	4.6	74.1	7.8	.830	.92	.52	.78
21	78.1	5.6	74.2	9.5	.832	.91	3.16	.74
22	79.0	5.9	74.9	10.0	.851	9.09	.40	.73
23	78.4	6.1	74.1	10.4	.830	8.89	.46	.73
24	79.3	4.9	75.9	8.3	.879	9.42	2.82	.77
25	80.4	5.7	76.4	9.7	.893	.53	3.42	.74
26	80.1	6.4	76.3	10.2	.890	.50	.60	.73
27	79.4	7.2	75.1	11.5	.857	.12	4.02	.69
28	81.0	6.9	76.9	11.0	.908	.64	.00	.71
29	80.0	6.7	76.0	10.7	.882	.39	3.79	.71
30	81.0	6.2	77.3	9.9	.919	.78	.59	.73
31	79.2	4.9	75.8	8.3	.876	.39	2.82	.77

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

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
Iid-ght.	29.771	29.925	29.646	0.279	80.1	84.3	72.3	12.0
1	.758	.902	.639	.263	79.7	84.0	72.0	12.0
2	.748	.898	.626	.272	79.4	83.8	72.0	11.8
3	.740	.896	.612	.284	79.1	83.5	71.8	11.7
4	.743	.910	.618	.292	78.8	83.0	71.5	11.5
5	.758	.918	.638	.280	78.6	82.5	71.5	11.0
6	.775	.938	.650	.288	78.9	83.0	72.0	11.0
7	.799	.969	.678	.291	80.4	84.9	74.0	10.9
8	.816	.960	.692	.268	82.6	87.2	75.5	11.7
9	.826	.977	.694	.283	85.1	89.8	76.0	13.8
.0	.825	.989	.697	.292	87.5	91.4	79.0	12.4
.1	.814	.968	.673	.295	89.5	93.4	80.0	13.4
on.	.797	.932	.661	.271	90.9	95.5	83.5	12.0
1	.772	.908	.643	.265	92.1	97.4	86.6	10.8
2	.743	.863	.615	.248	92.4	98.0	84.4	13.6
3	.722	.860	.588	.272	91.6	97.5	71.5	26.0
4	.705	.862	.570	.292	90.8	97.6	74.0	23.6
5	.700	.949	.561	.388	88.8	96.0	73.5	22.5
6	.712	.885	.557	.328	86.7	94.0	73.4	20.6
7	.733	.886	.580	.306	83.8	90.0	73.5	16.5
8	.748	.884	.607	.277	82.7	88.5	71.4	17.1
9	.769	.908	.639	.269	81.7	86.8	73.5	13.3
0	.781	.931	.654	.277	81.2	85.5	73.2	12.3
1	.784	.944	.661	.283	80.4	85.0	72.5	12.5

he Mean Height of the Barometer, as likewise the Dry and Wet Bulb rmometer Means are derived from the observations made at the several rs during the month.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

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.	77.3	2.8	75.3	4.8	0.862	9.31	1.53	0.86
1	77.2	2.5	75.4	4.3	.865	.35	.37	.87
2	77.0	2.4	75.3	4.1	.862	.32	.30	.88
3	76.9	2.2	75.4	3.7	.865	.35	.18	.89
4	76.9	1.9	75.6	3.2	.871	.42	.02	.90
5	76.8	1.8	75.5	3.1	.868	.40	0.98	.91
6	76.9	2.0	75.5	3.4	.868	.40	1.07	.90
7	78.1	2.3	76.5	3.9	.896	.67	.27	.88
8	79.0	3.6	76.5	6.1	.896	.63	2.05	.83
9	79.6	5.5	75.7	9.4	.873	.34	3.23	.74
10	80.6	6.9	76.5	11.0	.896	.54	3.95	.71
11	81.1	8.4	76.1	13.4	.885	.38	4.91	.66
Noon.	81.4	9.5	75.7	15.2	.873	.22	5.67	.62
1	81.7	10.4	75.5	16.6	.868	.14	6.27	.59
2	81.6	10.8	75.1	17.3	.857	.02	.43	.58
3	80.8	10.8	74.3	17.3	.835	8.81	.38	.58
4	80.3	10.5	74.0	16.8	.827	.73	.11	.59
5	79.9	8.9	74.6	14.2	.843	.94	5.06	.64
6	79.3	7.4	74.9	11.8	.851	9.06	4.12	.69
7	77.9	5.9	73.8	10.0	.822	8.80	3.30	.73
8	77.9	4.8	74.5	8.2	.840	9.03	2.69	.77
9	77.8	3.9	75.1	6.6	.857	.21	.16	.81
10	77.8	3.4	75.4	5.8	.865	.32	1.89	.83
11	77.3	3.1	75.1	5.3	.857	.25	.69	.85

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	133.0	...	S,S.byW.&S.SW.	0.8	198.8	Chiefly clear. Brisk from 8¾ to 11 A. M.
2	...	...	S,S.byW.&S.byE.	1.0	273.0	Clear to 7 A. M., scuds from S to 1 P. M., scatd. \i afterwards. Brisk wind at 8½ A. M., & from 11½ A. M., to 2¾ P. M.
3	133.8	...	S. S. W. & S.	...	217.0	Scatd. \i to 7 A.M., scatd. ⌒i to 11 A. M., clear afterwards.
4	135.0	...	S. by W. & S.	1.0	199.3	Chiefly clear. Brisk wind at 7¾ A. M.
5	133.0	...	S. & S. by E.	0.3	198.9	Chiefly scatd. \i.
6	137.5	...	S.	3.6	233.5	Clear to 4 A. M., scatd. \i to noon, clear to 7 P.M., scuds from S afterwards. Brisk wind from 5 to 10½ P. M.,
7	134.5	...	S. & S. S. W.	4.0	306.5	Clouds of different kinds to 10 A. M., clear afterwards. Brisk wind from 9½ A. M. to 8½ P. M.
8	134.0	1.56	S. S. E. & S.	40.0	345.7	Scatd. _i to 5 A. M., scatd. ⌒i to 5 P. M., overcast afterwards. Brisk wind from 5½ A. M., to 5 P. M. Storm at 6¼ P. M. Thunder & lightning at 7 & 8 P. M. Rain at 7, 8 & 11 P. M.
9	...	0.88	Variable.	...	260.6	Scatd. \⌣i to 5 A. M., stratoni to 8 A. M., scatd. ⌒i to 1 P. M., overcast to 5 P. M., clouds of different kinds afterwards. Brisk wind at 3, 6½ & 7½ P. M. Drizzled at 6½A. M. Thunder & rain from 2 to 4 P. M.
10	133.8	...	S. by E. & S. by W.	...	146.5	Scatd. ⌒i to 7 A. M., \⌣i to 1 P. M., clouds of different kinds afterwards. Lightning to N from 8 to 10 P. M. Slight rain at 11 P. M.
11	134.8	*1.30	S. E, S. & S. S. W.	...	299.9	Clouds of kinds to 9 A. M., scatd. ⌒i to 3 P. M., overcast afterwards. Brisk wind nearly the whole day. Thunder &lightning from 6 to 11 P. M. Rain from 5 to 11 P. M.
12	131.9		S. & S. S. E.	...	297.4	Overcast. Thunder & lightning to 4 A. M., scatd. _i to 6 P. M., clear afterwards. High wind at 2 A. M. Rain from midnight to 3 A. M.

* Fell since 5 P. M. of the 11th to 3 A. M. of the 12th.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
13	135.0	...	S. S. E. & S. S. W.	2.0	176.5	Scatd. \i to 5 A. M., scatd. ⌒i to 4 P. M., stratoni afterwards. Brisk wind from 3 to 6¼ P. M. Lightning at 11 P. M.
14	128.8	0.02	S.S.W.& variable.	1.3	212.3	Clouds of different kinds. Brisk wind at 3 & 10 A. M. Lightning to E at midnight & 4 A.M. Thunder at 4 A.M. Slight rain from 2 to 4 & at 8 A. M.
15	139.0	...	S. S. E. & S.	2.6	117.4	Clear to 7 A. M., scatd. ⌒i to 9 P. M., clear afterwards. Brisk wind between 4½ & 5½ P. M. Lightning at 7 P. M.
16	132.3	0.06	S. byE. & S. S.E.	2.1	267.6	Clear to 7 A. M., scatd. ⌒i to 3 P. M., \⌣i to 8 P. M., stratoni afterwards. Brisk wind from 3½ to 4½ P. M. Thunder at 4 & 5 P. M. Lightning at 5 & 8 P. M. Light rain at 5 P. M.
17	134.0	0.07	S. S. E. & S. W.	10.0	115.5	Stratoni to 8 A. M., scatd. \i to 11 A. M., scatd. ⌒i to 4 P. M., overcast afterwards. Strong wind from 6¼ to 6¾ P. M. Brisk wind from 8 to 8½ P. M. Thunder at 7 & 8 P. M. Lightning at 7, 8 & 10 P. M. Light rain at 1½ & 8 P. M.
18	134.4	...	S. W. & S.	0.5	119.7	Stratoni to 3 A. M., scatd. \i & ⌒i to 6 P. M., stratoni afterwards. Lightning to N from 8 to 11 P. M.
19	132.8	1.06	S. S. E.&S. S. W.	3.1	157.4	Stratoni to 3 A. M., scatd. ⌒i to 4 P. M., overcast afterwards. Brisk wind from 1 to 7½ P. M. Thunder at 1 A. M. 3½, 6 & 7 P. M. Lightning at 1 A. M. & from 7 to 11 P. M. Rain at 1, 10½ A. M., 6, 7½ & 11 P. M.
20	138.5	0.04	S. & S. S. E.	4.6	232.1	Overcast to 5 A. M., scatd. \i to 9 A. M., scatd. ⌒i to 7 P. M., clear afterwards. Strong wind between midnight to 1 A. M. Lightning to SW from midnight to 2 A. M. & at 11 P. M. Light rain at midnight.

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bstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

Solar Radiation, Weather, &c.,

Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
			lb	Miles	
139.0	...	S. S. E. & S.	...	124.5	Scatd. \i to 3 A. M., scatd. \⌒i to 8 A. M., scatd, ⌒i to 6 P. M., clear afterwards. Thunder at 4 P. M., Slight rain between 4 & 5 P. M.
134.8	...	S. by W. & S. S. W.	4.8	142.9	Clear to 7 A. M., scatd. ⌒i to 5 P. M., stratoni afterwards. High wind between 8¼ & 9 P. M. Lightning at 8 & 9 P. M. Slight rain at 9½ P. M.
135.5	...	Variable	...	104.9	Stratoni to 4 A. M., thin \i to 8 A. M. clear to noon, scatd. ⌒i to 6 P. M., clear afterwards. Lightning to S W at midnight.
135.8	...	S. S. W.	4.7	132.2	Clear to 4 A. M., scatd. ⌒i to 4 P. M. \⌣i afterwards. High wind at 3 & 4½ P. M. Thunder & slight rain at 3 P. M.
139.0	...	S. S. W. & S. by W.	...	150.4	Scatd. ⌒i to 5 P. M., stratoni afterwards.
138.5	...	S. S. W. & S.	5.8	137.6	Clear nearly the whole day. High wind between 6½ & 6¾ P. M. Lightning at 7 & 8 P. M.
137.3	...	S. & S. S. W.	...	156.0	Scatd. ⌣i to 6 A. M., scatd. ⌒i to 4 P. M. \⌣i afterwards. Lightning to N at 8 P. M.
139.0	...	S. by W. & S.	...	96.0	Clear to 4 A. M., scatd. ⌒i to 6 P. M., clear afterwards.
138.5	0.23	S. S. W, & S. W.	2.4	101.5	Clear to 6 A. M., scatd. \i to 10 A. M., scatd. ⌒i to 7 P. M., clear afterwards. Brisk wind from 5½ to 6¾ P. M. Thunder & rain at 6 P. M.
135.5	...	S. S. W.	0.7	137.3	Clear to 7 A. M., scatd. ⌒i to 6 P. M. scatd. \i afterwards. Brisk wind from noon to 5 P. M.
133.0	0.58	S. by E. & S. S. E.	12.0	200.2	Scuds from S to 5 A. M., scatd. ⌒i to 2 P. M., stratoni afterwards. Strong wind from 2¾ to 3½ P. M. Thunder at 4 P. M. Lightning to W. at 8 P. M., Rain at 4 & 5 P. M.

Cirri, —i Strati, ⌒i Cumuli, ⌣i Cirro-strati, ⌒i Cumulo strati, \⌒i Nimbi
i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May 1868.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.764
Max. height of the Barometer occurred at 10 A. M. on the 17th. ...	29.989
Min. height of the Barometer occurred at 6 P. M. on the 7th. ...	29.557
Extreme range of the Barometer during the month	0.432
Mean of the daily Max. Pressures	29.836
Ditto ditto Min. ditto	29.683
Mean daily range of the Barometer during the month	0.153

	o
Mean Dry Bulb Thermometer for the month	84.3
Max. Temperature occurred at 2 P. M. on the 6th.	98.0
Min. Temperature occurred at 8 P. M. on the 11th.	71.4
Extreme range of the Temperature during the month	26.6
Mean of the daily Max. Temperature	93.0
Ditto ditto Min. ditto, ...	77.5
Mean daily range of the Temperature during the month... ...	15.5

Mean Wet Bulb Thermometer for the month	78.8
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	5.5
Computed Mean Dew-point for the month	74.9
Mean Dry Bulb Thermometer above computed mean Dew-point ...	9.4
	Inches.
Mean Elastic force of Vapour for the month	0.851

	Troy grain.
Mean Weight of Vapour for the month	9.11
Additional Weight of Vapour required for complete saturation ...	3.17
Mean degree of humidity for the month, complete saturation being unity	0.74

	Inches.
Rained 15 days,—Max. fall of rain during 24 hours	1.56
Total amount of rain during the month	5.80
Total amount of rain indicated by the Gauge attached to the anemometer during the month	4.62
Prevailing direction of the Wind... ... S, S. by E. & S. S. W.	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of May. 1868.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																					No. of days																											
Mid night	1												1						6		5		5		5	1	2		3		1																	
1															1				3	1	6		6		6		2		4		1																	
2									1						1	1					6		5		6		3		4		1														1			
3							1				1	1	1								7		4		4		4		5		1																	
4											1		1	1					2		4		7		1		6		5		1																	
5											1						1		1		7		5		2		5		7																			
6													1				1		2		6		3		7		3		7														1					
7													1				2		3		4		3		7		2		4		3		1										1	1				
8													1						4		6		1		5	1	3		8		3																	
9	1												1		1				1		6		1		5		3		8		4																	
10									1				1		1				1		8		1		7		2		7		1		1															
11									1										2		4		4	1	10		1		7		2																	
Noon.																			3		1		4		6		3		9		4																	
1													1						1				2		11		5		10																			
2							1	1											2				2		12		3		7		2	1	1															
3									1								1		1		1		3		11		3		7		2						1	1										
4									1						1				2	1			3		10		6	1	6		1												1	1				
5							1		3	2					1						1	1	4		7		5		6		2	1									1							
6					1								2	1	1	1	1		1	1	3		1		7		5		8		1																	
7							1	1			1		1						2		2		2		5		6		7		1	1											1		2	1		
8													2	2			1		1	1	2		5		10	1	4		4								2											
9					1				1						1				1		4		8		7		2		4	1	1												1					
10					1	1	1						2						3		4		3		10	1	5		2																			
11									2	1			1	1			1		4		4		7	1	4		2		3		2																	

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

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 the Barometer at 32° Faht.	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	29.742	29.804	29.664	0.140	84.7	92.8	77.2	15.6
2	.717	.788	.636	.152	87.3	95.0	80.0	15.0
3	.708	.777	.627	.150	87.2	95.2	80.5	14.7
4	.710	.781	.608	.173	87.8	96.2	80.5	15.7
5	.697	.760	.633	.127	84.9	92.8	78.7	14.1
6	.643	.705	.576	.129	80.3	84.5	78.5	6.0
7	.604	.639	.551	.088	78.5	79.4	77.7	1.7
8	.583	.640	.511	.129	79.3	81.4	77.3	4.1
9	.585	.647	.545	.102	81.1	83.5	79.3	4.2
10	.545	.591	.507	.084	80.4	83.4	78.4	5.0
11	.512	.571	.437	.134	81.8	87.0	78.5	8.5
12	.419	.500	.357	.143	81.9	84.5	77.5	7.0
13	.355	.417	.309	.108	79.5	83.0	77.0	6.0
14	.401	.460	.351	.109	79.2	80.0	78.4	1.6
15	.410	.458	.361	.097	80.7	83.5	79.0	4.5
16	.396	.464	.341	.123	79.7	82.6	77.6	5.0
17	.450	.502	.400	.102	81.3	85.0	78.0	7.0
18	.491	.548	.446	.102	82.2	87.0	78.0	9.0
19	.501	.550	.464	.086	82.2	85.5	78.4	7.1
20	.549	.586	.504	.082	86.8	92.5	82.0	10.5
21	.554	.590	.484	.106	87.7	93.3	82.0	11.3
22	.535	.585	.484	.101	87.6	93.5	82.0	11.5
23	.557	.590	.527	.063	87.7	91.9	83.6	8.3
24	.589	.635	.537	.098	89.4	94.4	84.8	9.6
25	.588	.628	.518	·110	88.8	94.4	79.5	14.9
26	.567	.608	.537	.071	84.5	88.5	82.1	6.4
27	.535	.572	.481	.091	85.1	87.2	82.5	4.7
28	.507	.563	.465	.098	85.8	89.0	84.0	5.0
29	.543	.589	.486	.103	83.5	84.6	81.7	2.9
30	.566	.634	.506	.128	82.2	84.6	79.5	5.1

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

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	79.9	4.8	76.5	8.2	0.896	9.59	2.83	0.77
2	80.7	6.6	76.7	10.6	.902	.58	3.83	.71
3	80.7	6.5	76.8	10.4	.905	.63	.74	.72
4	80.6	7.2	76.3	11.5	.890	.46	4.14	.70
5	80.4	4.5	77.2	7.7	.916	.79	2.70	.78
6	78.6	1.7	77.4	2.9	.922	.95	0.96	.91
7	77.8	0.7	77.3	1.2	.919	.97	.38	.96
8	78.5	0.8	77.9	1.4	.937	10.15	.44	.96
9	79.9	1.2	79.1	2.0	.973	.49	·68	.94
10	79.0	1.4	78.0	2.4	.940	.15	.79	.93
11	79.9	1.9	78.6	3.2	.958	.32	1.08	.91
12	79.1	2.8	77.1	4.8	.913	9.82	.62	.86
13	78.4	1.1	77.6	1.9	.928	10.03	0.63	.94
14	78.4	0.8	77.8	1.4	.934	.12	.44	.96
15	78.0	2.7	76.1	4.6	.885	9.53	1.51	.86
16	78.1	1.6	77.0	2.7	.910	.83	0.89	.92
17	79.2	2.1	77.7	3.6	.931	10.02	1.22	.89
18	79.0	3.2	76.8	5.4	.905	9.73	.81	.84
19	79.4	2.8	77.4	4.8	.922	.91	.63	.86
20	81.7	5.1	78.6	8.2	.958	10.21	3.00	.77
21	82.0	5.7	78.6	9.1	.958	.19	.37	.75
22	82.2	5.4	79.0	8.6	.970	.31	.21	.76
23	82.5	5.2	79.4	8.3	.983	.45	.11	.77
24	83.6	5.8	80.1	9.3	1.005	.64	.61	.75
25	83.4	5.4	80.2	8.6	.008	.68	.32	.76
26	82.4	2.1	80.9	3.6	.030	11.01	1.34	.89
27	81.9	3.2	79.7	5.4	0.992	10.61	.96	.84
28	82.4	3.4	80.0	5.8	1.001	.68	2.15	.83
29	81.3	2.2	79.8	3.7	0.995	.66	1.34	.89
30	79.4	2.8	77.4	4.8	.922	9.91	.63	.86

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

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. Max.	Range of the Barometer for each hour during the month. Min.	Range of the Barometer for each hour during the month. Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Range of the Temperature for each hour during the month. Min.	Range of the Temperature for each hour during the month. Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.572	29.770	29.392	0.378	82.0	86.6	78.5	8.1
1	.557	.764	.362	.402	81.8	86.4	77.5	8.9
2	.544	.755	.348	.407	81.7	86.2	77.8	8.4
3	.534	.748	.341	.407	81.4	86.0	77.5	8.5
4	.529	.739	.338	.401	81.3	86.0	77.3	8.7
5	.535	.755	.323	.432	81.0	85.8	77.0	8.8
6	.547	.768	.325	.443	80.9	85.7	77.5	8.2
7	.565	.771	.341	.430	81.8	87.0	77.6	9.4
8	.579	.799	.348	.451	82.9	88.7	77.5	11.2
9	.588	.804	.355	.449	83.9	90.5	77.3	13.2
10	.591	.795	.361	.434	84.7	92.5	77.6	14.9
11	.585	.783	.356	.427	85.8	93.4	78.0	15.4
Noon.	.576	.777	.362	.415	85.8	94.0	78.2	15.8
1	.559	.737	.344	.393	86.3	94.2	78.2	16.0
2	.540	.713	.340	.373	86.3	95.0	77.7	17.3
3	.521	.691	.323	.368	86.6	96.2	77.8	18.4
4	.506	.677	.312	.365	86.4	95.0	78.2	16.8
5	.503	.672	.309	.363	85.9	94.8	78.2	16.6
6	.509	.664	.335	.329	85.4	93.8	78.3	15.5
7	.529	.692	.359	.333	84.2	91.5	78.0	13.5
8	.549	.714	.386	.328	83.6	91.0	78.4	12.6
9	.568	.739	.399	.340	82.8	89.5	78.4	11.1
10	.582	.754	.410	.344	82.5	89.4	78.0	11.4
11	.581	.758	.399	.359	82.1	88.0	77.5	10.5

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

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.	79.9	2.1	78.4	3.6	0.952	10.23	1.24	0.89
1	79.8	2.0	78.4	3.4	.952	.25	.15	.90
2	79.7	2.0	78.3	3.4	.949	.22	.15	.90
3	79.5	1.9	78.2	3.2	.946	.19	.08	.90
4	79.5	1.8	78.2	3.1	.946	.19	.05	.91
5	79.3	1.7	78.1	2.9	.943	.16	0.98	.91
6	79.3	1.6	78.2	2.7	.946	.19	.91	.92
7	79.7	2.1	78.2	3.6	.946	.17	1.23	.89
8	80.0	2.9	78.0	4.9	.940	.09	.70	.86
9	80.2	3.7	77.6	6.3	.928	9.95	2.18	.82
10	80.6	4.1	77.7	7.0	.931	.96	.46	.80
11	80.9	4.9	77.5	8.3	.925	.88	.95	.77
Noon.	80.7	5.1	77.1	8.7	.913	.74	3.09	.76
1	81.0	5.3	77.3	9.0	.919	.80	.22	.75
2	81.0	5.3	77.3	9.0	.919	.80	.22	.75
3	81.1	5.5	77.8	8.8	.934	.95	.19	.76
4	81.1	5.3	77.4	9.0	.922	.83	.23	.75
5	81.1	4.8	77.7	8.2	.931	.94	2.93	.77
6	81.2	4.2	78.3	7.1	.949	10.14	.54	.80
7	80.7	3.5	78.2	6.0	.946	.13	.11	.83
8	80.3	3.3	78.0	5.6	.940	.07	1.96	.84
9	80.1	2.7	78.2	4.6	.946	.15	.60	.86
10	80.0	2.5	78.2	4.3	.946	.17	.47	.87
11	79.8	2.3	78.2	3.9	.946	.17	.34	.88

All the Hygrometrical elements are computed by the Greenwich Constants.

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***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June* 1868.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	139.4	...	S. S. E. & S. W.	1.5	185.2	Scatd. ⌣i to 5 A.M., scatd. ⌒i to 5 P.M., scatd. \i afterwards. Fresh breeze from midnight to 10 A. M., & from 4 to 5½ P. M.
2	137.0	...	S. by W.&S.S.W.	0.4	110.0	Clear to 2 A. M., scatd. ⌒i to 7 P. M., clear afterwards.
3	137.1	...	S. W. & S.	0.8	114.2	Clear to 8 A. M., scatd. ⌒i to 6 P. M., clear afterwards.
4	137.0	...	S. & S. S. W.	...	141.3	Clear to 7 A. M., scatd. ⌒i afterwards.
5	137.0	0.16	S. & S. E.	6.4	131.2	Scatd. \i to 6 A.M. \\⌣i to 11 A. M. Overcast to 2 P. M. Scatd. \i afterwards. High wind from 11½ to noon. Rain from noon to 2 P. M.
6	...	0.40	E. S. E.	2.0	157.0	Scatd. \\⌢ to 8 A. M., Overcast afterwards. Brisk wind at 9½ A. M., & from 2¼ to 11 P.M. Thunder at 9 & 10 A. M. Slight rain from 9½ A. M., to 7 P. M., & at 11 P. M.
7	...	5.35	E.S.E, E.&S.S.E.	4.4	245.5	Overcast. Brisk wind at 10½ A. M. Rain whole day & night.
8	...	2.42	S. S. E, & S. S. W.	...	189.1	Overcast. Rain from midnight to 1 P. M., & drizzled at 5 & 6 P. M.
9	...	0.22	S. S. W. & S. by W.	...	63.9	Overcast. Lightning to S at 1 A. M. Light rain after intervals.
10	...	1.24	S. W. & S. S. W.	3.1	180.3	Overcast. Brisk wind from 1 to 3½ P. M. Rain nearly the whole day & night.
11	...	1.34	S, S.S.E.&S.byE.	4.7	254.5	Overcast nearly the whole day & night. Brisk wind from 10½ A. M., to 7 P. M. Rain from 2 to 8 A. M., & from 3 to 5½ P. M.
12	...	0.77	S. S. W. & S.	5.5	342.4	Overcast. High wind from 9 A. M., to 11 P. M. Rain nearly the whole day & night.
13	...	5.85	S. W. & W.N.W.	6.5	437.0	Overcast, High wind from midnight to 5 A. M., & from 9 to 11 P. M. Rain nearly the whole day & night.
14	...	3.45	S. W.	3.7	299.4	Overcast. Brisk wind from 10½ A. M. to 3¼ P. M., & at 8 & 10 P. M. Rain nearly the whole day & night.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
15	...	0.27	S. S. W.	4.6	431.9	Overcast. High wind from 6½ A. M. to 11 P. M. Rain at 4, 7 & 8½ A. M. & at 10 P. M.
16	...	0.53	SW, SSW & WSW	4.0	400.8	Overcast. Brisk wind from midnight to 4½ A. M. Light rain from midnight to 8 A. M. & at 3, 10 & 11 P. M.
17	...	1.46	S, S.W. & S. S.W.	1.8	342.4	Overcast nearly the whole day & night. Brisk wind at 10 A. M., & from 2 to 3 P. M. Rain from midnight to 9½ A. M., & at 9½ P. M.
18	...	1.09	S. W. & W.S.W.	1.5	263.2	Overcast. Brisk wind from 10½ A. M., to 8 P. M. Light rain at 2, 4½ & 9½ A. M., & from 4½ to 11 P. M.
19	...	0.11	S. W. & S.	2.3	317.1	Overcast. Brisk wind from 2½ to 8 A. M. Light rain from midnight to 2 A. M.
20	130.4	...	SSW, SW & S by W.	...	175.6	Stratoni to 6 A.M., clear to 11 A. M., thin \i to 7 P. M., clear afterwards.
21	131.4	0.11	S. W. & S. S. W.	2.5	132.2	Clear to 2 P. M., thin \i to 6 P.M., stratoni afterwards. Lightning to W. at 8 P. M. Light rain at 9 P. M.
22	132.0	0.35	S. S. E. & S.S.W.	1.8	135.0	Stratoni to 3 A. M., scatd. \i to 7 A. M., scatd. \i to 11 A. M. Scatd. \i to 3 P. M., clouds of kinds afterwards. Brisk wind & rain at 8½ P. M. Thunder at 9 P. M. Lightning from 8 to 10 P. M.
23	133.0	...	S. by E. & WS.W.	...	80.7	Stratoni to 5 A.M. \i to 7 P.M., clear afterwards.
24	131.0	...	S by W, SW & SSW	...	64.5	Clear to 3 A. M., stratoni to 8 A. M. Thin \i afterwards. Lightning to N. at 8 P. M.
25	129.0	0.70	S. S. W. & S.W.	5.2	97.7	Clear to 4 A. M., scatd. \i to 8 A. M., scatd. ⌒i to noon, stratoni to 7 P. M., overcast afterwards. Strong wind at 8½ P. M. Thunder & Lightning at 8 & 9 P. M. Rain from 8½ & 10½ P. M.
26	...	0.24	S. S. E.	0.3	143.2	\i to 3 A. M., overcast to 7 P. M. \i afterwards. Thunder at 1 P. M. Rain from 2½ to 5 A. M., & at 1 P. M.

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Abstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

Solar Radiation, Weather, &c.,

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
				lb	Miles	
27	...	...	S. S.W. & S.	...	138.7	Stratoni to 8 A. M. overcast, afterwards.
28	...	...	S. S. W, & S. W.	0.2	150.7	Overcast to 4 A. M., stratoni to 11 A. M., overcast to 7 P. M., stratoni afterwards. Drizzled between noon & 1 P. M.
29	...	...	S. S. W, S.&S.W.	0.3	235.7	Stratoni to 2 A. M., overcast to 4 P. M., stratoni afterwards. Light rain from noon to 1 P. M.
30	...	0.55	S.W. & S. S. W.	0.2	145.0	Stratoni to 4 P. M. ⌊i to 8 A. M. ⌒i to 6 P. M., stratoni afterwards. Slight rain at 9 A. M. & between 1 & 2 P. M. Rain from 10 to 11 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, ⌊i Cirro-strati, ⌒i Cumulo strati, ⌣i Nimbi ⌊i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June 1868.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.552
Max. height of the Barometer occurred at 9 A. M. on the 1st. ...	29.804
Min. height of the Barometer occurred at 5 P. M. on the 13th. ...	29.309
Extreme range of the Barometer during the month	0.495
Mean of the daily Max. Pressures	29.606
Ditto ditto Min. ditto	29.495
Mean daily range of the Barometer during the month	0.111

	o
Mean Dry Bulb Thermometer for the month	83.6
Max. Temperature occurred at 3 P. M. on the 4th.	96.2
Min. Temperature occurred at 5 A. M. on the 13th.	77.0
Extreme range of the Temperature during the month	19.2
Mean of the daily Max. Temperature...	87.9
Ditto ditto Min. ditto, ...	79.8
Mean daily range of the Temperature during the month... ...	8.1

Mean Wet Bulb Thermometer for the month	80.3
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.3
Computed Mean Dew-point for the month	78.0
Mean Dry Bulb Thermometer above computed mean Dew-point ...	5.6
	Inches.
Mean Elastic force of Vapour for the month	0.940

	Troy grain.
Mean Weight of Vapour for the month	10.07
Additional Weight of Vapour required for complete saturation ...	1.96
Mean degree of humidity for the month, complete saturation being unity	0.84

	Inches.
Rained 22 days,—Max. fall of rain during 24 hours	5.85
Total amount of rain during the month	26.61
Total amount of rain indicated by the Gauge attached to the anemometer during the month	17.80*
Prevailing direction of the Wind... ... S. S. W, S. W. & S.	

* The amount of rain could not be determined by the Anemometer on 13th & 14th owing to the paper tearing.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June. 1868.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																					No. of days																											
Mid night													1				2	1			3	1	1		2	1	5		8	3	4	1																
1													1				1		1		4	1			3	1	2		7	2	7	2																
2											1		1				1				3	2	1		3	1	2		7	1	6	2	1	1														
3													2		1						3	1	1		3	2	2		6	1	7	3			1													
4													3	1							3	2	1		3	1	2		7	1	7	1	1		1													
5											1		1	1			1		1	1	2	1	2	1	2	1	3	1	6	1	8	3			1								1					
6											2						1	1	3	1	1		2	1	5	1	3	1	3		7	2	1		2	1												
7											1		2	2	1				2				1	1	3	1	5	3	6		7	2	2	1														
8									1				2	1					2		1	1	2	1	3		4	2	5		7	2	3	1														
9									1				2	1					1		1		1		4	2	1		9	2	8	2	2	1														
10																	1		2		3	1	1	1	7				7	1	6	3	3	1														
11													2	1			1	1			3	1	2	1	4	1	3		6	2	4		4										1	1				
Noon.													1	1			1		2	2	1		1	1	5	1	1		2	1	11	2	2				2				1	1						
1																	3	3	1		4	2	1		1	1	1		7	2	7	1	2		1		1				1							
2																	1	1	2	2	4		2		1		1		7	2	7	2	3		1						1							
3																	1	1	2		3	2			3		3		7	2	6	2	3		1		1											
4																			4	2	1		2	1	2		2		10	1	7		1														1	1
5																			3	1	2	2	3	1	6	1	2		5		6		1						1	1	1							
6																	1	1	1	1	1		3	1	6	2	4		8	2	4						1	1			1	1						
7																	1	1			2	1	1		6	1	4	1	12		2				1	1					1	1						
8	1																		1		2	1	2		3	1	4		13		1						1	1										
9	1	1													1	1			1		2	1			5		2	1	12	1	1	1	1				1	1										
10													1				1		1		3	2	1		2		5	1	9	2	1	1	2	1	1													
11																	1	1	1		3	2	1		4		5		6	1	3	1			2	1												

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

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 the Barometer at 32° Faht.	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	29.581	29.625	29.537	0.088	83.8	90.0	79.0	11.0
2	.593	.638	.553	.085	85.0	89.1	82.4	6.7
3	.595	.637	.557	.080	88.3	93.4	84.0	9.4
4	.564	.602	.515	.087	88.6	93.0	85.5	7.5
5	.586	.630	.540	.090	88.1	93.0	84.0	9.0
6	.629	.687	.567	.120	86.2	91.6	80.5	11.1
7	.668	.723	.624	.099	85.9	91.0	81.8	9.2
8	.651	.712	.580	.132	85.9	91.4	82.0	9.4
9	.574	.627	.498	.129	85.8	90.8	82.0	8.8
10	.569	.615	.532	.083	78.8	84.5	76.0	8.5
11	.590	.633	.520	.113	82.5	87.0	80.0	7.0
12	.616	.662	.566	.096	84.8	90.6	81.5	9.1
13	.590	.629	.534	.095	81.0	88.5	81.0	7.5
14	.565	.609	.508	.101	83.3	88.0	79.6	8.4
15	.545	.586	.479	.107	83.5	87.0	80.8	6.2
16	.567	.628	.522	.106	83.4	86.0	81.0	5.0
17	.602	.663	.544	.119	82.3	85.9	79.7	6.2
18	.599	.654	.528	.126	83.3	87.2	81.0	6.2
19	.530	.590	.457	.133	85.0	89.5	81.0	8.5
20	.468	.507	.390	.117	86.3	92.5	83.2	9.3
21	.495	.536	.452	.084	85.4	91.4	83.0	8.4
22	.513	.576	.450	.126	83.6	87.0	81.0	6.0
23	.582	.639	.525	.114	81.9	84.0	80.0	4.0
24	.632	.671	.593	.078	83.8	87.7	79.5	8.2
25	.613	.660	.537	.123	83.9	87.7	80.6	7.1
26	.562	.613	.501	.112	83.4	87.1	81.5	5.6
27	.552	.608	.497	.111	82.5	85.5	80.0	5.5
28	.574	.637	.513	.124	82.9	87.7	79.7	8.0
29	.618	.670	.575	.095	81.8	86.6	78.9	7.7
30	.644	.696	.601	.095	82.7	87.3	78.0	9.3
31	.636	.698	.557	.141	83.6	88.5	80.2	8.3

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

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	80.1	3.7	77.5	6.3	0.925	9.92	2.18	0.82
2	81.8	3.2	79.6	5.4	.989	10.58	1.95	.84
3	82.8	5.5	79.5	8.8	.986	.47	3.33	.76
4	83.2	5.4	80.0	8.6	1.001	.62	.30	.76
5	82.7	5.4	79.5	8.6	0.986	.47	.25	.76
6	81.4	4.8	78.0	8.2	.940	.03	2.96	.77
7	81.0	4.9	77.6	8.3	.928	9.91	.96	.77
8	81.1	4.8	77.7	8.2	.931	.94	.93	.77
9	81.9	3.9	79.2	6.6	.976	10.41	.42	.81
10	77.2	1.6	76.1	2.7	.885	9.57	0.87	.92
11	80.3	2.2	78.8	3.7	.964	10.36	1.28	.89
12	81.3	3.5	78.8	6.0	.964	.31	2.15	.83
13	81.0	3.0	78.9	5.1	.967	.37	1.80	.85
14	80.7	2.6	78.9	4.4	.967	.39	.54	.87
15	81.0	2.5	79.2	4.3	.976	.48	.52	.87
16	81.3	2.1	79.8	3.6	.995	.66	.30	.89
17	80.2	2.1	78.7	3.6	.961	.33	.25	.89
18	81.0	2.3	79.4	3.9	.983	.54	.39	.88
19	82.2	2.8	80.2	4.8	1.008	.77	.76	.86
20	82.5	3.8	79.8	6.5	0.995	.60	2.42	.81
21	82.2	3.2	80.0	5.4	1.001	.70	1.98	.84
22	80.9	2.7	79.0	4.6	0.970	.40	.63	.87
23	80.2	1.7	79.0	2.9	.970	.44	.00	.91
24	81.3	2.5	79.5	4.3	.986	.57	.53	.87
25	81.3	2.6	79.5	4.4	.986	.57	.56	.87
26	81.3	2.1	79.8	3.6	.995	.66	.30	.89
27	80.3	2.2	78.8	3.7	.964	.36	.28	.89
28	79.8	3.1	77.6	5.3	.928	9.97	.82	.85
29	78.7	3.1	76.5	5.3	.896	.65	.75	.85
30	79.6	3.1	77.4	5.3	.922	.91	.81	.85
31	80.6	3.0	78.5	5.1	.955	10.25	.78	.85

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

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.	29.598	29.673	29.497	0.176	82.5	86.5	78.8	7.7
1	.586	.655	.486	.169	82.2	86.5	78.5	8.0
2	.576	.652	.472	.180	81.9	86.5	78.4	8.1
3	.569	.647	.473	.174	81.6	86.0	77.0	9.0
4	.570	.649	.471	.178	81.4	85.9	76.5	9.4
5	.570	.656	.476	.180	81.2	85.5	76.5	9.0
6	.583	.666	.479	.187	81.3	85.5	76.5	9.0
7	.599	.689	.498	.191	82.0	85.7	77.5	8.2
8	.611	.700	.500	.200	83.1	88.0	76.5	11.5
9	.619	.707	.496	.211	84.4	89.5	76.0	13.5
10	.624	.712	.493	.219	85.3	90.5	76.9	13.6
11	.620	.723	.491	.232	86.1	90.9	76.5	14.4
Noon.	.605	.709	.473	.236	86.7	92.2	77.0	15.2
1	.592	.698	.443	.255	87.1	93.0	77.7	15.3
2	.572	.673	.428	.245	87.4	93.4	78.0	15.4
3	.553	.650	.411	.239	87.3	93.4	78.5	14.9
4	.539	.627	.393	.234	87.3	92.5	79.6	12.9
5	.532	.624	.390	.234	86.9	92.5	80.0	12.5
6	.539	.631	.429	.202	86.1	92.0	80.0	12.0
7	.559	.658	.442	.216	84.8	90.5	79.6	10.9
8	.579	.660	.460	.200	84.2	89.6	79.0	10.6
9	.599	.683	.484	.199	83.7	88.7	79.2	9.5
10	.610	.687	.507	.180	83.3	88.0	78.9	9.1
11	.609	.683	.502	.181	82.9	87.0	79.2	7.8

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

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.	
Midnight.	80.4	2.1	78.9	3.6	0.967	10.39	1.25	0.89
1	80.4	1.8	79.1	3.1	.973	.47	.07	.91
2	80.2	1.7	79.0	2.9	.970	.44	.00	.91
3	80.1	1.5	79.0	2.6	.970	.44	0.90	.92
4	79.9	1.5	78.8	2.6	.964	.38	.89	.92
5	79.8	1.4	78.8	2.4	.964	.40	.81	.93
6	79.8	1.5	78.7	2.6	.961	.35	.89	.92
7	80.3	1.7	79.1	2.9	.973	.47	1.00	.91
8	80.6	2.5	78.8	4.3	.964	.36	.50	.87
9	80.9	3.5	78.4	6.0	.952	.19	2.12	.83
10	81.2	4.1	78.3	7.0	.949	.14	.50	.80
11	81.6	4.5	78.4	7.7	.952	.15	.80	.78
Noon.	81.8	4.9	78.9	7.8	.967	.30	.88	.78
1	82.0	5.1	78.9	8.2	.967	.30	3.03	.77
2	82.3	5.1	79.2	8.2	.976	.39	.06	.79
3	82.1	5.2	79.0	8.3	.970	.33	.08	.77
4	82.2	5.1	79.1	8.2	.973	.36	.05	.77
5	82.0	4.9	79.1	7.8	.973	.36	2.89	.78
6	81.9	4.2	79.0	7.1	.970	.35	.60	.80
7	81.3	3.5	78.8	6.0	.964	.31	.15	.83
8	81.2	3.0	79.1	5.1	.973	.42	1.82	.85
9	80.8	2.9	78.8	4.9	.964	.34	.73	.86
10	80.6	2.7	78.7	4.6	.961	.31	.62	.86
11	80.6	2.3	79.0	3.9	.970	.42	.37	.88

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	...	...	S. W. & S. S. W.	0.2	227.1	∖‿i & ∖⌒i to 7 A. M. Stratoni afterwards.
2	...	...	S. S. W. & S.	...	248.0	Stratoni to 6 P. M. Scatd. ∖i afterwards. Light rain at 5 A. M.
3	130.0	...	S. W. & S. S. W.	...	59.8	Chiefly stratoni.
4	135.0	...	S. S. W. & S. W.	...	133.7	Chiefly stratoni.
5	136.0	...	S.	0.2	53.7	Chiefly stratoni.
6	130.2	...	S. S. W. & S.	0.5	171.8	Clouds of different kinds. Lightning to N. at 8 & 9 P. M.
7	131.0	...	S. S. W.	0.5	186.1	Chiefly scatd. ⌒i. Drizzled at 6 P. M.
8	133.0	...	S. S. W. & S. by W.	...	210.3	Clear to 2 A. M. scatd. ⌒i to 4 P. M., scatd. ∖i to 8 P. M., clear afterwards.
9	132.2	...	S. S. W.	2.2	282.9	Scatd. ⌒i to 3 A. M., scatd. ∖i to 6 P. M., stratoni afterwards. Lightning from 8 to 10 P. M.
10	...	3.47	S. & S. by E.	0.3	250.4	Overcast. Lightning from midnight to 3 A. M., & at 11 P. M. Thunder from 2 to 6 A. M. Rain from $1\frac{1}{2}$ A. M., to 3 P. M.
11	...	2.10	S, & S. S. W.	5.6	174.1	Overcast to 2 P. M. ∖i & stratoni afterwards. High wind at midnight. Thunder & lightning at midnight & 1 A. M. Rain from midnight to 3 A. M.
12	135.5	...	S, S. W. & S. S. W.	...	128.9	∖⌒i to 3 A. M. ⌒i to 4 P. M., stratoni afterwards.
13	...	...	S. by E.	...	105.9	Chiefly ⌒i. Slight rain, at 1 & 6 P. M.
14	...	0.35	S. E. & S. S. E.	...	123.5	⌒i & stratoni. Light rain from 8 A. M., to $4\frac{1}{2}$ P. M., & at 9 P. M.
15	130.0	0.34	S. S. E. & S.	...	148.3	Clear to 2 A. M., clouds of different kinds to 7 P. M., clear afterwards. Rain at 4, 7, & $11\frac{1}{2}$ A. M., & at 3 & 5 P. M.
16	...	0.40	S. by E. & S.	...	141.5	Clear to 2 A. M., scatd. ⌒i & ∖‿i afterwards. Rain at 5, $8\frac{1}{2}$, 10 & 11 A. M., & at $2\frac{1}{2}$ & 7 P. M.
17	...	1.23	S. S. E. & S.	0.9	135.3	Overcast to 3 P. M. ⌒i to 6 P. M. ∖i afterwards. Thunder at 3 A. M. Lightning at 2 & 3 A. M. Rain from 2 to 6, 10 & 11 A. M., & at 3 & $5\frac{1}{2}$ P. M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
18	...	0.02	S. by E. & S.	0.3	130.8	Clear to 3 A. M. ⌒i to 9 A. M. overcast to 2 P. M. \i to 7 P. M. clear afterwards. Slight rain at 9, 10 & noon.
19	133.5	0.14	S, S. W. & S. by W.	...	82.5	Scatd. ⌒i to 7 P. M., clear & lightning to N W afterwards. Rain at 3½ A. M.
20	138.0	0.35	S. by W. & variable	...	74.1	Scuds from S by W to 4 A. M. \i to 10 A. M. ⌒i afterwards. Thunder at 4½ P. M. Lightning at midnight, 4 A. M. & at 8 & 11 P. M. Rain at 6 P. M.
21	139.4	0.20	S. S. E, E. by S. & E. [S. E.	2.7	73.2	Clouds of different kinds. Brisk wind at 1½ P. M. Lightning from 2 to 4 A. M. Rain at 1½ & 11½ P. M.
22	...	0.18	S. S. E. & S. E.	3.2	184.8	Chiefly stratoni. Brisk wind from 9 A. M., to 9½ P. M. Light rain at 8½ & 11½ A. M.. & at 1, 3½ & 5 P. M.
23	...	0.78	S. & S. S. W.	2.0	173.1	Overcast. Brisk wind at 8½ A. M. Rain at 1 & from 4 to 11 A. M., & at 1, 2½ & 7½ P. M.
24	132.5	...	S. & S. by W.	1.6	291.4	Chiefly stratoni. Brisk wind at 3½ P. M. Drizzled at 10 A. M.
25	...	0.22	S. & S. S. W.	0.5	212.9	Clouds of various kinds. Rain from 1 to 3 P. M.
26	129.0	0.78	S. by W. & S. by E.	1.0	106.1	Stratoni to 6 A. M. ⌒i to 11 A. M., stratoni to 3 P. M. \⌒i afterwards. Rain at 11½ A. M. A meteor of unusual brilliancy passed at 8½ P. M.
27	130.4	0.10	S. S. E, S. & S. by E.	0.4	148.6	Clouds of different kinds. Light rain at 7 & 8 A. M. & at 3½ & 6 P. M.
28	104.4	0.09	S. E. & S. S. E.	1.8	169.8	Overcast to 5 A. M. ⌒i afterwards. Brisk wind at 1 & from 3 to 5 P. M. Light rain at midnight & at 1, 2 & 6 P. M.
29	119.5	0.19	E. S. E. & S. E.	3.1	255.4	Scatd. \i & ⌒i. Brisk wind from 9½ to 10½ A. M. & from 4¼ to 6 P. M. Rain at 11 A. M. & at 1, 2, 5 & 6 P. M.
30	...	0.08	S. E, S. S. E. & S by E	2.6	245.1	Chiefly ⌒i. Brisk wind from 12½ to 2 P. M. Light rain from 11 A. M. to 3 P. M.
31	120.0	0.15	S. by E. & S. by W.	0.6	188.7	Scatd. \i & ⌒i. Rain at 1, 2, 4 & from 7½ to 10 A. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒i Cumulo strati \⌒i Nimbi

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July 1868.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.584
Max. height of the Barometer occurred at 11 A. M. on the 7th. ...	29.723
Min. height of the Barometer occurred at 5 P. M. on the 20th. ...	29.390
Extreme range of the Barometer during the month	0.333
Mean of the daily Max. Pressures	29.634
Ditto ditto Min. ditto	29.527
Mean daily range of the Barometer during the month	0.107

	o
Mean Dry Bulb Thermometer for the month	84.2
Max. Temperature occurred at 2 & 3 P. M. on the 3rd.	93.4
Min. Temperature occurred at 9 A. M. on the 10th.	76.0
Extreme range of the Temperature during the month	17.4
Mean of the daily Max. Temperature	88.7
Ditto ditto Min. ditto, ...	80.9
Mean daily range of the Temperature during the month... ...	7.8

Mean Wet Bulb Thermometer for the month	81.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.2
Computed Mean Dew-point for the month	78.8
Mean Dry Bulb Thermometer above computed mean Dew-point ...	5.4
	Inches.
Mean Elastic force of Vapour for the month	0.964

	Troy grain.
Mean Weight of Vapour for the month	10.34
Additional Weight of Vapour required for complete saturation ...	1.90
Mean degree of humidity for the month, complete saturation being unity	0.85

	Inches.
Rained 23 days,—Max. fall of rain during 24 hours	3.47
Total amount of rain during the month	11.17
Total amount of rain indicated by the Gauge attached to the anemometer during the month	9.19*
Prevailing direction of the Wind... ... S. & S. S. W,	

* The amount of rain on the 26th could not be determined by the Anemometer as the string connected with the gauge got loose after one discharge.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July. 1868.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																					No. of days																											
Mid night															1		1				7	1	3		5		4		6		1												1	1				
1																	2				7	1	4	1	6	2	2		7		1																	
2							1	1					1		2				1		5	1	6	1	3	1	3		5		2																	
3													2				3		2		3	1	5		1		4		6	1	2						1	1										
4									1	1			1		1		4		1		2	1	4	2	1	1	4		8	1	2																	
5									1						1		4		2		2	1	4	1	2		3	1	7	1	2																	
6							1	1					1		2		3		2		3	1	3		5		3		6	1	1																	
7									1	1					1		4		3	1	2	1	2		6		4	1	4		3												1					
8									1	1					1		2	1	4		1		3		7	1	3	2	4		4		1	1									1					
9															2		2		5	1	1		2		5	2	3	1	4		6	2							1									
10															1		2	1	3		3		2		5	3	2		6	2	6	2											1					
11															1		1	1	4	2	3		2	1	7	2	2	1	4		5		1												1			
Noon.															1				5		4	1	1		5	3	4		4	1	4	1	1				1											
1													1		2	2	1		1	1	5	3	1		7	2	2		6		4	1			1													
2															2	1	1	1	1		5	1	2	2	5		4		3		7	1			1													
3															1				2		5	2	1	1	7	2	3	1	7	1	3						1				1	1						
4																	2	1			5	1	4	1	8		2		7		2		1															
5													1						1		5	3	2		10	1	5		4		3																	
6									1	1							1		1	1	4	1	4	1	12	2	1		6	1	1																	
7					1												1				3		8	1	6		4		8																			
8					1												1		1		2		5		9	1	5		6																			
9									1						1		1	1	3				7		8		6		2		1																	
10															1		3				1		7		10		5		2		1																	
11													1		1				3		1		5		9		5		5																			

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1868.

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 the Barometer at 32° Faht.	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	29.590	29.635	29.520	0.115	86.3	91.0	82.0	9.0
2	.604	.661	.543	.118	82.3	85.0	78.0	7.0
3	.580	.631	.494	.137	85.5	91.0	80.5	10.5
4	.544	.595	.478	.117	85.9	90.2	82.6	7.6
5	.511	.557	.462	.095	85.8	92.4	80.7	11.7
6	.462	.511	.395	.116	83.6	87.0	81.5	5.5
7	.487	.546	.430	.116	82.9	86.8	80.4	6.4
8	.542	.588	.498	.090	80.6	82.5	79.7	2.8
9	.527	.576	.470	.106	83.3	91.3	79.8	11.5
10	.515	.565	.447	.118	86.4	91.5	81.9	9.6
11	.488	.541	.401	.140	82.2	88.4	75.5	12.9
12	.467	.527	.426	.101	78.6	81.2	77.0	4.2
13	.435	.502	.392	.110	79.2	80.5	77.5	3.0
14	.496	.549	.453	.096	79.2	82.4	76.5	5.9
15	.521	.575	.475	.100	80.2	82.0	79.2	2.8
16	.512	.559	.441	.118	82.6	86.0	79.2	6.8
17	.518	.565	.454	.111	80.1	82.0	78.8	3.2
18	.600	.676	.534	.142	81.8	84.6	79.5	5.1
19	.646	.701	.590	.111	84.7	89.4	79.8	9.6
20	.599	.637	.540	.097	85.0	89.5	80.5	9.0
21	.576	.615	.537	.078	84.3	89.5	79.8	9.7
22	.580	.631	.543	.088	86.6	91.8	82.9	8.9
23	.627	.691	.574	.117	85.8	91.6	82.2	9.4
24	.649	.710	.596	.114	85.8	90.1	82.5	7.6
25	.669	.750	.624	.126	83.5	85.5	78.8	6.7
26	.678	.738	.611	.127	83.1	88.4	79.0	9.4
27	.676	.728	.616	.112	84.1	88.0	79.5	8.5
28	.714	.766	.653	.113	84.1	89.5	81.1	8.4
29	.758	.815	.707	.108	82.7	87.5	80.0	7.5
30	.785	.829	.717	.112	83.7	90.5	79.0	11.5
31	.818	.879	.777	.102	83.5	88.0	80.0	8.0

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 August 1868.

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	82.1	4.2	79.2	7.1	0.976	10.41	2.61	0.80
2	80.9	1.4	79.9	2.4	.998	.74	0.84	.93
3	82.5	3.0	80.4	5.1	1.014	.83	1.89	.85
4	82.6	3.3	80.3	5.6	.011	.78	2.09	.84
5	82.2	3.6	79.7	6.1	0.992	.59	.24	.83
6	80.7	2.9	78.7	4.9	.961	.31	1.72	.86
7	80.4	2.5	78.6	4.3	.958	.30	.49	.87
8	79.6	1.0	78.9	1.7	.967	.43	0.58	.95
9	81.2	2.1	79.7	3.6	.992	.63	1·30	.89
10	82.7	3.7	80.1	6.3	1.005	.71	2.35	.82
11	79.3	2.9	77.3	4.9	0.919	9.88	1.66	.86
12	77.6	1.0	76.9	1.7	.908	.82	0.56	.95
13	78.0	1.2	77.2	2.0	.916	.91	.65	.94
14	78.0	1.2	77.2	2.0	.916	.91	.65	.94
15	79.1	1.1	78.3	1.9	.949	10.24	.64	.94
16	80.6	2.0	79.2	3.4	.976	.50	1.18	.90
17	79.2	0.9	78.6	1.5	.958	.34	0.50	.95
18	79.9	1.9	78.6	3.2	.958	.32	1.08	.91
19	81.7	3.0	79.6	5.1	.989	.58	.84	.85
20	81.4	3.6	78.9	6.1	.967	.34	2.19	.83
21	81.3	3.0	79.2	5.1	.976	.45	1.83	.85
22	81.9	4.7	79.1	7.5	.973	.36	2.78	.79
23	82.3	3.5	79.8	6.0	.995	.62	.21	.83
24	82.6	3.2	80.4	5.4	1.014	.83	.00	.84
25	81.5	2.0	80.1	3.4	.005	.77	1.23	.90
26	80.0	3.1	77.8	5.3	0.934	.03	.83	.85
27	80.8	3.3	78.5	5.6	.955	.23	.98	.84
28	80.5	3.6	78.0	6.1	.940	.07	2.14	.83
29	80.1	2.6	78.3	4.4	.949	.20	1.52	.87
30	80.2	3.5	77.7	6.0	.931	9.98	2.09	.83
31	80.0	3.5	77.5	6.0	.925	.92	.08	.83

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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 1868.

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.	29.599	29.815	29.404	0.411	82.1	85.5	78.0	7.5
1	.587	.807	.403	.404	81.9	85.0	77.7	7.3
2	.575	.790	.397	.393	81.5	85.0	77.7	7.3
3	.566	.781	.392	.389	81.1	84.9	77.5	7.4
4	.564	.782	.400	.382	80.7	84.8	75.5	9.3
5	.571	.789	.408	.381	80.6	84.5	76.5	8.0
6	.586	.797	.419	.378	80.5	84.5	76.5	8.0
7	.602	.824	.424	.400	81.0	84.5	76.5	8.0
8	.616	.845	.438	.407	82.0	85.7	76.9	8.8
9	.625	.869	.442	.427	83.2	87.0	77.2	9.8
10	.628	.879	.447	.432	84.1	89.2	77.4	11.8
11	.621	.876	.445	.431	84.9	89.5	78.0	11.5
Noon.	.609	.852	.448	.404	85.5	90.0	78.0	12.0
1	.590	.832	.442	.390	86.1	91.0	79.5	11.5
2	.569	.810	.433	.377	86.4	91.6	78.5	13.1
3	.548	.794	.413	.381	86.3	92.4	78.0	14.4
4	.537	.777	.409	.368	86.2	92.0	79.5	12.5
5	.539	.781	.401	.380	85.6	91.0	78.0	13.0
6	.548	.783	.399	.384	84.9	91.0	77.5	13.5
7	.563	.799	.419	.380	83.7	88.0	78.2	9.8
8	.587	.831	.443	.388	83.4	87.0	78.5	8.5
9	.608	.845	.449	.396	83.1	86.8	78.3	8.5
10	.617	.852	.447	.405	82.7	86.0	78.5	7.5
11	.615	.858	.430	.428	82.4	85.6	78.0	7.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1868.

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.	80.5	1.6	79.4	2.7	0.983	10.56	0.95	0.92
1	80.3	1.6	79.2	2.7	.976	.50	.94	.92
2	80.1	1.4	79.1	2.4	.973	.49	.82	.93
3	79.7	1.4	78.7	2.4	.961	.37	.80	.93
4	79.6	1.1	78.8	1.9	.964	.40	.64	.94
5	79.4	1.2	78.6	2.0	.958	.34	.67	.94
6	79.5	1.0	78.8	1.7	.964	.40	.58	.95
7	79.8	1.2	79.0	2.0	.970	.46	.68	.94
8	80.1	1.9	78.8	3.2	.964	.38	1.09	.91
9	80.5	2.7	78.6	4.6	.958	.28	.61	.87
10	80.8	3.3	78.5	5.6	.955	.23	.98	.84
11	80.9	4.0	78.9	7.2	.967	.32	2.63	.80
Noon.	81.2	4.3	78.2	7.3	.946	.11	.61	.80
1	81.6	4.5	78.4	7.7	.952	.15	.80	.78
2	81.5	4.9	78.1	8.3	.943	.06	3.00	.77
3	81.6	4.7	78.3	8.0	.949	.12	2.90	.78
4	81.7	4.5	78.5	7.7	.955	.18	.81	.78
5	81.6	4.0	78.8	6.8	.964	.29	.47	.81
6	81.5	3.4	79.1	5.8	.973	.40	.09	.83
7	81.1	2.6	79.3	4.4	.979	.51	1.56	.87
8	80.9	2.5	79.1	4.3	.973	.45	.51	.87
9	80.9	2.2	79.4	3.7	.983	.54	.32	.89
10	80.6	2.1	79.1	3.6	.973	.45	.27	.89
11	80.5	1.9	79.2	3.2	.976	.50	.11	.90

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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* 1868.**

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	WIND. Prevailing direction.	Max. Pressure	Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	136.0	0.07	S. W. & S. S. W.	0.4	239.6	Stratoni to 7 A. M. Scattered ⌒i to 5 P. M. Scatd. \i afterwards. Thunder at 1½ A. M. Lightning at midnight, 1½ & 4 A. M. Light rain at 2½ & 3½ A. M.
2	...	2.19	S, S. S. E. & S by W.	3.8	191.2	\i & ⌒i to 3 A. M. Overcast to 2 P. M. Stratoni afterwards. High wind at 4½ & 9¼ A. M. Thunder 5, 7 & 8 A. M. Lightning at 5 A. M. & 11 P. M. Rain from 5 to 11 A. M.
3	132.0	0.31	S. & S. by W.	...	73.5	Stratoni to 7 A. M. ⌒i & \i afterwards. Lightning to N. at 8 & 11 P. M. Rain from 5½ to 7 A. M.
4	132.0	...	S by E, SW & SSW.	...	75.9	Chiefly ⌒i. Thunder & Lightning at 11½ P. M. Drizzled at 7. A. M. & 6½ P. M.
5	135.0	0.15	S. W, E. & E. S. E.	3.5	72.1	\⌣i to 6 A. ⌒i to 5 P. M. Overcast to 8 P. M. Stratoni afterwards. Strong wind at 4¼ & 6½ P. M. Rain from 4¼ to 7 P. M.
6	...	0.34	E. & E. S. E.	2.2	249.0	Stratoni & Overcast. Brisk wind from 8 A. M. to 1½ P. M. Rain at 2, 6, 8. & noon & at 8 & 9 P. M.
7	127.8	0.16	S. E. & E.	1.7	177.4	Stratoni & ⌒i. Brisk wind at 2½ & 7 P. M. Drizzled at 1 A. M. & at 1 & 2½ P. M. Rain at 5½ & 6½ P. M.
8	...	0.72	S. S. E.	...	247.2	Chiefly Overcast. Rain from midnight to 5 A. M. & from 7 A. M. to 2 P. M.
9	135.6	0.24	Variable.	...	130.2	Clear to 5 A M. ⌒i to 7 P. M., clear afterwards. Thunder at 2 & 3 P. M. Lightning at 7 & 10 P. M. Rain between 2½ & 4 P. M.
10	133.5	...	W. S. W.	...	83.2	\⌒i to 2 A. M. \i to 7 A. M. ⌒i afterwards. Lightning from 8 to 11 P. M.
11	123.5	3.06	W. S. W & variable.	...	124.9	\i to 2 A. M. Overcast to 10 A. M. \⌒i & _i to 6. P. M. Overcast afterwards. Thunder from 3 to 5 A. M., & at 6 & 11 P. M. Lightning from midnight to 5 A. M. & at 11 P. M. Rain from 3 to 8 A. M. & at 7 & 8 P. M.

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
12	...	8.19	W. & W. N. W.	11.0	210.5	Overcast. High wind from 1 to 11 P. M. Thunder & lightning at midnight. Rain whole day & night.
13	...	2.01	W. S. W. & W.	3.9	304.0	Overcast. Strong wind from 4½ A. M., to 11 P. M. Rain nearly whole day & night.
14	...	0.99	W. S. W. & S. W.	3.0	515.4	Overcast to 4 A. M. Stratoni afterwards. Strong wind from midnight to 6 A. M. Lighning at 11 P. M. Rain from 1 to 11½ A. M.
15	...	2.05	W. & W. S. W,	2.0	83.6	Overcast. Brisk wind from 2 to 5½ P. M. Thunder & lightning from 9 to 11 P. M. Rain after intervals.
16	120.0	1.03	W. S, W.	1.2	301.0	Overcast to 6 A. M. _i to 6 P. M. Overcast afterwards. Brisk wind at 2½ A. M. Thunder & lightning at midnight & 1 A. M. Rain from midnight to 5 A. M. & from 9 to 11 P. M.
17	...	1.50	W. S. W.	2.2	223.0	Overcast. Brisk wind at 10 A. M. Rain from midnight to 7 P. M.
18	113.8	...	S. W.	...	136.5	Overcast to 1 P. M. Stratoni to 7 P. M., clear afterwards.
19	131.5	...	S. W. & W. by N.	...	39.9	_i to 9 A. M. ⌒i to 4 P. M. Stratoni afterwards.
20	132.0	...	NNE, WSW & SW	...	74.1	Stratoni to 6 A. M. \\i to 2 P. M. Stratoni afterwards. Light rain at 2 A. M. & 11 P. M.
21	135.5	0.89	S. S. W.	...	104.4	Overcast to 7 A. M. Stratoni afterwards. Thunder & lightning at 2 & 3 A. M Rain from midnight to 7 A. M.
22	138.0	...	S. by W, W. by S. & S. S. W.	...	173.1	Stratoni to 6 A. M. ⌒i & \\i to 5 P. M. Stratoni afterwards. Lightning to NW at 10 & 11 P. M. Drizzled at 9 P. M.
23	134.0	...	S. & S. S. W.	...	123.2	Stratoni to 7 P. M. _i afterwards.
24	129.4	...	S by E, SW & SSW.	...	124.2	Chiefly Stratoni.
25	...	0.47	S. S. W. & S. by E.	...	152.8	Thin \\i to 4. All overcast to 3 P. M., clouds of different kinds afterwards. Lightning to N at 2 A. M. Drizzled at 8 A. M. & 1 P. M. Rain from 9½ to 11 P. M.

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Abstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1868.

Solar Radiation, Weather, &c.,

Date.	Max. Solar radiation.	Rain Guage 1 ft. 2 in. above Ground.	Wind. Prevailing direction.	Max. Pressure	Daily Velocity.	General aspect of the Sky.
				lb	Mlies	
26	135.2	...	S, S. E. & S.	...	128.0	Overcast to 7 A. M. \i to 10 A. M. \⌒i to 3 P. M. Stratoni afterwards. Lightning at 9 P. M. Drizzled at 1 A. M.
27	121.8	...	W. by N, S. by E. [&S.S.E.	...	75.3	Chiefly Stratoni.
28	136.0	...	S. by E.	...	78.6	Stratoni to 4 A. M. ⌒i & \⌒i to 1 P. M. Stratoni to 6 P. M. \i afterwards. Thunder at 4 P. M. Light rain at 2 P. M.
29	132.0	0.33	S.byE,S.S.E&SE.	0.2	81.3	Stratoni to 9 A. M. ⌒i to 7 P. M. \i afterwards. Thunder at 3 P. M. Rain at 6 A. M. & at 1. 2½ & 6½ P. M.
30	...	0.08	S. S. E. & S. by E.	2.6	124.4	Clouds of different kinds to 11 A. M. ⌒i to 7 P. M. \i afterwards. Brisk wind at 2½ P. M. Slight rain at 11 A. M. & at 1½ & 3½ P. M.
31	128.0	0.05	S. by E, S. S. W. [& S. by W.	...	172,4	\i to 2 A. M., clear to 6 A. M. ⌒i to 8 P. M. _i afterwards. Slight rain at 1½, 2½ & 5 P. M.

\i Cirri, —i Strati, ⌒i Cumuli, _i Cirro-strati, ⌒—i Cumulo strati, ~i Nimbi \⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August 1868.

Monthly Results.

	Inches.
Mean height of the Barometer for the month...	29.586
Max. height of the Barometer occurred at 10 A. M. on the 31st. ...	29.879
Min. height of the Barometer occurred at 3 A. M. on the 13th. ...	29.392
Extreme range of the Barometer during the month	0.487
Mean of the daily Max. Pressures	29.640
Ditto ditto Min. ditto	29.529
Mean daily range of the Barometer during the month	0.111

	o
Mean Dry Bulb Thermometer for the month	83.3
Max. Temperature occurred at 3 P. M. on the 5th.	92.4
Min. Temperature occurred at 4 A. M. on the 11th.	75.5
Extreme range of the Temperature during the month	16.9
Mean of the daily Max. Temperature	87.6
Ditto ditto Min. ditto, ...	79.9
Mean daily range of the Temperature during the month... ...	7.7

Mean Wet Bulb Thermometer for the month	80.7
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	2.6
Computed Mean Dew-point for the month	78.9
Mean Dry Bulb Thermometer above computed mean Dew-point ...	4.4
	Inches.
Mean Elastic force of Vapour for the month	0.967

	Troy grain.
Mean Weight of Vapour for the month	10.39
Additional Weight of Vapour required for complete saturation ...	1.54
Mean degree of humidity for the month, complete saturation being unity	0.87

	Inches.
Rained 25 days,—Max. fall of rain during 24 hours	8.19
Total amount of rain during the month	24.83
Total amount of rain indicated by the Gauge attached to the anemometer during the month	21.27
Prevailing direction of the Wind... ...	W. S. W. & S. W,

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Augt. 1868.

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																					No. of days																											
Mid night					1	1	1						2						1		2	1	3		2		2		4	1	5	1	4	1	1	1					1	1						
1							1						1						1	1	2	1	4	1	2		2		3	1	6	1	3	1			2	1			1	1	1					
2			1	1			1						1	1					1		3		5	1	2		1		3	1	4		3	2			1		3	3								
3					1								2				1	1			6	1	4	1	1		2	1	2		4	1	2	1			1		2	1	1	1						
4					1								1						3	2	2		5		3	1	3	1	1		5	1	3	3			1	1	1									
5					1								3	1			2				3	1	4		5	1	1		1		3		5	5			2	2	1									
6					1						1	1	2				1		1	1	3	1	5	1	4	1	1		3	1	2		5	4	1	1			1									
7					1								2		2	1			1		1	1	4	1	2		2	1	3		7	2	4	3	1		1	1										
8							1						3				2	2			3	1	2		2		2	1	3	1	7	1	3	3	1		1	1			1							
9							1		1						1		2				3	1	2		2		2	1	4		4	1	8	3			1	1										
10							1								2		1				4	1	1		2		1		4		3		6	3	1	1	3	2	1		1							
11													2				1		1		3	1	2	1	1		2		3		3		5	1			7	2			1	1						
Noon.													2				1	1	1		1		3		1	1	3		3		4		5	2	2		3	1	1	1			1					
1			1										1	1			1		2	1	2		2	1	1		2		3	1	3		2		3		6	2	1				1					
2									1		1		1		1				1		6	3			3		1	1	3		1		3	1	3	1	2		2		1		1	1				
3									1				1								4	1			7	1	2	1	2		3	1	4	2	3		1	1	1		1		1	1				
4													1		1		1		1	1	3		1		5	1	2		2		4		5	1	1		1	1	3	2								
5															1		1		3		3		2		4	1	1		4	1	1		4		2	1	3	2	1		1	1						
6																	1		2	1	4		1		3		3	1	5		5		3	1	1	1	1				2	1						
7	1	1															1		2	2			6	1	2		3		4	1	6		5	3														
8																	1		2	1	1		3		2		5		3		5		5	1			1	1			1							
9					1								1				1		1	1	2		3		1		3		4	1	6	1	4	1			2	2										
10															1		1		1		1		4		1		1		6		5	1	4	1			3	1							1	1		
11							1						1	1			1		1		2		3		1		3		4		4	1	7	3									1	1				

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

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 the Barometer at 32° Faht.	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	29.828	29.894	29.753	0.141	85 2	90.0	81.0	9.0
2	.764	.828	.700	.128	85.8	91.4	81.6	9.8
3	.695	.747	.618	.129	85.3	91.8	81.0	10.8
4	.656	.703	.571	.132	83.7	91.4	78.4	13.0
5	.660	.703	.611	.092	82.9	87.4	79.5	7.9
6	.679	.727	.619	.108	84.4	88.4	81.8	6.6
7	.724	.792	.638	.154	84.4	91.0	79.0	12.0
8	.743	.807	.671	.136	82.5	89.2	78.0	11.2
9	.739	.796	.673	.123	85.1	91.0	80.5	10.5
10	.695	.749	.609	.140	85.1	91.0	81.7	9.3
11	.608	.679	.521	.158	82.7	88.0	80.0	8.0
12	.539	.585	.485	.100	80.7	83.0	79.0	4.0
13	.525	.608	.474	.134	81.0	84.7	79.5	5.2
14	.579	.648	.516	.132	83.6	89.2	79.4	9.8
15	.591	.633	.529	.104	85.6	91.3	81.0	10.3
16	.590	.635	.541	.094	84.3	90.5	81.8	8.7
17	.540	.601	.447	.154	83.3	87.5	80.0	7.5
18	.574	.665	.479	.186	81.4	85.0	78.8	6.2
19	.651	.718	.583	.135	82.9	87.9	80.0	7.9
20	.645	.713	.579	.134	83.7	88.6	78.0	10.6
21	.652	.701	.601	.100	83.1	86.9	80.7	6.2
22	.690	.747	.649	.098	83.6	87.5	79.5	8.0
23	.685	.736	.621	.115	82.5	86.8	80.2	6.6
24	.671	.718	.622	.096	82.5	85.8	80.0	5.8
25	.719	.779	.661	.118	81.2	87.6	78.9	9.0
26	.775	.837	.728	.109	79.1	84.0	77.5	6.5
27	.803	.862	.744	.118	81.5	86.0	77.5	8.5
28	.822	.881	.761	.120	81.6	85.2	77.6	7.6
29	.823	.891	.753	.138	81.2	85.4	77.4	8.0
30	.792	.854	.724	.130	83.0	87.7	78.9	8.8

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

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	80.7	4.5	77.5	7.7	0.925	9.88	2.73	0.78
2	81.3	4.5	78.1	7.7	.943	10.06	.77	.78
3	81.3	4.0	78.5	6.8	.955	.21	.43	.81
4	80.6	3.1	78.4	5.3	.952	.21	1.86	.85
5	80.6	2.3	79.0	3.9	.970	.42	.37	.88
6	81.8	2.6	80.0	4.4	1.001	.72	.59	.87
7	79.7	4.7	76.4	8.0	0.893	9.55	2.76	.78
8	79.8	2.7	77.9	4.6	.937	10.06	1.58	.86
9	81.1	4.0	78.3	6.8	.949	.14	2.43	.81
10	81.3	3.8	78.6	6.5	.958	.23	.34	.81
11	80.1	2.6	78.3	4.4	.949	.20	1.52	.87
12	79.4	1.3	78.5	2.2	.955	.31	0.73	.93
13	79.7	1.3	78.8	2.2	.964	.40	.74	.93
14	80.9	2.7	79.0	4.6	.970	.40	1.63	.87
15	82.2	3.4	79.8	5.8	.995	.62	2.14	.83
16	81.9	2.4	80.2	4.1	1.008	.79	1.49	.88
17	80.9	2.4	79.2	4.1	0.976	.48	.45	.88
18	79.5	1.9	78.2	3.2	.946	.19	.08	.90
19	80.8	2.1	79.3	3.6	.979	.51	.28	.89
20	80.6	3.1	78.4	5.3	.952	.21	.86	.85
21	80.6	2.5	78.8	4.3	.964	.36	.50	.87
22	81.1	2.5	79.3	4.3	.979	.51	.52	.87
23	80.1	2.4	78.4	4.1	.952	.23	.41	.88
24	80.6	1.9	79.3	3.2	.979	.53	.11	.91
25	79.6	1.6	78.5	2.7	.955	.29	0.92	.92
26	78.0	1.1	77.2	1.9	.916	9.91	.62	.94
27	79.4	2.1	77.9	3.6	.937	10.08	1.23	.89
28	79.3	2.3	77.7	3.9	.931	.02	.32	.88
29	78.9	2.3	77.3	3.9	.919	9.90	.31	.88
30	79.8	3.2	77.6	5.4	.928	.97	.85	.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 Septemoer 1868.

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.	29.695	29.856	29.514	0.342	81.5	84.4	78.7	5.7
1	.683	.848	.499	.349	81.3	84.2	78.5	5.7
2	.675	.840	.482	.358	81.1	83.7	78.5	5.2
3	.665	.828	.474	.354	80.8	83.5	77.6	5.9
4	.661	.817	.476	.341	80.6	83.0	78.0	5.0
5	.652	.829	.484	.345	80.5	83.0	78.0	5.0
6	.685	.848	.498	.350	80.3	83.0	77.6	5.4
7	.704	.873	.518	.355	80.9	83.8	77.5	6.3
8	.721	.890	.544	.346	82.1	85.5	77.4	8.1
9	.732	.894	.562	.332	83.7	87.5	78.0	9.5
10	.732	.893	.549	.344	84.9	89.0	78.8	10.2
11	.722	.884	.541	.343	85.5	89.8	79.5	10.3
Noon.	.703	.868	.550	.318	86.5	90.6	79.2	11.4
1	.677	.841	.518	.323	86.9	91.5	77.5	14.0
2	.649	.809	.495	.314	86.6	91.8	77.8	14.0
3	.630	.779	.466	.313	86.6	91.4	78.7	12.7
4	.622	.761	.456	.305	86.2	91.0	79.2	11.8
5	.633	.774	.447	.327	84.6	91.3	78.5	12.8
6	.645	.792	.467	.325	83.2	89.0	78.5	10.5
7	.666	.803	.488	.315	82.6	86.6	78.5	8.1
8	.685	.828	.498	.330	82.4	86.5	77.5	9.0
9	.702	.850	.537	.313	82.0	86.0	78.2	7.8
10	.708	.865	.528	.337	81.8	85.0	78.5	6.5
11	.700	.853	.510	.343	81.6	84.9	78.5	6.4

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

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.	
Midnight.	80.0	1.5	78.9	2.6	0.967	10.41	0.90	0.92
1	79.9	1.4	78.9	2.4	.967	.43	.81	.93
2	79.8	1.3	78.9	2.2	.967	.43	.74	.93
3	79.5	1.3	78.6	2.2	.958	.34	.73	.93
4	79.3	1.3	78.4	2.2	.952	.27	.74	.93
5	79.2	1.3	78.3	2.2	.949	.24	.74	.93
6	79.0	1.3	78.1	2.2	.943	.18	.73	.93
7	79.2	1.7	78.0	2.9	.940	.13	.97	.91
8	79.9	2.2	78.4	3.7	.952	.23	1.28	.89
9	80.7	3.0	78.6	5.1	.958	.28	.79	.85
10	81.2	3.7	78.6	6.3	.958	.26	2.23	.82
11	81.4	4.1	78.5	7.0	.955	.21	.51	.80
Noon.	81.8	4.7	79.0	7.5	.970	.33	.77	.79
1	81.9	5.0	78.9	8.0	.967	.30	.95	.78
2	81.5	5.1	78.4	8.2	.952	.15	.99	.77
3	81.6	5.0	78.6	8.0	.958	.21	.93	.78
4	81.5	4.7	78.2	8.0	.946	.09	.90	.78
5	81.1	3.5	78.6	6.0	.958	.26	.13	.83
6	80.3	2.9	78.3	4.9	.949	.18	1.71	.86
7	80.2	2.4	78.5	4.1	.955	.27	.41	.88
8	80.2	2.2	78.7	3.7	.961	.33	.28	.89
9	80.0	2.0	78.6	3.4	.958	.32	.15	.90
10	80.1	1.7	78.9	2.9	.967	.41	0.99	.91
11	79.9	1.7	78.7	2.9	.961	.35	.99	.91

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	WIND. Prevailing direction.	Max. Pressure	Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	129.6	...	SSW,SbyW&SW	3.0	85.1	⌒i & \i to 6 P. M. \⌣i afterwards. Brisk wind at 2¼ P.M.
2	133.0	...	S. W. & S. S. W.	0.7	352.7	\⌣i to 8 A. M. ⌒i to 5 P. M. \i afterwards. Lightning to W at 7 P. M. Thunder at 8 P. M.
3	134.2	0.12	S. S. W. & S. W.	1.6	208.5	⌣i to 4 A. M. \⌣i to 8 A. M. \i to 3 P. M. \⌣i to 8 P.M. Stratoni afterwards. Brisk wind & rain at 4¼ P. M. Thunder at 6 & 7 P. M. Lightning to S W at 7 & 8 P. M.
4	131.4	3.10	S. W.	...	205.9	\i to 2 A. M. ⌒i to 4 P. M. Overcast afterwards. High wind from 4¼ to 6¾ P. M. Thunder at 5 & 6 P. M. Lightning from 6 to 10 P. M. Rain from 4½ to 11 P. M.
5	...	...	S. by W. & S.	...	221.2	Chiefly \⌣i. Lightning at midnight & 1 A. M. & at 7 & 8 P. M. Drizzled at 5½ A. M.
6	130.0	0.05	S. E. & S. S. E.	...	144.2	Stratoni to 5 A. M. ⌒i to 3 P. M. Stratoni afterwards. Thunder at 4 & 5 P. M. Lightning to W at 8 & 9 P. M. Light rain at 11 A. M. & at 4 & 5 P. M.
7	135.0	0.30	S. E.	...	92.1	⌒i to 4 P. M. \⌣i. afterwards. Thunder at 3 & 4 A. M. & at 6 & 9 P. M. Lightning at 3 & 4 A. M. & from 6 to 11 P. M. Rain at 3 & 4 A. M.
8	136.0	0.44	N.N.E.& variable.	...	139.6	⌒i & \⌣i. Lightning & rain at midnight. Thunder at 1 A. M.
9	135.0	...	S. E, E. S. E. & S.	...	97.7	\⌣i to 4 A. M. \i to 8 A. M. ⌒i to 6 P. M., clear afterwards.
10	137.5	...	S. & variable.	1.5	81.8	Clear to 5 A. M. ⌒i to 4 P. M., clear afterwards. Brisk wind at 2½ P. M. Thunder at 2 P. M. Lightning from 7 to 11 P. M.
11	131.8	0.74	S. & E.	3.5	89.5	\⌣i to 4 A. M. \⌣i to 8 A. M. Stratoni & ⌒i to 4 P. M. Overcast afterwards. Brisk wind at 4½ P. M. Rain from 7 to 9 A. M. & from 4½ to 9 P. M.
12	...	1.21	E.	1.9	239.0	Chiefly overcast. Brisk wind from 8½ to 9½ & at 12½ A. M. Thunder & Lightning at 9½ P. M. Rain after intervals.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
13	...	1.09	E. S. E. & E.	1.8	322.5	Overcast to 1 P. M. Stratoni afterwards. Brisk wind from 3 to 11½ A. M. Thunder from 2 to 5 A. M. Lightning at 3 A. M. Rain from midnight to 7 A. M. & from 9 to noon & at 1½, 3½ & 6 P. M.
14	134.5	0.27	S. E. & S. by E.	0.7	229.3	⌒i to 6 A. M. Scuds from SE to 10 A. M. ⌒i to 7 P. M., clear afterwards. Rain at 4½ & 10½ A. M. & at 5½ P. M.
15	134.5	...	S.S.E.,S.E&S.W.	...	148.9	Clear to 3 A. M. ⌒i to 7 P. M. clear afterwards.
16	132.0	0.10	S. W. & E.	...	52.7	\i to 5 A. M. ⌒i to 1 P. M. Stratoni afterwards. Thunder & light rain at 1½ P. M. Lightning at 3 A. M.
17	127.0	0.13	E. & E. N. E.	3.1	82.6	Stratoni to 5 A. M. ⌒i to 4 P. M. Overcast afterwards. Brisk wind from noon to 2 P. M. & from 6½ to 11 P. M. Lightning at 9 P. M. Light rain at 8 & 10½ A. M. & from 5½ to 11 P. M.
18	...	0.94	S. S. E. & S. E.	2.1	324.7	Overcast to 5 A. M. \⌣i to 10 A. M. ⌒i & \i to 6 P. M., clear afterwards. Brisk wind at 2½ 6½ & 10 A. M. Lightning from 3 to 5 A. M. & at 9 & 10 P. M. Rain at midnight, 2, 3, 7, 9 & 10 A. M. & at 5½ P. M.
19	132.0	0.26	S. S. E, S. E. & S.	...	145.3	Clear to 4 A. M., clouds of different kinds afterwards. Rain at 5 & 8 A. M. & at 2 & 4½ P. M.
20	130.8	0.99	S. & S. by W,	...	80.1	Clear to 2 A. M. ⌒i to 5 P. M. \i afterwards. Rain from 6½ to 7½ A. M.
21	122.0	0.19	S. & S. by E.	0.6	168.4	Clear to 4 A. M. ⌒i to 1 P. M. Overcast to 6 P. M., clear afterwards. Thunder at 2 P. M. Rain at 9½ & 12½ A. M. & at 3½ & 5½. P. M.
22	...	0.24	S.byE, S.&S.S.E.	0.2	156.0	Stratoni to 5 A. M., clouds of different kinds afterwards. Thunder at 4 & 5½ A. M. Lightning at 3 & 4 A.M. Rain at 4½, 5½ & 10½ A. M. & at 5½ P. M.

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Abstract of the Result of the Hourly Meterological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

Solar Radiation, Weather, &c.,

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{3}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
				lb	Mlies	
23	129.0	0.90	S, & S. by W.	0.3	138.9	Clear to 5 A. M. ⌒i to 6 P. M. ╲i afterwards. Rain at 10 & $12\frac{1}{2}$ A. M. & from 3 to 5 P. M.
24	131.5	0.05	S. by E. & S. S. E.	0.2	132.1	Clouds of different kinds to noon, ⌒i to 7 P. M. ╲i afterwards. Thunder at 5 A. M. Lightning at 7 & 8 P. M. Light rain at $4\frac{1}{2}$ and Noon.
25	131.0	1.93	S. by E, & S. E.	0.4	102.3	Stratoni to 8 A. M. ╲i to Noon. Overcast afterwards, Thunder at $12\frac{1}{2}$ A. M. Rain at $2\frac{1}{2}$ A. M. and from $12\frac{1}{2}$ to 9 P. M.
26	...	1.15	E, & E. S. E.	0.5	167.8	Overcast to 6 P. M. Stratoni afterwards. Lightning to N. at 4 A. M. Drizzled at midnight. Rain from $10\frac{1}{2}$ A. M. to 2 P. M. & at 5, 8, 9 & 10 P. M.
27	122.0	...	S.S.W. & S. by E.	0.4	105.9	Stratoni to 2 A. M., overcast to 8 A. M. ⌒i afterwards. Drizzled at $2\frac{1}{2}$, $4\frac{1}{2}$ & $6\frac{1}{2}$ A. M.
28	...	0.83	S. by E. & S.	1.2	159.1	Overcast to 11 A. M. Stratoni to 3 P. M. ╲i & ⌒i afterwards. Lightning to S, at 3 A. M. Thunder at $5\frac{1}{2}$ A. M. Rain from $1\frac{1}{2}$ to 7 & at 11 A. M.
29	...	0.66	S. & S. by E.	1.8	164.6	╲i to 2 A. M., overcast to 1 A. M. ╲i to 8 P. M. Stratoni afterwards. Thunder at 6 & $12\frac{1}{2}$ A. M. Lightning at 6 A. M. & at 11 P. M. Rain from 5 to 7 A. M. and at 1 P. M.
30	130.0	...	S. & S. by E.		164,8	╲i to 8 A. M. ⌒i to 1 P. M. ╲i afterwards. Drizzled at 2 P. M.

╲i Cirri, — i Strati, ⌒i Cumuli, ╲_i Cirro-strati, ⌒_i Cumulo strati, ╲⌒i Nimbi. ╲⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of September 1868.

Monthly Results.

	Inches.
Mean height of the Barometer for the month	29.683
Max. height of the Barometer occurred at 9 A. M. on the 1st. ...	29.894
Min. height of the Barometer occurred at 5 P. M. on the 17th. ...	29.447
Extreme range of the Barometer during the month	0.447
Mean of the daily Max. Pressures	29.741
Ditto ditto Min. ditto	29.616
Mean daily range of the Barometer during the month	0.125

	°
Mean Dry Bulb Thermometer for the month	83.1
Max. Temperature occurred at 2 P. M. on the 3rd.	91.8
Min. Temperature occurred at 8 A. M. on the 29th.	77.4
Extreme range of the Temperature during the month	14.4
Mean of the daily Max. Temperature	88.0
Ditto ditto Min. ditto, ...	79.6
Mean daily range of the Temperature during the month... ...	8.4

Mean Wet Bulb Thermometer for the month	80.4
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	2.7
Computed Mean Dew-point for the month	78.5
Mean Dry Bulb Thermometer above computed mean Dew-point ...	4.6
	Inches.
Mean Elastic force of Vapour for the month	0.955

	Troy grain.
Mean Weight of Vapour for the month	10.25
Additional Weight of Vapour required for complete saturation ...	1.61
Mean degree of humidity for the month, complete saturation being unity	0.86

	Inches.
Rained 25 days,—Max. fall of rain during 24 hours	3.10
Total amount of rain during the month	15.69
Total amount of rain indicated by the Gauge attached to the anemometer during the month	10.59
Prevailing direction of the Wind... ...	S. & S. E.

Note.—The clock attached to the Anemometer being out of order from 4th to 8th, the Max. Pressure and Rain could not be registered.

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***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Sept.* 1869.**

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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.
																			No. of days																													
Mid night															2		1		5		5		6		6		3		2																			
1													1	1	1		2		5	2	5		5		6		3		2																			
2							1	1							2		2		5		4		5		6		3	1	2																			
3											1	1			2		3		4	2	6		3		5		3		2	1	1	1																
4											1				3	1	2		4		7	1	2		8	1	2		1																			
5											1		1		2		2		3		7	2	3	1	7	1	3		1																			
6													2		2		4		3		5	1	4	1	6		3	1	1																			
7													1		2		5		5	2	3	1	2	1	8		3	1																				
8															1		6		5	1	6		1		4		3	1	3	1																		
9															2		3		7	1	6		3		1	1	1		6																			
10													1		1		5		7	1	4		1		4	1	1		4		1																	
11													2				3		6		4	1	2	1	2		4	1	5		1																	
Noon.							1						3		1		3	1	2		6	2	3	2	3		5	3	2		1																	
1											3		3		1		1		4	2	4	1	3		4		5		2																			
2									1		1		2	1	1		4	1	4	2	3		1		8		3		2																			
3													4	2	1		1	1	2	1	4	2	6		8	1	2		2																			
4											1		2				1		4	1	7	2	4	1	5	1	1		5																			
5													1		1		4		2		7	2	2	1	4		4		5																			
6													1		2		1		3	1	6	1	3	1	10	1	3	1	1	1																		
7													2		2		1		2	1	5	2	6		7	1	4		1																			
8															1		2		2		6	3	8	2	7		4	1																				
9															2		1		3		5		8	1	7		4																					
10															2		1		4	1	4		9		7		3	1																				
11															2		2		3		4		9		7		3																					

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1868.

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 the Barometer at 32° Faht.	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	29.787	29.854	29.719	0.135	83.2	87.5	80.0	7.5
2	.775	.838	.712	.126	84.2	88.5	80.5	8.0
3	.773	.821	.714	.107	84.2	90.2	82.0	8.2
4	.760	.825	.707	.118	83.9	87.7	81.0	6.7
5	.755	.801	.705	.096	83.4	88.3	81.2	7.1
6	.737	.791	.680	.111	84.9	90.0	81.5	8.5
7	.745	.811	.692	.119	84.8	90.6	80.0	10.6
8	.750	.810	.701	.109	84.4	90.0	80.4	9.6
9	.767	.823	.721	.102	84.0	89.4	78.5	10.9
10	.820	.880	.784	.096	83.0	88.4	77.8	10.6
11	.838	.902	.792	.110	82.9	87.5	79.5	8.0
12	.863	.923	.812	.111	83.6	87.7	79.6	8.1
13	.870	.943	.824	.119	85.4	91.0	80.6	10.4
14	.872	.950	.826	.124	85.1	92.1	80.0	12.1
15	.869	.929	.821	.108	83.2	87.5	78.5	9.0
16	.907	.962	.867	.095	82.5	88.7	78.0	10.7
17	.941	30.004	.890	.114	83.1	89.0	79.0	10.0
18	.946	.015	.888	.127	82.5	87.6	77.0	10.6
19	.956	.030	.904	.126	81.7	87.5	75.5	12.0
20	.942	.012	.899	.113	81.7	87.3	76.4	10.9
21	.910	29.982	.855	.127	82.0	88.5	76.6	11.9
22	.872	.935	.810	.125	81.0	88.0	75.0	13.0
23	.876	.953	.826	.127	79.8	87.3	72.2	15.1
24	.886	.963	.840	.123	80.4	87.0	73.7	13.3
25	.876	.940	.823	.117	80.8	87.6	74.8	12.8
26	.903	.965	.860	.105	80.9	87.2	76.0	11.2
27	.945	30.025	.901	.124	79.9	87.5	73.5	14.0
28	.961	.035	.909	.126	79.5	86.5	73.0	13.5
29	.942	.017	.880	.137	78.0	85.5	70.8	14.7
30	.935	.017	.874	.143	77.5	85.4	71.5	13.9
31	.962	.042	.905	.137	77.6	84.6	71.0	13.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1868.

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	80.5	2.7	78.6	4.6	0.958	10.28	1.61	0.87
2	80.8	3.4	78.4	5.8	.952	.19	2.05	.83
3	81.1	3.1	78.9	5.3	.967	.37	1.87	.85
4	81.4	2.5	79.6	4.3	.989	.60	.53	.87
5	81.2	2.2	79.7	3.7	.992	.63	.33	.89
6	80.3	4.6	77.1	7.8	.913	9.76	2.73	.78
7	78.8	6.0	74.6	10.2	.843	.02	3.44	.72
8	78.2	6.2	73.9	10.5	.824	8.81	.50	.72
9	77.3	6.7	72.6	11.4	.790	.47	·70	.70
10	78.1	4.9	74.7	8.3	.846	9.08	2.74	.77
11	79.8	3.1	77.6	5.3	.928	.97	1.82	.85
12	80.2	3.4	77.8	5.8	.934	10.01	2.02	.83
13	80.5	4.9	77.1	8.3	.913	9.76	.92	.77
14	79.2	5.9	75,1	10.0	.857	.15	3.42	.73
15	79.0	4.2	76.1	7.1	.885	.50	2.39	.80
16	76.5	6.0	72.3	10.2	.783	8.41	3.23	.72
17	76.1	7.0	71.2	11.9	.756	.10	.76	.68
18	75.0	7.5	69.7	12.8	.720	7.72	.92	.66
19	74.8	6.9	70.0	11.7	.727	.81	.56	.69
20	75.6	6.1	71.3	10.4	.758	8.16	.21	.72
21	75.3	6.7	70.6	11.4	.741	7.97	.50	.70
22	73.1	7.9	67.6	13.4	.672	.25	.89	.65
23	73.0	6.8	68.2	11.6	.686	.40	.35	.69
24	74.2	6.2	69.9	10.5	.725	.80	.14	.71
25	75.2	5.6	71.3	9.5	.758	8.16	2.91	.74
26	74.8	6.1	70.5	10.4	.739	7.97	3.13	.72
27	72.8	7.1	67.8	12.1	.677	.30	.48	.68
28	71.6	7.9	66.1	13.4	.640	6.92	.74	.65
29	70.0	8.0	64.4	13.6	.605	.55	.64	.64
30	70.1	7.4	64.9	12.6	.615	.67	.37	.66
31	71.1	6.5	66.5	11.1	.648	7.03	.04	.70

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1868.

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. Max.	Min.	Diff.	Mean Dry Bulb Thermometer.	Range of the Temperature for each hour during the month. Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid-night.	29.861	29.963	29.745	0.218	79.6	83.2	74.0	9.2
1	.852	.945	.733	.212	79.1	83.0	73.6	9.4
2	.843	.946	.727	.219	78.7	82.8	73.0	9.8
3	.837	.932	.719	.213	78.3	82.5	72.0	10.5
4	.842	.947	.715	.232	77.9	82.5	71.9	10.6
5	.854	.963	.727	.236	77.6	82.2	71.0	11.2
6	.872	.983	.746	.237	77.4	82.0	70.8	11.2
7	.890	30.000	.758	.242	78.5	83.0	71.5	11.5
8	.913	.022	.772	.250	81.0	85.2	75.0	10.2
9	.926	.042	.789	.253	83.0	86.7	77.7	9.0
10	.926	.039	.791	.248	84.8	87.5	80.0	7.5
11	.907	.017	.778	.239	85.8	89.0	81.4	7.6
Noon.	.886	29.984	.761	.223	86.5	90.0	82.7	7.3
1	.856	.957	.730	.227	87.0	90.2	83.4	6.8
2	.831	.932	.703	.229	87.4	90.5	84.5	6.0
3	.816	.919	.686	.233	87.6	90.6	84.5	6.1
4	.814	.910	.686	.224	87.1	91.0	83.0	8.0
5	.818	.912	.680	.232	86.5	92.1	81.5	10.6
6	.828	.924	.689	.235	84.2	87.4	80.0	7.4
7	.842	.947	.701	.246	82.9	86.2	78.5	7.7
8	.862	.962	.725	.237	81.9	85.0	77.2	7.8
9	.874	.982	.747	.235	81.0	84.6	76.3	8.3
10	.880	.992	.756	.236	80.3	84.0	75.5	8.5
11	.875	.980	.755	.225	79.8	83.5	74.9	8.6

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1868.

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.	76.7	2.9	74.7	4.9	0.846	9.14	1.55	0.86
1	76.5	2.6	74.7	4.4	.846	.16	.37	.87
2	76.2	2.5	74.4	4.3	.838	.08	.33	.87
3	75.9	2.4	74.2	4.1	.832	.02	.26	.88
4	75.7	2.2	74.2	3.7	.832	.02	.14	.89
5	75.7	1.9	74.4	3.2	.838	.10	0.97	.90
6	75.7	1.7	74.5	2.9	.840	.12	.89	.91
7	76.6	1.9	75.3	3.2	.862	.34	1.01	.90
8	77.1	3.9	74.4	6.6	.838	.02	2.12	.81
9	77.0	6.0	72.8	10.2	.795	8.54	3.28	.72
10	77.2	7.6	71.9	12.9	.773	.26	4.20	.66
11	77.1	8.7	71.0	14.8	.751	.00	.83	.62
Noon.	76.9	9.6	71.1	15.4	.753	.03	5.07	.61
1	76.7	10.3	70.5	16.5	.739	7.85	.44	.59
2	76.7	10.7	70.3	17.1	.734	.81	.64	.58
3	76.6	11.0	70.0	17.6	.727	.71	.81	.57
4	76.5	10.6	70.1	17.0	.729	.76	.57	.58
5	76.8	9.7	71.0	15.5	.751	.99	.11	.61
6	76.9	7.3	71.8	12.4	.771	8.25	3.99	.67
7	77.3	5.6	73.4	9.5	.811	.69	.10	.74
8	77.2	4.7	73.9	8.0	.824	8.87	2.57	.78
9	77.0	4.0	74.2	6.8	.832	.96	.18	.80
10	76.9	3.4	74.5	5.8	.840	9.07	1.84	.83
11	76.7	3.1	74.5	5.3	.840	.09	.66	.85

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	129.0	0.22	S by E. & S.S.W.	...	138.1	\i to 8 A. M. ⌒i to 4 P. M., stratoni to 8 P. M. _i afterwards. Thunder at $2\frac{1}{2}$ & $3\frac{1}{2}$ P. M. Rain at 1 P. M.
2	129.0	...	S.S.W.&S. by W.	...	93.6	Scuds from S S W to 3 A. M. \i to 3 P. M., clouds of different kinds afterwards. Lightning to S at 5 A. M.
3	135.0	...	S.S.W. & S.by E.	...	76.4	\i to 7 A. M. ⌒i to 2 P. M. \⌣i afterwards. Thunder at 2 & 3 P. M. Lightning to N W at 3 A. M. Drizzled at 4 & 5 P. M.
4	131.2	...	S. by E. & S.	1.0	84.0	\i to 7 A. M. ⌒i to 3 P. M., stratoni afterwards. Lightning to W at 11 P. M.
5	...	1.31	S. & S. by E.	0.5	118.0	\i & ⌒i to 11 A. M., overcast to 4 P. M., clouds of different kinds afterwards. Thunder at $1\frac{1}{2}$ & 2 P. M. Lightning at 7 P. M. Rain from 11 A. M. to 2 P. M.
6	125.0		S. S. W. & N. W.		30.4	\i to 7 A. M. Clear afterwards.
7	130.0		W. S.W. &. S.W.		83.2	\i to 10 A. M. ⌒i to 4 P. M. Clear afterwards. Foggy from 9 to 11 P. M.
8	127.0		S.W & W .N. W.		52.8	Clear to 3 A. M. \i to 9 A. M. \i & ⌒i to 5 P. M., clear afterwards. Slightly, foggy at 11 P. M.
9	128.0		W. N. W. & N,		46.8	Chiefly \i.
10	126.5		N, N. by E. & E.		86.6	\i to 9 A. M. ⌒i to 6 P. M. Clear afterwards. Drizzled at 3 P. M.
11	120.0		E,E.byN.&E.byS.		127.4	\i to 6 A. M. ⌒i to 7 P. M. clear afterwards.
12	125.0		E. by S. & N. W.		76.1	\i to 7 A.M. ⌒i to 6 P.M., stratoni afterwards.
13	128.6		E.S.E. & E. N. E.		101.3	Clear to 9 A. M. ⌒i to 6 P. M. Clear afterwards. Slightly, foggy from 8 to 10 P. M.
14	128.8		E.N.E.&W.by N.		65.7	Clear to 10 A. M. ⌒i to 6 P. M. clear afterwards.
15	128.5		S. W. & S.		50.2	Clear to 5 A. M. ⌒i afterwards. Thunder & Lightning to S at 8 P. M.
16	128.5		S. S. W. & S.		89.4	Clouds of different kinds.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{2}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
17	129.0	...	N. N. W. & S. W.	...	68.5	Clear to 10 A. M. ⌒i to 6 P. M., clear afterwards.
18	126.5	...	W.N.W.& S.S.E.	...	74.5	_i to 2 A. M., clear to 11 A. M. ⌒i to 4 P.M., clear afterwards.
19	127.7	...	W. N. W, & W.	...	68.9	Clear to 10 A. M. ⌒i to 6 P. M. clear afterwards.
20	126.0	...	W,S.W.& S.S.W.	...	59.6	Clear to 6 A. M. \i & ⌒i to 6 P M., clear afterwards. Slightly foggy from 8 to 11 P. M.
21	138.0	...	S. S. W. & S. W.	...	41.6	Chiefly clear. Foggy from 7 to 11 P. M.
22	125.4	...	N.N.W.&S. by E.	0.4	65.1	Clear
23	126.0	...	N.N.W. &N.N.E.	...	97.0	Clear
24	127.0	...	E.S.E. & variable	...	76.3	Clear. Foggy from 7 to 10 P M.
25	129.0	...	S. by W. & S. W.	...	54.0	Clear to 9 A. M. \i & ⌒i to 6 P M., clear to 9 P. M. \i afterwards.
26	125.6	...	WSW,WNW & S	...	60.0	Clear to 5 A. M. \i to Noon. _i to 3 P. M., clear afterwards. Slightly foggy from 9 to 11 P. M.
27	125.5	...	S.byE. & E.N.E.	...	46.5	Clear to 4 A. M. \i to 2 P. M. ⌒i to 5 P.M. clear afterwords. Foggy from 8 to 11 P. M.
28	126.0	...	N by E&W.N.W.	...	75.4	Clear.
29	126.0	...	N. E. & N. N. W.	...	87.0	Clear.
30	122.0	...	S.S. E. & W.S.W.	...	85.9	Clear, foggy from 7 to 11 P. M.
31	121.0	...	S. W.	...	47.5	Clear to 11 A. M. ⌒i to 1 P. M. Clear afterwards. Foggy at midnight & 1 A. M.

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\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 1868.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.862
Max. height of the Barometer occurred at 9 A. M. on the 31st. ...	30.042
Min. height of the Barometer occurred at 5 P. M. on the 6th. ...	29.680
Extreme range of the Barometer during the month	0.362
Mean of the daily Max. Pressures	29.929
Ditto ditto Min. ditto	29.811
Mean daily range of the Barometer during the month	0.118

	o
Mean Dry Bulb Thermometer for the month	82.2
Max. Temperature occurred at 5 P. M. on the 14th.	92.1
Min. Temperature occurred at 6 A. M. on the 29th.	70.8
Extreme range of the Temperature during the month	21.3
Mean of the daily Max. Temperature	88.1
Ditto ditto Min. ditto, ...	77.3
Mean daily range of the Temperature during the month... ...	10.8

Mean Wet Bulb Thermometer for the month	76.6
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	5.6
Computed Mean Dew-point for the month	72.7
Mean Dry Bulb Thermometer above computed mean Dew-point ...	9.5
	Inches.
Mean Elastic force of Vapour for the month	0.792

	Troy grain.
Mean Weight of Vapour for the month	8.51
Additional Weight of Vapour required for complete saturation ...	3.03
Mean degree of humidity for the month, complete saturation being unity	0.74

	Inches.
Rained 4 days,—Max. fall of rain during 24 hours	1.31
Total amount of rain during the month	1.53
Total amount of rain indicated by the Gauge attached to the anemometer during the month	1.42
Prevailing direction of the Wind... ...	S. W. & S. S. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Oct. 1868.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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						3				1		1		1				2		3		2		1		3		4						3				2				3			
1	1		1						1		1		1		2		2				2		2		4		1		3		3		1				2				2				2			
2	1						1		1				1		1		2		1				3		5		1		4		2		2				1				2				2			
3	1						1		1				1		1		2				2		3		4		2		4		2		3								2				1			
4			1				1		1		1				1		2		1		1		3		3		2		3		2		4								3				1			
5			1				1		1		1				1		2				1		4		1		2		4		2		5								3				1			
6			1				1		1		1				1		2				1		3		2		1		6		3		4								3				1			
7			1				1		1		1				1		2				2		1		2		4		8		1		2						2		1				1			
8					1		2		2						1		2		2		2		1		2		3		3		5		2				1		1		1							
9							2		1		2		1				1				3		3		1		3		3		2		3		1		1		2		1				1			
10			1				2		3										4		3		2		1		2		1		5				2		1				2		1				1	
11					1		4		3				2				1		1				2		4		3		1	1	1		3				1		1		1						2	
Noon.			1		1		2		2		1		1				2		1				3		1	1	1		1		4		2		1				1		1		3		1		1	
1					1		3		3				1				1		2				3	1			2				1	1	4		1				1		4		2		2			
2	1				1		1		3										2		1		1		1				1		5	1	2		1		2				4		3		1		1	
3	3		1				1		2	1									1		1		1		1				2		5		1				3				5		2		1		1	
4	2				4		2														2	1	1		1		1		2		1		3		2				1		2		5		1		1	
5	1		1		1		1		2				1				1				2	1			1		2		1		2		1		2		1		2		3		4		2			
6	1		1		1				3						1						1		1		1		3		3		4		1				1		1		3		2		3			
7	1		1		1				2				1		1						1		2		1		2		3		5						1		1		3		2		3			
8	1		1		1				2				1		1						1		2		2		1		3		5						1		1		3		2		3			
9	1		1		1				2				1		1						1		2		3				4		5						2				2		2		3			
10	1		1		1				2				1		1						1		2		3		1		4		4						2				2		2		3			
11	1		1				1		2				1		1		1				1		2		3		1		3		5						3				2				3			

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

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 the Barometer at 32° Faht.	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	29.989	30.062	29.940	0.122	78.0	85.4	71.5	13.9
2	.975	.059	.924	.135	78.5	85.4	73.0	12.4
3	.985	.061	.934	.127	79.2	87.0	73.0	14.0
4	.980	.057	.935	.122	78.8	85.2	73.0	12.2
5	.908	29.979	.832	.147	78.8	85.0	73.5	11.5
6	.845	.901	.782	.119	79.1	86.0	72.2	13.8
7	.856	.907	.819	.088	77.6	83.7	72.5	11.2
8	.818	.895	.753	.142	77.0	83.0	72.5	10.5
9	.789	.848	.730	.118	76.9	84.7	71.4	13.3
10	.801	.874	.740	.134	78.3	85.8	71.5	14.3
11	.841	.912	.796	.116	79.5	87.1	73.2	13.9
12	.881	.939	.833	.106	78.0	84.0	73.0	11.0
13	.865	.925	.800	.125	76.1	82.3	71.0	11.3
14	.883	.950	.825	.125	75.0	84.0	67.4	16.6
15	.949	30.015	.901	.114	75.6	85.0	68.8	16.2
16	30.024	.103	.940	.163	73.3	82.4	66.5	15.9
17	.034	.110	.970	.140	72.1	81.0	64.8	16.2
18	.009	.083	.940	.143	72.7	81.6	64.5	17.1
19	29.991	.061	.927	.134	73.1	81.9	66.0	15.9
20	.974	.049	.924	.125	72.1	80.6	64.8	15.8
21	.987	.047	.942	.105	71.6	79.6	64.5	15.1
22	.990	.046	.936	.110	72.0	80.5	64.5	16.0
23	30.026	.106	.972	.134	72.3	81.3	64.0	17.3
24	.048	.126	.996	.130	71.8	80.2	64.5	15.7
25	.080	.162	30.025	.137	71.6	79.5	64.5	15.0
26	.082	.154	.023	.131	71.8	79.6	65.2	14.4
27	.062	.139	29.993	.146	72.8	81.0	66.0	15.0
28	.072	.137	30.023	.114	73.2	81.7	67.4	14.3
29	.093	.185	.021	.164	71.5	79.5	66.0	13.5
30	.042	.128	29.966	.162	71.7	80.0	65.0	15.0

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

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	71.4	6.6	66.8	11.2	0.655	7.10	3.09	0.70
2	72.6	5.9	68.5	10.0	.692	.50	2.85	.73
3	72.8	6.4	68.3	10.9	.688	.43	3.13	.70
4	72.6	6.2	68.3	10.5	.688	.43	.01	.71
5	72.6	6.2	68.3	10.5	.688	.43	.01	.71
6	72.1	7.0	67.2	11.9	.664	.17	.36	.68
7	72.1	5.5	68.2	9.4	.686	.44	2.63	.74
8	72.5	4.5	69.3	7.7	.711	.70	.19	.78
9	72.0	4.9	68.6	8.3	.695	.55	.31	.77
10	72.0	6.3	67.6	10.7	.672	.28	3.00	.71
11	72.1	7.4	66.9	12.6	.657	.09	.57	.67
12	72.7	5.3	69.0	9.0	.704	.62	2.57	.75
13	68.7	7.4	63.5	12.6	.588	6.38	3.25	.66
14	67.5	7.5	62.2	12.8	.563	.13	.18	.66
15	66.8	8.8	60.6	15.0	.534	5.80	.68	.61
16	63.4	9.9	55.5	17.8	.450	4.92	.92	.56
17	63.1	9.0	55.9	16.2	.456	.99	.54	.59
18	64.5	8.2	57.9	14.8	.488	5.33	.35	.61
19	65.4	7.7	59.2	13.9	.509	.57	.22	.63
20	64.9	7.2	59.1	13.0	.508	.56	2.97	.65
21	65.2	6.4	60.1	11.5	.525	.75	.65	.69
22	65.2	6.8	59.8	12.2	.520	.69	.81	.67
23	66.4	7.9	58.1	14.2	.491	.38	3.20	.63
24	65.1	6.7	59.7	12.1	.518	.68	2.77	.67
25	65.4	6.2	60.4	11.2	.530	.82	.58	.69
26	65.9	5.9	61.2	10.6	.544	.97	.48	.71
27	65.9	6.9	60.4	12.4	.530	.81	.90	.67
28	66.8	6.4	61.7	11.5	.554	6.04	.70	.69
29	65.9	5.6	61.4	10.1	.548	.02	.36	.72
30	64.6	7.1	58.9	12.8	.504	5.52	.91	.66

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

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.	29.967	30.101	29.796	0.305	71.9	76.8	68.0	8.8
1	.957	.092	.790	.302	71.3	76.4	67.0	9.4
2	.947	.080	.779	.301	70.8	75.8	66.4	9.4
3	.940	.082	.773	.309	70.1	75.0	66.0	9.0
4	.939	.083	.772	.311	69.5	74.5	65.0	9.5
5	.951	.090	.764	.326	69.1	73.8	64.5	9.3
6	.968	.110	.777	.333	68.6	74.5	64.0	10.5
7	.988	.134	.784	.350	68.9	74.3	64.5	9.8
8	30.013	.161	.814	.347	71.3	76.7	66.5	10.2
9	.032	.185	.848	.337	74.2	80.0	68.8	11.2
10	.031	.170	.843	.327	77.0	82.5	71.8	10.7
11	.011	.144	.826	.318	79.4	84.5	75.5	9.0
Noon.	29.982	.122	.788	.334	80.8	85.6	77.0	8.6
1	.948	.071	.751	.320	82.0	86.5	78.8	7.7
2	.924	.045	.736	.309	82.5	87.0	78.0	9.0
3	.911	.031	.730	.301	82.6	87.1	77.6	9.5
4	.907	.026	.735	.291	81.4	85.5	77.4	8.1
5	.916	.037	.743	.294	80.0	84.6	75.7	8.9
6	.928	.051	.754	.297	77.7	82.6	74.0	8.6
7	.946	.066	.789	.277	76.2	82.6	72.2	10.4
8	.964	.092	.804	.288	75.0	80.8	71.2	9.6
9	.977	.109	.813	.296	74.0	79.5	70.0	9.5
10	.982	.110	.818	.292	73.2	78.0	69.0	9.0
11	.977	.106	.805	.301	72.4	77.2	68.0	9.9

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

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.	
Midnight.	67.8	4.1	64.5	7.4	0.607	6.67	1.81	0.79
1	67.4	3.9	64.3	7.0	.603	.63	.70	.80
2	67.0	3.8	64.0	6.8	.597	.56	.64	.80
3	66.5	3.6	63.6	6.5	.590	.48	.55	.81
4	66.3	3.2	63.7	5.8	.591	.51	.37	.83
5	65.9	3.2	63.3	5.8	.584	.43	.35	.83
6	65.6	3.0	63.2	5.4	.582	.43	.24	.84
7	65.7	3.2	63.1	5.8	.580	.39	.35	.83
8	67.1	4.2	63.7	7.6	.591	.48	.85	.78
9	68.0	6.2	63.7	10.5	.591	.45	2.64	.71
10	68.9	8.1	63.2	13.8	.582	.31	3.58	.64
11	69.6	9.8	62.7	16.7	.572	.17	4.45	.58
Noon.	69.5	11.3	61.6	19.2	.552	5.94	5.13	.54
1	69.8	12.2	61.3	20.7	.546	.86	.61	.51
2	69.7	12.8	60.7	21.8	.536	.74	.90	.49
3	69.6	13.0	60.5	22.1	.532	.71	.97	.49
4	69.4	12.0	61.0	20.4	.541	.82	.45	.52
5	69.8	10.2	62.7	17.3	.572	6.17	4.64	.57
6	69.9	7.8	64.4	13.3	.605	.56	3.54	.65
7	69.7	6.5	65.1	11.1	.619	.74	2.92	.70
8	69.2	5.8	65.1	9.9	.619	.75	.56	.73
9	68.6	5.4	64.8	9.2	.613	.71	.33	.74
10	68.3	4.9	64.4	8.8	.605	.62	.20	.75
11	67.9	4.5	74 3	8.1	.603	.61	1.99	.77

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage $1\frac{1}{3}$ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	125.5	...	S. W. & S. by W.	...	57.7	Clear to 11 A. M., scatd. ⌒i to 2 P. M., clear afterwards.
2	123.5	...	S.W. & S.by W.	...	78.3	Clear to 11 A. M., scatd. ⌒i to 6 P. M., clear afterwards.
3	122.5	...	S.S.W,N.&E.S.E.	...	58.3	Clear to 10 A.M., scatd. ⌒i to 4 P. M., clear afterwards. Foggy from 8 to 11 P. M.
4	112.0	...	E.S. E.& N. W.		64.9	Clear to 5 A. M., scatd. ╲i & ⌒i afterwards. Foggy from midnight to 5 A. M.
5	127.0	...	E.,S.byE.&S.S.W		55.7	Scatd. ⌒i to 3 P. M., clear afterwards.
6	122.6	...	N.W. & variable		79.5	Scatd. ╲i & ╰─i to 6 P. M., clear afterwards.
7	122.5	...	E. by S. & S. E.		83.2	Chiefly ╲i. Foggy from 7 to 9 A. M.
8	124.9	...	S. E.		73.7	╲i to 9 A. M., scatd. ⌒i to 7 P. M., clear afterwards.
9	125.4	...	S. E. & N. E.	1.0	91.6	Clear to noon, clouds of different kinds to 6 P. M., clear afterwards. Brisk wind from noon to 2 P. M.
10	126.5	...	N. E.	1.8	224.6	Clear to 2 A. M., scatd. ╲i & ╰─i to 6 P. M., stratoni afterwards. Brisk wind from 9½ to 12½ A. M.
11	128.4	...	NNE,NE&NbyE.		228.6	╲i to 2 A. M., ╲i & ╲⌒i to 7 P. M., ⌒i afterwards.
12	116.7	...	N byE,NNE,&N.		183.8	Stratoni to 11 A.M., ⌒i to 7 P. M., stratoni afterwards. Drizzled at 6½ P. M.
13	116.0	...	N. W. &N. N.W.		194.9	Stratoni to 4 A. M., ╲i to 5 P. M., clear afterwards.
14	125.0	...	N. W. & variable		84.7	Clear. Slightly foggy at 8 P. M.
15	121.0	...	W SW.& variable		179.2	Clear.
16	128.4	...	W. N. W. & N.		106.5	Chiefly clear. Slightly foggy at 8 P. M.
17	118.7	...	N. N.W. & N. W.		123.7	Clear to 6 A. M., scatd. ╲i to 6 P. M., clear afterwards.
18	120.8	...	NW,Nby W & NNW.		136.6	Clear.
19	117.0	...	NNW,NW& W by N.		120.8	Clear.
20	115.0	...	S. W.& S.S.W.		60.4	Clear. Foggy from 7 to 11 P.M.
21	121.5	...	S.W. & S. S. W.		38.1	Clear. Slightly foggy at midnight, 1 & 11 A. M. & from 7 to 11 P. M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
22	122.0	...	S. S.W.	...	41.9	Clear. Foggy from midnight to 8 A. M. & from 7 to 11 P. M.
23	122.0	...	N. & variable.	...	38.6	Clear. Slightly foggy at 5 & 6 A. M. & at 7, 9, 10 & 11 P. M.
24	119.4	...	N, N by W & W.	...	68.2	Chiefly clear. Foggy at midnight & 1 A. M. & at 7, 8, 10 & 11 P. M.
25	116.0	...	S.W, W by N&W. [by S.	...	37.3	Clear to 6 A. M., scatd. ╲_i & ╲i to 4 P. M., clear afterwards. Foggy from midnight to 4 A.M. & from 8 to 11 P. M.
26	115.0	...	S. W. & variable.	...	54.0	Clear to 11 A. M., scatd. ⌒i to 8 P. M., scatd. ╲i afterwards.
27	121.0	...	SSW, WSW & SW		55.1	Clear to 6 A. M., scatd. ╲i to 5 P. M., scatd. ╲_i afterwards. Slightly foggy at 6 A. M. & at 7 & 8 P. M.
28	123.0	...	N.N.E.&W. by N.	...	58.3	Chiefly scatd. ╲i. Slightly foggy from 7 to 10 P. M.
29	120.0	...	NE, NNE & E by N.	...	73.5	Stratoni to 8 A. M., ╲i to 2 P. M., stratoni to 4 P. M., clouds of different kinds afterwards. Slightly foggy from 9 to 11 P.M.
30	123.6	...	N. E. & N.	...	50.3	╲⌒i to 9 A. M., ╲i & ╲_i afterwards.

╲i Cirri, —i Strati, ⌒i Cumuli, ╲_i Cirro-strati, ⌒—i Cumulo strati, ╲⌒—i Nimbi ╲⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November 1868.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.963
Max. height of the Barometer occurred at 9 A. M. on the 29th. ...	30.185
Min. height of the Barometer occurred at 3 P. M. on the 9th. ...	29.730
Extreme range of the Barometer during the month	0.455
Mean of the daily Max. Pressures	30.034
Ditto ditto Min. ditto	29.905
Mean daily range of the Barometer during the month	0.129

	o
Mean Dry Bulb Thermometer for the month	75.0
Max. Temperature occurred at 3 P. M. on the 11th.	87.1
Min. Temperature occurred at 6 A. M. on the 23rd	64.0
Extreme range of the Temperature during the month	23.1
Mean of the daily Max. Temperature	82.8
Ditto ditto Min. ditto, ...	68.5
Mean daily range of the Temperature during the month... ...	14.3

Mean Wet Bulb Thermometer for the month	68.2
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.8
Computed Mean Dew-point for the month	63.4
Mean Dry Bulb Thermometer above computed mean Dew-point ...	11.6
	Inches.
Mean Elastic force of Vapour for the month	0.586

	Troy grain.
Mean Weight of Vapour for the month	6.37
Additional Weight of Vapour required for complete saturation ...	2.94
Mean degree of humidity for the month, complete saturation being unity	0.68

	Inches.
Drizzled 1 day,—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 anemometer during the month	Nil
Prevailing direction of the Wind... ...	S. W., N. E. & N. W.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Nov. 1868.

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.

No. of days

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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	2				2		1				1		1		1		1		3						1		1		4		4		1		1				1		1		1		2		1	
1	1		1		1		2				1		1		1		1		3						1		1		3		5		1		1				1		1		1		2		1	
2	2		1		1		1				1		1		1		1		4						1		1		3		5		2								1		1		3			
3	1		1		2		2						1		1		2		3								2		4		3		3								1		2		2			
4	1		2		1		2						1		1		2		2						1		1		5		3		3								1		2		2			
5					2		3								1		2		1				1		1		1		4		3		2		1				1		1		2		2		2	
6					2		3						1		1				2				1				2		4		3		2		1				1		1		1		3		2	
7					2		4								1				2		1		1		1		1		2		3		1		1		1		1		1		2		3		2	
8					3		4								1		1		1		1		1		1				2		3		2				1		3		1		2		2		1	
9	1		1		2		4								1		2		3				1		1				1		3				1		3		2		1		3					
10	1		1				5		1		1				1		1		2				1		1				1		3						1		5		2		2		1			
11	1				3		3		2		2				1		1		2						1				1		3						1		2		1		4		2			
Noon.	2		2		3		3		2		1		1		2														1		1		2		2		2				2		2		1		1	
1	2				2		5				1		2						1		1										2		1		1		2		2		3		3		2			
2	3		1		1		3		4				1								2										1		2				1		1		4		4				1	
3	6				4		4		1				1																		1		5		1		1						3		2			
4	2		1		3		1		2				1																1		3		1		2		3		1		1		3		5			
5	4		1		2		3				2														1				1		4				2		2		1				5		1		1	
6	4		1		2		3						1						1								1		3		4				1		1		1				5		1		1	
7	4		1		3	1	2						1						1								1		3		4				1		1		1				5		1		1	
8	4		1		2		1				1						1		2								1		3		4				1		2		1				5				1	
9	3		1		1		2				1						1		2		1						1		3		3				2		2		1				4		2			
10	3		1		1		2				1		2				1		2						1		1		3		4				2				2				2		2			
11	3				1		2				1		2				1		3		1				1		1		3		3				1				1		1		1		3			

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

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 the Barometer at 32° Faht.	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	30.013	30.086	29.962	0.124	68.6	76.0	63.5	12.5
2	.089	.163	30.039	.124	68.0	77.6	60.0	17.6
3	.115	.183	.049	.134	67.9	77.5	59.5	18.0
4	.119	.184	.060	.124	68.6	77.0	62.0	15.0
5	.112	.186	.051	.135	69.9	79.0	62.5	16.5
6	.092	.161	.027	.134	70.9	79.5	62.5	17.0
7	.076	.157	29.992	.165	70.3	77.5	64.0	13.5
8	.029	.111	.961	.150	69.6	77.7	62.5	15.2
9	.002	.055	.934	.121	69.0	76.6	62.4	14.2
10	29.997	.074	.935	.139	69.1	77.2	62.4	14.8
11	.961	.034	.895	.139	69.7	77.5	62.5	15.0
12	.944	.015	.891	.124	70.9	79.5	63.5	16.0
13	.992	.070	.927	.143	72.2	81.0	66.0	15.0
14	30.052	.137	30.001	.136	71.7	80.0	64.4	15.6
15	.093	.156	.028	.128	71.5	80.0	65.5	14.5
16	.143	.206	.088	.118	70.2	79.0	64.3	14.7
17	.142	.200	.081	.119	70.1	78.3	62.5	15.8
18	.106	.177	.033	.144	69.9	78.5	62.2	16.3
19	.071	.136	.019	.117	70.2	78.2	65.0	13.2
20	.103	.194	.061	.133	69.0	76.4	63.2	13.2
21	.048	.123	29.992	.131	66.9	74.6	60.0	14.6
22	.024	.103	.967	.136	66.5	74.0	59.5	14.5
23	.043	.134	.986	.148	64.7	73.2	56.5	16.7
24	.021	.103	.973	.130	64.7	73.7	56.0	17.7
25	.026	.091	.973	.118	67.6	76.4	59.8	16.6
26	.063	.146	.995	.151	66.2	75.7	58.5	17.2
27	.017	.098	.949	.149	66.0	75.5	57.0	18.5
28	.010	.084	.963	.121	69.1	79.1	61.4	17.7
29	.005	.090	.946	.144	68.9	78.0	61.0	17.0
30	.027	.116	.983	.133	67.0	74.4	61.5	12.9
31	.066	.166	30.018	.148	64.4	72.4	58.0	14.4

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

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	62.1	6.5	56.9	11.7	0.472	5.19	2.48	0.68
2	60.4	7.6	54.3	13.7	.432	4.77	.76	.63
3	59.5	8.4	52.8	15.1	.411	.54	.97	.61
4	60.8	7.8	54.6	14.0	.437	.82	.85	.63
5	63.5	6.4	58.4	11.5	.496	5.45	.53	.68
6	64.6	6.3	59.6	11.3	.516	.67	.56	.69
7	64.2	6.1	59.3	11.0	.511	.61	.47	.69
8	63.6	6.0	58.8	10.8	.503	.53	.37	.70
9	63.1	5.9	58.4	10.6	.496	.46	.30	.70
10	63.4	5.7	58.8	10.3	.503	.54	.24	.71
11	64.0	5.7	59.4	10.3	.513	.64	.29	.71
12	66.2	4.7	62.4	8.5	.567	6.22	.01	.76
13	67.7	4.5	64.1	8.1	.599	.56	1.99	.77
14	66.8	4.9	62.9	8.8	.576	.31	2.12	.75
15	65.9	5.6	61.4	10.1	.548	.02	.36	.72
16	63.6	6.6	58.3	11.9	.494	5.43	.62	.68
17	63.3	6.8	57.9	12.2	.488	.36	.67	.67
18	63.1	6.8	57.7	12.2	.485	.33	.65	.67
19	63.5	6.7	58.1	12.1	.491	.40	.65	.67
20	61.9	7.1	56.2	12.8	.461	.07	.69	.65
21	59.2	7.7	53.0	13.9	.414	4.58	.70	.63
22	58.5	8.0	52.1	14.4	.401	.45	.74	.62
23	56.7	8.0	50.3	14.4	.377	.20	.60	.62
24	57.3	7.4	51.4	13.3	.392	.36	.44	.64
25	62.2	5.4	57.9	9.7	.488	5.38	.06	.72
26	58.3	7.9	52.0	14.2	.400	4.43	.69	.62
27	58.5	7.5	52.5	13.5	.407	.51	.57	.64
28	63.4	5.7	58.8	10.3	.503	5.54	.24	.71
29	61.5	7.4	55.6	13.3	.452	4.99	.75	.65
30	59.8	7.2	54.0	13.0	.428	.73	.57	.65
31	57.1	7.3	50.5	13.0	.389	.23	·51	.63

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

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.	30.055	30.163	29.941	0.222	65.6	69.5	60.5	9.0
1	.047	.152	.936	.216	64.8	69.0	59.8	9.2
2	.038	.140	.925	.215	64.2	68.5	59.0	9.5
3	.030	.134	.920	.214	63.5	68.0	58.6	9.4
4	.028	.131	.914	.217	62.9	67.5	57.5	10.0
5	.040	.135	.924	.211	62.3	67.0	57.0	10.0
6	.054	.151	.939	.212	61.8	66.5	56.4	10.1
7	.075	.163	.961	.202	61.8	66.2	56.0	10.2
8	.102	.188	.986	.202	63.6	67.5	56.8	10.7
9	.123	.202	30.006	.196	67.2	71.0	61.8	9.2
10	.126	.206	.015	.191	70.8	75.0	65.5	9.5
11	.107	.190	29.998	.192	73.5	77.0	67.6	9.4
Noon.	.075	.162	.959	.203	75.1	78.5	69.0	9.5
1	.040	.128	.925	.203	76.2	79.8	70.5	9.3
2	.016	.101	.905	.196	76.9	81.0	71.5	9.5
3	.001	.095	.891	.204	76.8	79.6	72.4	7.2
4	29.997	.088	.893	.195	75.7	78.6	71.2	7.4
5	30.005	.099	.900	.199	74.3	77.3	70.0	7.3
6	.017	.116	.914	.202	71.8	75.2	67.6	7.6
7	.032	.144	.929	.215	70.2	73.8	65.5	8.3
8	.048	.148	.947	.201	68.9	72.6	64.0	8.6
9	.060	.165	.955	.210	67.8	71.5	63.3	8.2
10	.069	.172	.970	.202	66.7	70.7	61.8	8.9
11	.064	.169	.954	.215	65.9	70.5	61.0	9.5

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.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

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.	
Midnight.	61.6	4.0	58.4	7.2	0.496	5.50	1.50	0.79
1	61.1	3.7	58.1	6.7	.491	.45	.38	.80
2	60.6	3.6	57.4	6.8	.480	.33	.36	.79
3	60.1	3.4	57.0	6.5	.473	.27	.28	.81
4	59.7	3.2	56.8	6.1	.470	.25	.18	.82
5	59.2	3.1	56.4	5.9	.464	.18	.13	.82
6	58.7	3.1	55.9	5.9	.456	.10	.11	.82
7	58.7	3.1	55.9	5.9	.456	.10	.11	.82
8	59.9	3.7	56.6	7.0	.467	.21	.36	.79
9	61.3	5.9	56.6	10.6	.467	.16	2.19	.70
10	63.0	7.8	56.8	14.0	.470	.16	3.04	.63
11	63.7	9.8	56.8	16.7	.470	.13	.77	.58
Noon.	64.0	11.1	56.2	18.9	.461	.01	4.33	.54
1	64.0	12.2	55.5	20.7	.450	4.89	.77	.51
2	64.2	12.7	55.3	21.6	.447	.85	5.01	.49
3	63.9	12.9	54.9	21.9	.441	.78	.05	.49
4	63.5	12.2	55.0	20.7	.442	.81	4.70	.51
5	63.9	10.4	56.6	17.7	.467	5.09	.03	.56
6	64.3	7.5	58.3	13.7	.494	.40	3.05	.64
7	63.9	6.3	58.9	11.3	.504	.55	2.50	.69
8	63.3	5.6	58.8	10.1	.503	.54	.20	.72
9	62.6	5.2	58.4	9.4	.496	.48	.00	.73
10	62.3	4.4	58.8	7.9	.503	.56	1.67	.77
11	61.8	4.1	58 5	7.4	.498	.52	.54	.78

All the Hygrometrical elements are computed by the Greenwich Constants.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
1	111.0	...	W.S.W.,W&SW.	...	52.7	Chiefly \i. Slightly foggy at midnight & at 1 A. M.
2	118.5	...	S.W. & W. by N	...	73.2	Scatd. \i to 5 P. M., clear afterwards. Foggy at 9& 10 P.M.
3	116.4	...	N.byW.&N.byE.	...	102.7	Scatd. \i to 1 P. M., clear to 5 P. M., scatd. \i afterwards.
4	119.0	...	N. N. W.	...	147.4	Scatd. \i to 6 P. M. clear afterwards.
5	120.5	...	N.N.W,NNE&N.	...	126.4	Clear to 2 P. M., scatd. \i to 6 P. M., clear afterwards.
6	126.0	...	N. & S. E.	...	115.0	Clear to 5 A. M., \⌒i to 9 A. M. ⌒i & _i to 5 P. M., ⌒i afterwards.
7	119.4	...	E. by S. & N.	...	78.2	Scatd. \i to 5 A. M., \⌒i to 8 A. M., ⌒i to 3 P. M., clear afterwards. Slightly foggy from 7 to 11 P. M.
8	118.7	...	N.,N. W. & S. W.	...	91.0	Clear. Slightly foggy at 8, 9 & 11 P. M.
9	118.0	...	S. S. W. & S. W.	...	51.0	Clear. Foggy from midnight to 4 A. M., at 8 A. M., & at 9 P. M.
10	117.0	...	S. & S. S. W.	...	46.7	Clear. Slightly foggy from 6 to 8 A. M. & at 6 & 9 P. M.
11	112.5	...	E., S. E. & S. W.	...	38.5	Clear to 11 A. M., scatd. ⌒i to 4 P. M., clear afterwards. Foggy at 6 & 7 A. M., & at 8 P. M.
12	119.8	...	S. & S. W.	...	47.5	Clear to 9 A. M., scatd. ⌒i to 3 P. M., clear afterwards. Foggy from 3 to 8 A. M.
13	120.6	...	S. & S. S. W.	...	60.7	Clear to 9 A. M., scatd. ⌒i to 5 P. M., clouds of different kinds afterwards. Foggy from 3 to 9 A. M.
14	122.0	...	S. S. E. &SS W.	...	98.5	Clear to 6 A. M., scatd. \i to 10 A. M., scatd. ⌒i to 6 P. M., clear afterwards.
15	120.0	...	SE,WNW& variable.	...	43.2	Clear to noon, scatd. ⌒i to 5 P. M., clear afterwards. Slightly foggy at 5 & 6 A. M. & at 7 & 8 P. M.
16	131.0	...	S. S. E. & N.	...	77.8	Chiefly clear.
17	117.0	...	N. & W.by N.	...	114.1	Clear. Slightly foggy at 10 & 11 P. M.
18	119.8	...	S W. & W by S.	...	49.7	Clear to 1 P. M., \⌒i to 8 P. M., clear afterwards. Slightly foggy at 6 & 7 A. M.
19	117.4	...	E byN&variable.	...	94.3	Chiefly clear. Foggy at 7 P.M.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Guage 1½ ft. above Ground.	Wind. Prevailing direction.	Wind. Max. Pressure.	Wind. Daily Velocity.	General aspect of the Sky.
	o	Inches		lb	Miles	
20	122.0	...	N.N.E.&W.N.W.	...	98.0	Clear to 3 A. M., ⌵i to 8 A. M., clear to noon, ⌒i to 5 P. M., clear afterwards. Slightly foggy at 10 & 11 P. M.
21	116.0	...	N. E. & S. W.	...	86.9	Clear. Slightly foggy from 7 to 11 P. M.
22	110.6	...	S.S.W. & variable	...	65.3	Clear. Slightly foggy at midnight & 1 A. M. & from 7 to 11 P. M.
23	116.0	...	N. by E. & N. E.	...	55.0	Clear. Slightly foggy from 8 to 11 P. M.
24	117.0	...	NbyE &W. S.W	...	57.4	Clear. Slightly foggy at midnight & 1 A. M. & from 7 to 10 P. M.
25	115.0	...	S. by W.,S.&S.W.	...	30.8	Clear to 7 A. M., scatd. ⌒i to 5. P. M., clear afterwards.
26	111.8	...	E.N.E & N.NE.	...	115.5	Clear. Slightly foggy from 7 to 11 P. M.
27	116.0	...	N. E. & S.by W.	...	53.0	Clear. Foggy at midnight & 1 A. M.
28	118.5	...	S.by W. E.S.E&NNW.	...	42.1	Clear to 6 A. M., stratoni to 10 A M., clear afterwards. Slightly foggy from 9 to 11 P. M.
29	112.0	...	N.N.W.	...	59.2	Clear. Foggy to midnight & 1 A. M. & from 7 to 11 P. M.
30	109.5	...	WSW&variable.	...	79.1	Clear to 5 A, M., scatd. ∖i to noon, clear afterwards. Slightly foggy from midnight to 4 A. M. & from 8 to 10 P. M.
31	115.0	...	N.byE.&W.N.W.	...	75.0	Clear. Foggy at midnight & from 8 to 11 P. M.

∖i Cirri, — i Strati, ⌒i Cumuli, ∖_i Cirro-strati, ⌒_i Cumulo strati, ⌵i Nimbi ⌒i Cirro cumuli.

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Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of December 1868.

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	30.052
Max. height of the Barometer occurred at 10 A. M. on the 16th. ...	30.206
Min. height of the Barometer occurred at 3 P. M. on the 12th. ...	29.891
Extreme range of the Barometer during the month	0.315
Mean of the daily Max. Pressures	30.127
Ditto ditto Min. ditto	29.993
Mean daily range of the Barometer during the month	0.134

	o
Mean Dry Bulb Thermometer for the month	68.7
Max. Temperature occurred at 2 P. M. on the 13th.	81.0
Min. Temperature occurred at 7 A. M. on the 24th	56.0
Extreme range of the Temperature during the month	25.0
Mean of the daily Max. Temperature	77.1
Ditto ditto Min. ditto, ...	61.6
Mean daily range of the Temperature during the month... ...	15.5

Mean Wet Bulb Thermometer for the month	62.1
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.6
Computed Mean Dew-point for the month	56.8
Mean Dry Bulb Thermometer above computed mean Dew-point ...	11.9
	Inches.
Mean Elastic force of Vapour for the month	0.470

	Troy grain.
Mean Weight of Vapour for the month	5.18
Additional Weight of Vapour required for complete saturation ...	2.41
Mean degree of humidity for the month, complete saturation being unity	0.67
	o
Mean Max. Solar radiation Temperature for the month.	117.0

	Inches.
Rained no day,—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 anemometer during the month	Nil
Prevailing direction of the Wind... ...	N. N. W., S. W. & N.

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***Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Decr.* 1868.**

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. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	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
																			No. of days																													
Mid night	3		1		1		2		2				1		1				2						2		2		1		5								1		2		1		4			
1	4		1		2				3				1		1				2		1				3		3				2		1						1		1				4		1	
2	4		1		2		1		2				1		1				1		3				4		2				2		1						1		1				3		1	
3	3		2		2		1		2				1		1				1		3				5		1				1		2		1						1				3		1	
4	2		2				3		2				1		1						2		1		5		1				1		2		1						1				5		1	
5	1		4				3		3						1						4		1		4						1		3		1						1				4			
6	2		3		1		3		3						1		2				2		1		3		1				1		3		1										3		1	
7	1		4		1		2		3		1				2		3		1		1				3		1				2		2								1				3		1	
8	1		3		2		2		5						1		2		2		2				3						1						2				2				3			
9	1		3		1		5		1		1		3		1		2		1		3				1		1		1								1				1				4			
10	2				3		4		4		4				2		2				3		1		1		2										1						1		1			
11	2				5		3		1		2		1		1		2		2				1		3				1		1		1				1		1		1				2			
Noon.	2		1		1		2								3		1		1						2				2		3		1				2				1		2		5		2	
1	5		2		1		1		1														1		2						3						5		1		2		2		4		1	
2	3		1		4								1												1				1		2		2				5				3		3		3		2	
3	4		1		1														1										3		3		2		1		2		2		2		4		5			
4	3		1		3														1										2		4		3		1		1		3		3		3		2		1	
5	3		2		1														1										5		4		2				2		1		2		3		2		3	
6	3		1		1						1								1										5		6		1		1				1		4		1		3		2	
7	3		1		1						1								1						1		1		4		6		1						1		3		2		3		2	
8	4		1		1						1								1						1		1		5		5		1						1		3		1		3		2	
9	3		1		2						1				1								1		1		2		5		4								1		3		1		4		1	
10	3		1		2		1				1		1		1				1		1		1		1		1		3		6								1		2				4		1	
11	3		1		2		1		1				1		1				1						2		3		2		5						1		1		2				4			

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Add the mean hourly variations of the

August	September	October	November	December
29·591	29·681	29·820	29·961	30·020
+ ·019	+ ·013	− ·000	− ·001	− ·001
+ ·006	− ·000	− ·010	− ·009	− ·008
− ·005	− ·011	− ·018	− ·017	− ·017
− ·016	− ·021	− ·025	− ·023	− ·025
− ·017	− ·021	− ·023	− ·025	− ·026
− ·012	− ·013	− ·011	− ·012	− ·015
+ ·005	+ ·004	+ ·008	+ ·007	+ ·002
+ ·019	+ ·023	+ ·028	+ ·029	+ ·024
+ ·035	+ ·043	+ ·052	+ ·054	+ ·052
+ ·044	+ ·054	+ ·063	+ ·070	+ ·072
+ ·045	+ ·055	+ ·061	+ ·067	+ ·073
+ ·037	+ ·043	+ ·043	+ ·046	+ ·054
+ ·021	+ ·023	+ ·017	+ ·018	+ ·023
+ ·001	− ·004	− ·011	− ·015	− ·010
− ·023	− ·030	− ·037	− ·037	− ·035
− ·043	− ·050	− ·050	− ·049	− ·049
− ·057	− ·059	− ·051	− ·052	− ·053
− ·056	− ·056	− ·043	− ·044	− ·046
− ·046	− ·043	− ·036	− ·033	− ·035
− ·029	− ·023	− ·016	− ·015	− ·018
− ·004	+ ·001	+ ·003	+ ·002	− ·002
+ ·016	+ ·020	+ ·015	+ ·012	+ ·010
+ ·029	+ ·027	+ ·019	+ ·016	+ ·015
+ ·027	+ ·024	+ ·016	+ ·010	+ ·009

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