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# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL,

EDITED BY

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### THE SECRETARIES.

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VOL. XXIX.

Nos. I. TO IV.—1860.

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

SIR WM. JONES.

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ASIANIC SOCIETY OF BENGAL

THE SECRETARIES

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VOL. XXIX  
No. 1. to IV. - 1900.

It is hereby notified that the following specimens have been deposited in the collection of the American Museum of Natural History, New York, and are available for study and loan to the Asiatic Society of Bengal. It will be found in the list of specimens deposited and it will be found in the list of specimens deposited.

For the Society

SECRETARIES  
ASIANIC SOCIETY OF BENGAL  
10, RAJABAZAR STREET, CALCUTTA.

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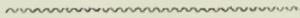
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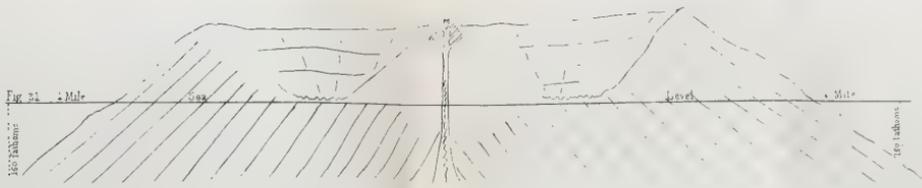
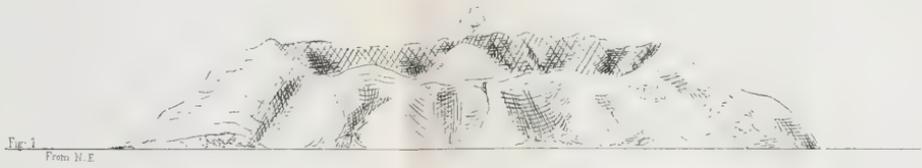
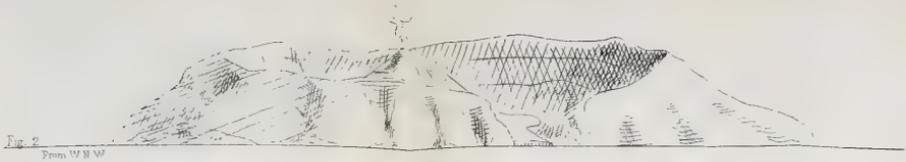




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Fig. 







JOURNAL  
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No. I. 1860.

*Account of a Visit to Barren Island in March 1858. By G. VON  
LIEBIG, M. D.\**

Barren Island is a volcanic island, situated in Lat.  $12^{\circ} 17'$  N. and in Long.  $95^{\circ} 54'$  E. Its smallest distance from the Andaman Archipelago is in a straight line only 36 miles East. The distance from the nearest point of the main land, near Tavoy, is about 270 miles W. S. W. It lies not far out of the straight course between Port Blair and Amherst, about 63 miles from the former, and 330 from the latter place. The *Semiramis* approached the island on the morning of the 19th March, 1858, coming from the N. E., and steamed round it by S. keeping close to the shore, until the ship was opposite the entrance of the crater (Fig. 2.) bearing about W. and by N. from the centre of the island, where she hove to, and we landed.

It is stated in former accounts, that all round the island the lead finds no bottom at 150 fathoms, only  $\frac{1}{4}$  mile distance from the shore. Captain Campbell found however ground at that distance on one side of the island, its centre bearing N. E. at a depth varying from  $4\frac{1}{2}$  to 14 fathoms.

Nearing the island from the North and passing round to the South East of it, it looks from a distance like an oval-topped hill; but coming closer, the sides of the mountain are discovered to belong to a steep circular elevation, sending out spurs towards the sea and enclosing a central valley. The sides of the enclosing circle being low-

\* An account of a previous visit to this Island by Dr. G. R. Playfair, Bengal army, will be found in the 25th No. of the records of the Government of India.

er in the direction of the spectator, the upper circumference of this valley is seen in the shape of an oval ring, formed by the crest of the surrounding ridge. In the middle of this ring, the upper part of a regular cone is visible, from the apex of which small white vapour-like clouds emanate. It is also distinguished from the surrounding darker masses by its grey colour, and some large white marks on it, like fields of snow. An entrance is not discernible.

The slopes towards the sea are generally covered with shrubby vegetation, presenting however some bare patches towards the upper edge; small trees grow about the base, where large rounded stones are washed by the sea.

Turning now to the S. and S. W. the enclosing wall is higher than the cone and the crest of the opposite ridge, and both therefore disappear from the view. On this side the vegetation down the spurs to the sea may be called rich, and consists of different forest trees of moderate height, interspersed with graceful palms; and where the descent is rocky, the rocks are frequently covered with ferns.

Passing to the westward of the centre of the island, and continuing the survey towards the northern end, one of the first turns discovers a large gap in the circular wall, extending quite down to the base of the island, through which the interior of the valley, with the cone in the middle, opens at once into full view.

The sides of this gap or fissure in the circular wall form a regular cut or short transverse valley through it, opening towards the sea into a small bay, and on the other side into the circular valley, to which it is the only way of access. Opposite this entrance, in the centre of the valley, rises the cone of grey ashes, and surrounding its base the bottom of the valley is filled with black masses of cold lava, which are continued like a congealed stream through the gap, breaking off abruptly when they arrive near the water's-edge. At its termination the steam is about 10 or 15 feet high, and its breadth seems less than farther up. It looks like a black perpendicular wall drawn across the entrance and facing the sea.

The lava consists of a black basalt mass (matrix) throughout which are disseminated innumerable semi-transparent little crystals of a variety of common felspar (orthoclase), and also many bright green granules of olivine. The lower part of its thickness is homogeneous,

with a smooth fracture, but from the upper surface to a depth of several feet it is cleft in all directions, whereby the upper part is divided into rough blocks, possessing a spongy texture as well as countless sharp edges and corners.

The older lava, composing the rocks on the side of the valley and also the strata of the surrounding ridge is slightly different from this. The colour of its principal mass is a reddish grey, felspar and olivine crystals are embedded in it in the same proportions as before, and in addition small pieces of black augite of the granular kind, with conchoidal fracture. From underneath the black lava, where it terminates near the sea, issues a broad but thin sheet of hot water, mixing with the sea water between the pebbles of the beach. The Thermometer I had with me was not graduated high enough to measure its temperature, its highest mark being 104° F. (40° C.) The water where escaping from the rock must have been nearly at the boiling point, judging from the heat felt when the hands were dipped into it, or when the hot stones were touched. When bathing, we found the sea water warm for many yards from the entrance of the hot spring and to a depth of more than 8 feet. It is not impossible that a jet of hot steam or water may emerge from the rocks below the level of the sea. The hot water tasted quite fresh, and not saline as might have been expected, showing that it could not have been long in contact with the rocks.

We ascended to the base of the cone, passing along the sloping sides of the transverse valley through dry grass and brushwood or over sandy ridges, so long as the solidified stream of lava in the middle left us room to do so. At last we had to ascend the rugged surface of the black lava itself, and cross the circular valley, which has about the same breadth as the transverse valley (not quite one-eighth of a mile), until we arrived at the base about half a mile from the sea. The cone rises from the lava accumulated in the circular valley, and its base is about 50 feet higher than the level of the sea, at a rough estimate. It is quite round and smooth, and the inclination of its sides is 40 degrees. No vegetation of any kind was visible along its surface. We turned to the left and went up from the north side, where the appearance of a ravine, some way up, only two or three feet deep and very narrow with some tufts of grass growing along it, promised an

easier ascent for a part of the way, and where a rocky shoulder at about two-thirds of the height would offer a place to rest. Our ascent commenced at about 2½ P. M., and was certainly the most fatiguing expedition many of us remember ever to have undertaken. The sky was almost cloudless, and the heat consequently was great. The lower third and more of the slope consisted of a powder of ashes into which we sunk ankle-deep, and we often fell a step back for two gained. A little higher, stones loosening when the foot stepped on them and rolling down in long jumps, were dangerous to any one following.

Arrived at the rocks mentioned, their nature and the manner in which the side of the cone bulged out in their neighbourhood, showed that they marked the point from whence an effusion of lava of the same kind, as we have seen below, had taken place from the side of the cone, not reaching the mouth of the tube at the apex. The last third of the way from the rocks upwards offered a firmer footing, the ashes being cemented by sulphate of lime (gypsum) which, where it was present, formed the white patches we had already observed from a great distance when approaching the island. The ground now became very hot, not however intolerably so, until about 30 feet from the apex a few rocks again offered a convenient seat, not affected by the heat of the ground. There the Aneroid barometer and the temperature of the air were observed in the shade of an umbrella.

About half way between these rocks and the highest point cracks and fissures commenced to intersect the ground, widening higher up to the breadth of several inches, where clouds of hot watery vapour issued from them. They were filled with sulphur, often accompanied with beautifully crystallised white needles of gypsum, and a sulphurous smell also accompanied the vapour (sulphurous acid). This smell was however not very strong and did not prevent us from penetrating the clouds, when we discovered that what had appeared from below as the summit was in fact the edge of a small crater, about 90 or 100 feet wide, and 50 or 60 deep. At that depth it had a solid floor of decomposed lava or tufa and volcanic sand. Its walls were made up of rocks, in appearance like those of the older lava and were highest on the north and south sides. Towards the west the crater opened with a similar cleft, to that which had permitted us

to enter the island. The vapours rose principally from the northern and southern quarters of the edge where the fissures were largest and longest, running both parallel and across the edge. The rocks where the sulphurous vapours issued from between them, were covered with reddish and white crusts, indicating the beginning of decomposition of their substance. From the top the horizon and more or less of the sea were visible in all directions, with the exception of the quarter between South and West. The inner slope of the circular elevation enclosing the valley, had no spurs, but was like a plain wall, falling off with a steep descent all round towards the centre. It had a uniform brownish colour, appertaining either to the surface of larger masses of the rock itself, or being derived from the dry grass and smaller shrubs covering the slope. There were no trees or brushwood visible to correspond to the richer vegetation on the external circumference. Horizontal parallel lines, traceable throughout the circle and rising somewhat like the borders of receding steps, indicated the thickness and strike of the different sheets of lava and tufa which, superimposed upon one another, formed the substance of the circular elevation. A very good transverse section of it had already attracted my attention, where the left side of the transverse valley debouches into the sea. Several strata of tufaceous formation, alternating with older rock like lava, could be seen there rising from the rocky beach. One of the most remarkable amongst these was a stratum of rounded stones, like large pebbles, cemented by tufa, exactly like those of the present beach, but at a considerable elevation (about 20 feet) above the high water mark, showing that the sub-marine base of the Island must have been raised since those pebbles had been washed by the sea. All these strata dipped outwards from the centre of the island, parallel with the external slope of the encircling wall. It is interesting to observe that this slope continues under the sea level on three sides of the Island at least, at the same inclination as above water, which averages about 35°. This is shown by the soundings, which exceed 150 fathoms at a distance of a quarter of a mile from the shore.

Judging from what we saw, as I have here attempted to describe it, I would conclude that the circular valley and its walls constitute the crater of a huge volcanic cone of sub-marine basis, which had

been the vent for fluid masses of rock, when such eruptions took place on a larger scale than in more recent times. The smaller cone in the centre of the old crater, corresponding in its size to the diminished forces of volcanic action, is of recent origin, and represents those smaller cones of still active volcanoes which are usually distinguished as cones of eruption from the original cones, also called the cones of elevation.

We have it on record that about 60 years ago, the crater of the little cone was throwing out showers of red hot stones of several tons weight and enormous volumes of smoke (Captain Blair's account *Asiatic Researches 1795*), and but for the isolated position of the volcano preventing its more frequent observation, we should doubtless be able to fix the date of the eruption that left the stream of lava behind, which is now filling the valley and its outlet into the sea. Since that time it has entered the period of decline of volcanic activity, without however leaving us the assurance that it will not some day revive again.

From barometrical observations, I deduced the height of the cone by Gauss's formula, allowing for the time of the day and the influence of the hot ground near the summit, to be about 980 feet, from the level of the sea to the northern edge of the crater. This height is confirmed by a trigonometrical measurement of Lieutenant Heathcote, I. N., to whom I am indebted for the communication of his results. He visited the Island about four months earlier than we did, when he found the height of the cone 975 feet above the level of the sea, and the diameter of the Island 2,970 yards, 1.68 miles North and South.

The few notes I could glean respecting the recent history of the Island, are derived from the Island itself, from the records of the Asiatic Society, and from Horsburgh. We found on a rock in the transverse valley the inscription "Galathea 1846," showing that since then no alteration has taken place. The same conclusion can be extended farther back to the year 1831 or 1832, judging from an account communicated to the Asiatic Society (*Asiatic Society's Journal*, April 1832) by Dr. J. Adam, whose informant landed in the month of March, and reached the base of the cone. By this explicit account, the descriptions of the Island in "Lyell,"\* dated 1843, and in Hum-

\* Lyell's Principles of Geology.

boldt's *Cosmos*, both apparently derived from the same source, must be rectified. The narrator states (in "Lyell") that the sea filled the circular valley round the cone.

Horsburgh states that in 1803 the volcano was observed to explode regularly every 10 minutes, projecting each time a column of black smoke, perpendicularly, to a great height, "and in the night a fire of considerable size continued to burn on the east side of the crater, which was then in view."

The oldest account on record is that of Captain Blair, already quoted, taken from his Report of the survey of the Andaman Islands. He must have visited the Island about 1790, as far as I am able to conclude from the publication in the researches and the date of his chart of the Andamans which is 1790. He approached nearly to the base of the cone, which he describes as the lowest part of the Island, very little higher than the level of the sea, but he does not mention the black stream of lava. The acclivity of the cone he states to be  $32^{\circ} 17'$ , and its height 1,800 feet nearly, which, says he, is also the elevation of the other parts of the Island. On the other hand he remarks that the cone is visible in clear weather at a distance of twelve leagues, which would require a height of not more than from 900 to 1,000 feet. I think therefore that Captain Blair could have taken no accurate measurements, contenting himself with a rough estimate. If it could be proved otherwise, the Island would have subsided 820 feet since he visited it.

From the description in some of these accounts it would appear that the high vegetation which we found on the external slope of the Island, is of quite recent origin.

Mr. Adam's authority (1831) states as follows:—

"The summits to the N. E. were completely smooth and covered with ashes; those to the S. W., although partly covered with ashes, also have a good many small shrubs over them, with dry and parched grass growing on the surface."

He conjectures from this that the eruptions would take place only in the S. W. Monsoon or rainy season, at which time the S. W. wind would blow the dust and ashes on the hills in the opposite direction, or N. E.; such a conjecture is hardly admissible on the ground given, it being easier to account for the vegetation on the

south-western slope by its angle of descent being much smaller than that of the north-eastern slope.

The sulphur on the top of the cone occurs in such quantity in the cracks and fissures, often lining them to the thickness of more than half an inch, that the question naturally arises, whether the sulphur could not be worked with advantage.

Although in the immediate neighbourhood of the crater, where the fissures are numerous, the ground seems to be completely penetrated with sulphur, this is not so evident in other parts, only a few feet lower, where the surface is unbroken. There are however some reasons which seem to promise that a search might be successful. In eruptive cones, like that of Barren Island, there is always a central tube, or passage, connecting the vent in the crater with the heat of volcanic action in the interior. In this tube the sulphur, generally in combination with hydrogen, rises in company with the watery vapour, and is partly deposited in the fissures and interstices of the earth near the vent, the remainder escaping through the apertures.

If in the present case we admit the sensible heat of the ground of the upper third of the cone to be principally due to the condensation of steam, a process of which we have abundant evidence in the stream of hot water rushing out from underneath the cold lava, it is not improbable that the whole of the upper part of the interior of the cone is intersected with spaces and fissures filled with steam and sulphurous vapour, these being sufficiently near the surface to permit the heat to penetrate. It is therefore not unlikely that at a moderate depth we should find sulphur saturating the volcanic sand that covers the outside of the cone.

I only speak of the outside, as we may conclude from the evidence we have in the rocks of lava in the crater and those bulging out on the side, that the structure of the cone is supported by solid rock nearly to its summit, the ashes covering it only superficially.

From what has been said above, the probability of sulphur being found near the surface disposed in such a way as to allow of its being profitably exhausted, will depend on the following conditions:

*First.*—That the communication of the central canal, through which the vapours rise, with its outlets, be effected not through a few

large, but through many and smaller passages, distributed throughout the thickness of the upper part of the cone.

*Second.*—That some of these passages communicate with the loose cover of ashes and stones which envelopes the rocky support of the cone.

Although I have mentioned some facts which seem to indicate the existence of such favorable conditions, and which are moreover strengthened by an observation by Captain Campbell, who saw vapour issuing, and sulphur being deposited near a rocky shoulder about two-thirds of the height on the eastern descent of the cone, still their presence can only be ascertained satisfactorily by experimental digging.

The Solfatara at Puzuoli, near Naples, is a similar instance of the production of sulphur. It is a crater in which exhalations of watery vapour, sulphurous acid and hydrochloric acid take place, and where sulphur is also deposited. The sulphur is gained there by distilling it out of the sand of the crater, to a depth of 10 metres or 32 feet—it becomes too hot lower down—and returning the sand which after 25 or 30 years is again charged with sulphur. The permanency of the volcano of Barren Island as a source of sulphur would depend on the rapidity with which the sulphur would be replaced after the sand had been once exhausted. The time required for this is not necessarily fixed to periods of 25 or 30 years. In Iceland, at a similar spot, the sulphur is renewed every two or three years.

If a preliminary experiment should make it appear advantageous to work the cone regularly, the material about the apex, after being exhausted of the sulphur that is present, could by blasting and other operations be disposed in such a way as to direct the jets of vapour in the most convenient manner through uncharged portions of ground. If the sulphur should aggregate in periods of not too long duration, it would be possible to carry on the work of filling up new ground on one side, and taking away saturated earth on the other at the same time, so that after working round the whole circumference, the earth that had been first put on would be ready to be taken away.

If the periods should prove too long to allow the work permanently to be carried on, an interval of time might be allowed to pass, before resuming operations.

Water for the labourers could always be obtained from the warm spring at the entrance of the Island.

The distilling or melting of sulphur to separate it from adherent earth is a matter of comparatively little expense or trouble. If the sulphur be abundant, it might be effected as in Sicily by using a part of it as fuel. It is not necessary to do it on the spot; it might be done at any place where bricks and fuel are cheap.

It is impossible to predict certain and lasting success to an undertaking of this kind, all depending on the quantity of sulphur present and the rapidity with which it will be replaced.

The situation of Barren Island offers every facility for a preliminary trial. The near proximity of the Andamans insures a supply of convict labour, timber, bricks, and lime. All the wood and iron work required for facilitating the transport of loads up and down the hill could be made on the Andamans.



*On certain Mediæval Apologues.*—By E. B. COWELL, M. A.

Among the many by-paths of inquiry which open in every direction from the broad beaten track of literature, few are more inviting than those which trace the mutual likenesses between the household legends of different nations, now widely separated by lands and seas, but once linked in close association. Mr. Dasent, in his recent work on the Popular Norse Legends, has followed out most successfully one of these paths, and has traced the same stories under varying names and localities, from nation to nation of the great Indo-Germanic family,—showing that everywhere the natural literature which bursts spontaneously from the heart of the people, bears evidence of a common origin for its favourite legends, though now lost in a far distant past.

The present paper is not, however, concerned with those popular tales which float from mouth to mouth among the unlettered peasants,—its business is with certain apologues of a more philosophic character, which are yet common to the East and West, and which must have flowed from one identical source, though the particular channels by which the commerce of ancient thought was conducted,

are now no longer to be mapped out by the historian. Nor can we trace the course which any particular apologue took, as it found its way from land to land; too often it acts *per saltum* in its progress, and its intermediate history is concealed between its two appearances in two different epochs and countries. The stream rises to the surface in the far East and the far West, but its main current runs underground.

The first instance which I shall offer is one too well known to be dwelt upon at length, but it is one too remarkable to be wholly omitted in the present sketch,—I refer to the story of Abraham and the Fireworshipper, which Jeremy Taylor subjoined as a colophon to his *Liberty of prophesying*,\* expressly adding that he found it “in old Jewish books.” I am not aware, however, that it has ever yet been traced to the Rabbinical writings, and its spirit of toleration is widely different from the usual bigotry of the Talmud; and Bishop Heber has very plausibly suggested that Jeremy Taylor’s memory deceived him and that he had really seen it as a quotation from Sádí’s *Bostán*. It is thus quoted by Gentius in his preface to a translation of a Hebrew History of the Jews published at Amsterdam in 1651; and it is singular that it was added to the second edition of the ‘*Liberty of Prophesying*’ published in 1653—the first, published six years before, and therefore earlier than Gentius’ work, not containing any allusion to it.†

Still any one who has seen the voluminous stores of mediæval Jewish writings, which fill the shelves of the Bodleian Library, cannot but feel a lingering suspicion that Taylor in his omnivorous reading may have met with the story as he states,—and that it may yet be found by the Rabbinical student in some mediæval Jewish book. Bishop Heber in his note remarks that a learned Jew, Mr. J. D’Allemand, professes to have a strong impression on his mind that he has seen it in a Jewish commentary on Genesis xviii. 1. It is a favourite story in the East,—it occurs in the *Subhat ul Abrár* of Jámí as well as the *Bostán* of Sádí,—and it may very probably be found in Arabic, whence the Rabbis may have derived it as they derived the

\* It was here no doubt that Benjamin Franklin found it, though he borrowed it without acknowledgment.

† See Bishop Heber’s edition of Jeremy Taylor’s works, vol. i. note xx.

*Ikhwân-us-Safâ*, of the Hebrew translation of which there are no less than three editions,—printed respectively in 1557, 1703 and 1713.\*

The next of these legends to be noticed occurs in the 237th number of the *Spectator*, in a paper by Hughes, who gives it as an old Jewish tradition. I cannot however find any trace of Hughes' proficiency in Hebrew or Rabbinical lore, though he was a good classical scholar, and I am quite at a loss to trace the source from which he derived it. The story, as he relates it, describes an interview between Moses and the Supreme Being, respecting the apparent anomalies of Providence, and the discourse turns on an incident which takes place beside a stream at the mountain's foot. A soldier comes to drink, and, as he leaves, drops his purse, which is soon after picked up by a boy who passes by. An old man next totters up to the fountain and sits down to rest, when the soldier suddenly returns and accuses him of having his purse. An altercation ensues, and the soldier in his passion kills him. "Moses fell on his face with horror and amazement, when the divine voice thus prevented his expostulation: 'Be not surprised, Moses, nor ask why the Judge of the whole earth has suffered this thing to come to pass. The child is the occasion that the blood of the old man is spilt; but, know, that the old man, whom thou sawest, was the murderer of that child's father.' "

The story is particularly interesting to an English reader, as there can be no doubt that it must have given the first idea of 'the Hermit' to Parnell. Whether it occurs in any Hebrew work, I cannot say,—but the story wears on its face an oriental aspect. The only oriental book, however, where I remember to have seen it, is the *Subhat ul Abrâr* of Jâmi; and I subjoin the original with a translation. There are one or two singular variations between the two versions, and the oriental has the advantage in compactness of narrative.

### † حکایت

گفت روزی بمناجات کلیم کای جهاندار خداوند کریم  
بر دلم روزن حکمت بکشای عدل در صورت ظلم به نهای

\* De Sacy, *Notices des MSS.* vol. ix. p. 406.

† Metre, — u — — u — — u — —

قوت دیدن ایدت نبود  
 مغبذ از نور یقین دور مرا  
 می نگر قدرت مارا ز کمین  
 منتظر پای بدامن بنشست  
 چون خضر رخت بسر چشمه کشید  
 تن فروشت و بر آمد بشناب  
 ره سوی منظر و کاشانه گرفت  
 از دل سفله زد دنیا پرتو  
 جانب کیسه اش افتاد نگاه  
 کیسه بر بود و سوی خانه دوید  
 راه چشمه بعضا پیدمائی  
 بست بر یک طرف احرام نماز  
 خیر باد خرد و هوش کرده  
 بهر پریش بسوئی کور شناخت  
 زد بران قهر کزان تیغی و کشت  
 گفت گای تخت گهت عرش مجید  
 وین دگر ضربت خنجر خورده  
 پیش شرع و خرد این حکم خطاست  
 کارها راست نیا ید بقیاس  
 مزد را بهر کسان کار گوی  
 کرد یک چند بمزدوری کار  
 مزد وے بود در ان کیسه که برد  
 ریخت خون پدر قاتل خویش  
 وز پدر روز جزا داد خلاص

گفت تا نور یقینت نبود  
 گفت یارب بده آن نور مرا  
 گفت نزدیک فلان چشمه نشین  
 موسی آنجا شد و پنهان بنشست  
 دید کز راه سواری برسد  
 جامه کند از تن و زد غوطه در آب  
 جامه پوشید و ره خانه گرفت  
 بر زمین ماند ازو کیسه زر  
 پس ازان کودکی آمد از راه  
 از چپ و راست کسی را چوندید  
 بعد ازان دید که نا بینائی  
 آمد و ساخت وضوئی به نیاز  
 نا گه آن کیسه فراموش کرده  
 آمد و کیسه بجا باز نیافت  
 کور با وے سخنی گفت درشت  
 موسی آن صورت هائل چو بدید  
 آن یکی کیسه پر زر بوده  
 کیسه آن بود برین زخم چراست  
 آمدش وحی که ای خورده شناس  
 داشت آن کودک نورس پدری  
 در عمارت گرئی مرد سوار  
 مزد نگرفته بیفتاد و بمرد  
 کور مقتول ازین کوری پیش  
 کشتش امروز پسر بهر قصاص

One day spake Moses in his secret converse with God,

“ Oh thou all-merciful Lord of the world,

Open a window of wisdom to my heart,

Shew me thy justice under its guise of wrong.”

God answered, “ While the light of truth is not in thee,

Thou hast no power to behold the mystery.”

Then Moses prayed, " O God, give me that light,  
 Leave me not exiled far away from truth's beams."  
 " Then take thou thy station near yonder fountain,  
 And watch there, as from ambush, the counsels of my power."  
 Thither went the prophet, and sat him down concealed,  
 He drew his foot beneath his garment, and waited what would be.  
 Lo from the road there came a horseman,  
 Who stopped like the prophet Khizr by the fountain.  
 He stripped off his clothes and plunged into the stream,  
 He bathed and came in haste from the water.  
 He put on his clothes and pursued his journey,  
 Wending his way to mansion and gardens ;  
 But he left behind on the ground a purse of gold,  
 Filled fuller with lucre than a miser's heart.  
 And after him a stripling came by the road,  
 And his eye, as he passed, fell on the purse ;  
 He glanced to right and to left, but none was in sight ;  
 And he snatched it up and hastened to his home.  
 Then again the prophet looked, and lo ! a blind old man  
 Who tottered to the fountain, leaning on his staff.  
 He stopped by its edge and performed his needful ablutions,  
 And pilgrim-like bound on him the sacred robe of prayer.  
 Suddenly came up he who had left the purse,  
 And left with it his wits and his senses too,  
 —Up he came, and, when he found not the purse he sought,  
 He hastened to make question of the blind old man.  
 The old man answered in rude speech to the questioner, [him.  
 And in passion the horseman struck him with his sword and slew  
 When the prophet beheld this dreadful scene,  
 He cried, " Oh thou whose throne is highest heaven,  
 It was one man who stole the purse of gold,  
 And another who bears the blow of the sword.  
 Why to that the purse and to this the wound ?  
 This award, methinks, is wrong in the eye of reason or law."  
 Then came the Divine Voice, " Oh thou censurer of my ways,  
 Square not these doings of mine with thy rule ?  
 That young boy had once a father

Who worked for hire and so gained his bread ;  
 He wrought for that horseman and built him his house,  
 Long he wrought in that house for hire,  
 But ere he received his due, he fell down and died,  
 And in that purse was the hire, which the youth carried away.  
 Again, that blind old man in his young days of sight  
 Had spilt the blood of his murderer's father ;  
 The son by the law of retaliation slays him to-day,  
 And gives him release from the price of blood in the day of retri-  
 bution !”

In neither of the foregoing apologues have we been able to trace a Rabbinical origin, though there are grounds for believing that both originally may have come from a Jewish source ; but in the next story, I have lately discovered the original Jewish version, which affords a strong presumption that a more careful search might identify the others too. The subject in itself may seem of small import,—but it is not of small import to trace the progress of ideas among nations ; and each of these apologues has a professed philosophical aim. They are not mere fables, whose marvels serve only to excite amusement or wonder,—they are myths, like those in Plato, with an intended meaning, and they passed current from the thinkers of one nation to those of another because they came home to all with a certain reality and power of their own. At the same time, if we could trace a Jewish origin to all the three, it would be a new and interesting proof of the wide influence which the mediæval Jewish mind exercised upon its contemporaries, in spite of the contempt and persecution which universally strove to keep it down.

This next apologue is one which, I believe, was given by Voltaire, but I have not verified the passage in his works. It has been more than once copied from him, as for instance by Lord Byron in the notes to one of his poems.

The Persian version is found in the first book of the Masnavi of Jaláluddín Rúmí, who died A. D. 1272 (A. H. 671.) To understand the story aright, we must remember the oriental notions of Solomon's power over the elements and the genii.

One simple of heart came in the morning  
 Running into Solomon's judgment-hall,

His face pale with terror and both his lips blue,  
 And Solomon said to him, "O friend, what meaneth this?"  
 He answered, "The angel 'Izráíl  
 Hath just thrown on me a glance full of wrath and hatred."  
 "Ask," said the king, "what boon thou desirest."  
 "Oh thou refuge of the heart, command the wind  
 That it bear me from hence to Hindustán,  
 It may be that there I may save my life."  
 Then Solomon gave to the wind its mission  
 And it bore the man away to Somnáth.—  
 Thus too thou may'st see men flying from poverty,  
 They are swallowed as victims by desire and hope,  
 That fear of theirs is but like his in the story,  
 And desire and its greed is *their* Hindustán!—  
 He commanded the wind that forthwith in haste  
 It should bear him to Hindustán across the sea.  
 The next day at the time of audience  
 King Solomon spake unto 'Izráíl,  
 "Thou looked'st with wrath on a true believer,—  
 Tell me wherefore, oh messenger of the Lord.  
 'Twas a strange action, methinks, this of thine,  
 To frighten him an exile from house and home."  
 He answered, "Oh thou King of an unsetting empire,  
 His fancy interpreted my action wrong.  
 How should I have looked with anger on such as him?  
 I but cast a glance of wonder as I passed him in the road,  
 For God had commanded me that very day  
 To seize his soul in Hindustán.  
 I saw him here and greatly did I marvel,  
 And I lost myself in a maze of wonder.  
 I said in my heart, Though he had an hundred wings  
 He could never fly from hence to Hindustán in a day.  
 But when I arrived, as God commanded,  
 I found him there before me and took his soul."

Few Oriental Apologues have a more striking outline than the above, rising almost to the moral sublime; but it is only one of the many fine legends and fables which are scattered throughout the

Masnavi. It is in fact this simplicity and power which distinguish the apologues of Jaláluddín from most of those which we find in Jámí or Faríduddín 'attár;—the latter are generally *only* stories, graceful enough in their way, but seldom striking any deeper chord. The legend itself is found in al Beidáwi's Commentary on the Koran, *sur.* 31.; *v.* 34.\* and the following, from the Talmud, is undoubtedly an earlier and cruder version of the same story. It is immeasurably poorer in every respect, but the scene and dramatis personæ are identical. (See Dr. Lightfoot's *Horæ Talmudicæ*, vol. ii. p. 428, who quotes it from the treatise Succah, fol. 53. 1.)

“Those two men of Cush that stood before Solomon, Elihoreph and Ahijah the scribes, sons of Shausha. On a certain day Solomon saw the Angel of death weeping; he said, Why weepest thou? He answered, Because these two Cushites entreat me, that they may continue here. Solomon delivered them over to the devil, who brought them to the borders of Luz; and when they were come to the borders of Luz, they died.”

Dr. Lightfoot adds the following from the ancient Gloss. “He calls them Cushites† [*ironically*], because they were very beautiful. They ‘entreat me that they may continue here.’ For the time of their death was now come; but the angel of death could not take their souls away, because it had been decreed, that they should not die but at the gates of Luz. Solomon, therefore, delivered them over to the devils; for he reigned over the devils, as it is written, And Solomon sat upon the throne of the Lord, for he reigned over those things that are above and those things that are below.”

I may mention in conclusion, as a fourth instance (though in a somewhat different style), the story of the Santon Barsisa, in the Guardian, No. 148. Steele avowedly takes it from the once popular “Turkish tales;” but the original is probably to be found in the fifth majlis of Sádí, and it is singular that even here we can trace some apparent signs of a Jewish source, as the tale opens with the words, اورده اند كه در بنی اسرائیل زاهدی بود نام او بر صیصا “They have related that among *the children of Israel* there was a Záhíd named Barsísá.”

\* I may add that Parnell has taken part of his Hermit from the legend in *sur.* 18.

† Scil. Ethiopians, or negroes.

*Two Letters on Indian Inscriptions.—By FITZ E. HALL, M. A.*

[We have received the following letters from Mr. Hall, in America ; —they were enclosed in a letter, dated Troy, New York, Nov. 17th, 1859.—EDS.]

Calcutta, April 22nd, 1859.

*To the Secretary, Asiatic Society of Bengal.*

SIR,—My agent in this place has instructions to make over to you, in my name, an inscription-stone, now on its way hither from Benares. This monument I wish to present to the Museum of our Society. It was found among the ruins of Páṭan, a decayed city near Rátgurh in the Saugor District.

The inscription, as you will see, is well-nigh effaced. With some distrust, I read the beginning of it as follows :

सिद्धिः । संवत् १११५ वर्षे फाल्गुनवदि ८ गुरा ।  
 सदपतितकपालः कान्तदान्तः कपाल-  
 क्षिमिततिमिरजालः सञ्चलत्कर्णतालः ।  
 कुलिशकठिनशुण्डादण्डराजन् मनोवि-  
 भ्रकदलनकरालः पातु वः शम्भुबालः ॥

‘Auspiciousness ! Year of *Samvat*, 1115 : Thursday, the 8th day of the dark fortnight of *Phálguna*.

‘May S’ambhu’s son—with exudation falling on his cheeks, with brilliant tusks, protector of the earth, checker of all darkness, waving his ears, adorned with a mace-like proboscis, obdurate as adamant, potent in removing mental impediments—protect you !’

All the rest is abundantly doubtful. Even the little that I have decyphered of it may, therefore, admit of correction. According to my reading, there was a Bráhmaṇ in the west, apparently a royal personage, by name Kandukádriṇa, of the Vásaḷa (?) *gotra* and *Udgara anwaya* ; and among his ascendants was one Ráma. Kandukádriṇa’s wife was called Sávitrí ; and this pair had issue two sons, Purukárva (Purukárya ?) and Mahodadhi ; and a daughter Lakshmi.

Another family is afterwards spoken of. There was a Bráhma named Bhíma, of the S'ándilya *gotra* and Udgara *anwaya*. He had a brother Vásudeva and a sister Lakshmi. Her one Vámana seems to have married: but I have failed to ascertain who he was, as likewise the purport of all that ensues of the inscription.

The year 1115 of the *Samvat* era corresponds to A. D. 1058.

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*To the Secretary, Asiatic Society of Bengal.*

SIR,—I have the honor to present to our Society, on behalf of Major R. R. W. Ellis, a copper-plate land-grant, dated in the year of Vikramáditya answering to A. D. 1097. The donor informs me that this record was “discovered, six years ago, by the *Jágirdár* of Kotí, in removing some ruins in a fort, Raipur, near Soháwal, an ancient city four *kos* east from Nágod.”

This grant is the first of the two which I have translated in our Journal for last year, (Vol. XXVII. pp. 217, 250). On recent reference to the original, I find that, at p. 221, l. 6 *ab infra*, I should have read श्रीमन्म हाराज- in place of श्रीमद्राजाधिराज-. But the change of sense entailed by this correction is only very immaterial. In my rendering of a passage a little higher up the same page, perhaps it would have been preferable to restrict समाज्ञापयति to षण्णसरमौ अ० &c., बोधयति to निखिल० &c., and आदिशति to राजराज्ञी० &c.

*Calcutta, Maundy Thursday, 1859.*

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*Memorandum on the Survey of Kashmir in progress under Captain T. G. MONTGOMERIE, Bengal Engineers, F. R. G. S. and the Topographical Map of the Valley and surrounding Mountains, with chart of the Triangulation of the same executed in the Field Office and under the Superintendence of Lt.-Colonel A. SCOTT WAUGH, F. R. S. F. R. G. S. Surveyor General of India, Dehra Dhoon, May 1859. Read at a Meeting of the Asiatic Society on the 6th of July, 1859. By Major H. L. THUILLIER, F. R. G. S. Deputy Surveyor General of India.*

In No. 263 of the Asiatic Journal for 1857 a paper was published by Lieutenant (now Captain) Montgomerie of the Bengal Engineers, 1st Assistant Great Trigonometrical Survey of India on the height of the Nanga Parbut and other snowy mountains of the Himalaya range adjacent to Kashmir; and it was therein stated that although not equal to Mount Everest (29,002 feet) still the Nanga Parbut (26,629 feet) was as much the king of the Northern Himalayas as Mount Everest is the king of the Southern Himalaya. I have now the satisfaction, through the kind consideration of my friend Colonel Waugh, of laying before the Society, the actual results of the progress of this magnificent and unparalleled survey, up to a very recent date, and the maps now presented to the view of the meeting, together with the few details I am about to read, will prove better than anything else, the value and the character of the great national work which the Surveyor General of India is now rapidly carrying out to completion—a work which I believe will bear a comparison with any geographical operation undertaken in any country with which we are acquainted.

As the operations proceed, the labours of the Surveyors are rewarded with discoveries which certainly of late years have been but of infrequent occurrence. Another stupendous mountain has been measured and fixed by Captain Montgomerie, which perhaps is second in the world only to the one above alluded to, viz. Mount Everest, as measured by Col. Waugh in 1847. A snowy peak very nearly in the ray of Skardo from Sirinagur and distant N. E. about one hundred and fifty-eight miles from that capital, on the Kara Koram

range, termed for the present K. 2, proves to be 28,278 feet above the sea level, which is 122 higher than Kanchingga, but 724 feet lower than Mount Everest. It is impossible to say therefore what the exploration of the interesting ground in the Northern Himalayas now under survey may bring forth. The project in hand of bringing all this difficult and hitherto comparatively unknown tract of country under minute and accurate survey is a grand one. For the eastern portion already achieved, and represented by maps in the form of degree sheets on the quarter inch scale, manuscript specimens of which are laid on the table, together with one sheet No. 47 of the engraved Atlas of India, containing a portion of the same survey, Colonel Waugh has been rewarded by the Royal Geographical Society with their gold medal in 1857; and when the whole of the Himalayas from British Gurhwal to the Indus is completed, it will form a noble memorial of the undaunted skill and energy of the officer who planned, and his subordinates who executed it.

This valuable map and beautiful specimen of Topographical Drawing now exhibited in manuscript, measuring 4 ft. 1 in.  $\times$  4 ft. 1 in. embraced between the meridians of  $74^{\circ}$  to  $75^{\circ} 40'$  East Longitude and the parallels of  $33^{\circ} 20'$  to  $34^{\circ} 44'$  North Latitude, has been compiled, on the scale of *half an inch* to the mile, from the Field work of the Trigonometrical and Topographical parties, under the immediate superintendence of Captain T. G. Montgomerie, Bengal Engineers, 1st Asst. G. T. Survey of India. It embraces eight thousand and one hundred square miles of country including the lovely valley and surrounding mountains of the romantic country of Kashmir, with no less than four thousand six hundred and six villages, depending on three hundred and fifty-two trigonometrical points, and gives the computed positions of the principal towns, mountains, &c. with all the topographical details, viz.: the villages, roads, passes, lakes, ridges, slopes of mountains, &c.

This is the original scale on which the survey has been projected, a reduction to the usual geographical scale of *quarter inch* to the mile is being likewise made and this will be incorporated into the Indian Atlas and engraved like the other sheets.

The compilation of the Map has been executed by Mr. W. H. Scott, the able Chief Draftsman at the Surveyor General's Head Quarters,

under the immediate inspection and guidance of Colonel Waugh; and the drawing and printing which will bear close examination is due to Mr. Scott and Sheikh Gholam Kadar, native draftsman, the hills in brush work (Indian ink) being copied from the original plane table sheets or sections executed on the ground by the officers of the Survey. The skeleton chart of triangles shews the basis of the work on which the topographical map has been compiled, and is interesting as illustrating the rigorous and minute method with which every thing is conducted in the Department.

Captain Montgomerie in his report gives the following description of the country under survey.

“Kashmir is a large valley lying between two snowy spurs of the great Himalayan range drained by the ‘Vedasta’ or ‘Jhelum’ river which with its tributaries is navigable by large boats for about ninety miles. The greatest length of the valley from ridge to ridge measured from south-east to north-west, which is also the direction of the drainage, is about one hundred and eighteen miles. The flat portion is about eighty-nine miles long with an average breadth of sixteen and three quarter miles, and elevated about 5,200 feet above the sea.

“The flat ground consists of an upper, lower and level, the former separated from the latter by cliffs of clay, coloured with burnt sienna, called ‘kharewah’ by the Kashmiris and forming a distinguishing feature on the map, some 200 to 300 feet in height.

“The upper or table land is often found standing in isolated masses,\* but is generally connected with the foot of the hills. Most of the upper level was formerly irrigated, but is now generally fallow and dry.

“The lower level is subject to inundation, and indeed the portion between the city and great lake, still forms one vast marsh, but vaguely separated from the lake itself.

“The slopes of the hills between the flat ground and the limit of forest are a mixture of cultivation, good grazing grounds and forests of cedars, pines, firs, &c.; the forests preponderating.

“The number of lakes in the valley, and of tarns in the mountains form a distinctive feature in Himalayan Geography, as they are but rarely met with on the Hindustan side of the Himalayan range.”

\* Several miles in length and breadth.

The chief features in the valley are the Lakes which are of world-wide celebrity. These overflow the country and give it the marshy character so delicately depicted on the map before us.

The "Great Wulur" lake, the largest in the valley, is about twenty-one miles north-west of the city of Sirinagar, the capital. Its extreme breadth north and south is ten and a half miles; this does not include the marshes on the south side, and which continue past the parallel of the city. The extreme breadth a little north of the Island of Lunka is ten miles and the circumference nearly thirty miles.

During a storm the waters lash themselves into high waves, so that no boat will venture on it. The waters find their way out of the valley by the Burrumulla pass, dashing in a most fearful torrent through the mountains and at last meet the Jhelum river about one hundred miles above the town of that name. About half way up the mountains surrounding this lake a perfectly level water mark is to be seen running along them, which would seem to corroborate the belief of the natives that the valley was once a large lake.

The "Manus Bal" lake is twelve and a half miles from Sirinagar and in the same direction as the Wulur lake. Its length is two miles east and west, and breadth seven-tenths of a mile.

The hill of "Aha Tung" 6290 feet, bounds the southern face of this lake and is remarkable, owing to its isolated position and abrupt rise from the level of the surrounding country of 1000 feet.

The "Anchar" can scarcely be called a lake, it is caused by the waters of the Sind river, overflowing the low ground north of the city.

The lake immediately east of the city supplied by the Arrah river, boasts of the far famed Isle of Chinars (Chinar or *Platinus Orientalis* though considered an exotic thrives luxuriantly in the valley). The gardens and groves of poplars, cherries, walnut, peach, apricot, apples and mulberries along its bank, add considerably to the beauty of this lake.

All over the valley very interesting ruins are found, some near the Island of Lunka are entirely under water, whether these have been submerged from the ground sinking or owing to the water rising above its original level it is difficult to say.

The east end of the valley consists entirely of rice-fields. At the west part there is little or no cultivation, being very woody. Culti-

vation is carried on in the small valleys that run into the mountains, viz. the Daras valley, Teregram, Hurripore and Tevil (near Wurtapore). These are the prettiest spots, the east end is scarcely worth a journey to see it.

The Great Wulur Lake is a favorite resort of sportsmen in search of rare aquatic birds. The lake also abounds with fish of all sizes peculiar to hill waters, the larger kinds being speared or harpooned from small boats.

The river Jhelum is navigable from the city to the great lake, and indeed most of the marshes and lakes can be crossed in boats, so that sportsmen and travellers in search of the beautiful or romantic can be easily gratified.

Ibex, Bara-singha or Elk, brown and black Bears, Musk-deer and Gazelle are found on most of the higher ranges, but it needs a keen sportsman both willing and able to endure fatigue and hardship, to boast of having shot an Ibex. Many are the thrilling incidents of a chase after Ibex, over fearful precipices and slippery glaciers, where a single false step would have sealed the fate of the daring hunter.

The grandeur and beauty of Kashmirian scenery cannot be described, it must be seen to be fully understood or appreciated. The high masses of mountains, many covered with snow, which surround the valley on every side, the lakes and streams, the variety and luxuriance of the foliage and the mildness of the climate are together not to be met with in any other part of India.

The town of Kashmir or Sirinagur is quite an Eastern Venice, the place being intersected with canals in every direction and the houses built out from the water. The lake adjoining, with its pretty little island of Chinars, and its numberless floating gardens, is like a mirror reflecting the surrounding mountains on its surface, so as quite to give the idea when passing over in a boat that one is skimming over the peaks and crags in an aerial machine. At the bottom of these mountains on the borders of the lake are the famous gardens of Shalimar and Nishat. Streams from the mountains, are made to run through them, forming Cascades and canals, the Chinar trees casting their shade over them and the walks lining the sides.

The houses in the city of Sirinagur are chiefly of brick-work, built

up in frames of wood. The walls seldom exceed a single brick in thickness, so that but for the wooden frame work, these habitations would not be very safe. Sirinagar, like all Indian cities, is exceedingly dirty, and the inhabitants, except the shawl and wool merchants, vie with each other in uncleanness.

The bridges over the Jhelum, shewn on the map opposite Sirinagar, are entirely constructed of logs of wood heaped up cross wise, which serve as piers, over which a platform is laid of planks and beams roughly nailed or tied together, the spaces between the piles of wood being left open and of such width, as to allow of the passage of the boats on the river.

The garden houses and dhurrumsallas in the suburbs of the city are chiefly used by visitors.

“The mountains around Kashmir” Capt. Montgomerie observes, “are covered with snow for at least eight months in the year, many being from 15,000 to nearly 18,000 feet above the sea, include large glaciers between their spurs, and retain the snow throughout the year.

The chief peculiarities of the survey operations arise from this great elevation. Special arrangements were required for the protection of the natives and for the necessary supplies of food and wood, when the surveyors were working far above villages and even above the forest itself.

“The triangulation depends upon the Kashmir Series of the Great Trigonometrical Survey, which emanates from a side of the North-West Longitudinal Series in low hills near Sealkote.

“In order to connect the triangulation in the Punjab with Kashmir, it was necessary to carry it across the Chatadhar and Pir Punjal snowy ridges. This was done by taking observations from the tops of the snowy peaks best adapted to form a series of symmetrical polygons and quadrilaterals. In this way the triangulation has been carried on systematically from the foundation. It consists of one main axis, viz. the principal triangulation, which is composed of polygons and quadrilaterals. From this axis, diverge numerous minor Series of triangles, which starting from one side of the principal Series are tested by closing on another side of the same, or upon a side of the North-west Himalaya Series.

“From these minor series, secondary stations have been fixed, so as to cover the whole country with tested trigonometrical points.

“Though the country to be surveyed was so elevated, the rigorous rules of the G. T. Survey of India were adhered to throughout.

“The highest points suited to the triangulation were always occupied and observations were taken from stations upwards of 16,000 feet above the sea.

“On the principal series of triangles the observations were invariably made to luminous signals, viz. Heliotropes and Reverberatory lamps on the Argand principle with parabolic reflectors, notwithstanding the physical difficulties and the severity of the climate on the snowy peaks, so especially trying to the natives of India who served the signals.

“Numerous observations being required, it was necessary to reside on the peaks for at least two days and nights, generally more.

“Some of the peaks below 14,000 feet lose the greater part of their snow by September, but practically it was necessary to observe most of the stations earlier in the season, when the snow was still heavy at 11,000 feet, and occasionally in consequence of clouds and storms, the party had to remain pitched on the snow for upwards of a week at a time.”

Colonel Waugh thus speaks on this point:—

“The physical difficulties imposed by the nature of the country and survey arising from the necessity of ascending and encamping on snowy mountains of great elevation were very great. The character of a Trigonometrical survey demands that the stations shall be fixed on the highest summits, or on points commanding extensive views and the system of the department, requires that an adequate number of good observations shall be taken, which usually occupies several days. To accomplish this task, not only the observers, but the signal men (natives) must encamp at or near the stations. The heights of the snowy peaks, ascertained on the Punjal range were ‘Moolee’ 14,952 G. T. Survey and Ahertatopa 13,042 G. T. Survey and to the north of Kashmir Hara Mook 16,015 feet. Amongst the highest elevations visited in Thibet were the principal stations of Shimshak 18,417 and Shunika 18,224 feet. The difficulty of obtaining supplies and firewood at such elevations may be imagined, yet

they were every-day occurrences. Out of sixteen principal stations in Thibet fourteen exceed 15,000 feet in height. Great as the hardships entailed on the European officers undoubtedly were, they were slight compared with those endured by the native establishment, with the utmost cheerfulness. The signallers and headmen were mostly natives of Hindustan to whom extreme cold is a condition of positive suffering, yet these men were loyal and contented as they have been in all survey parties over India during the mutiny."

Capt. Montgomerie states "On the Pir Punjal peaks the electricity was so troublesome even when there was no storm, that it was found necessary to carry a portable lightning conductor for the protection of the Theodolite.

"Space sufficient even for the very small camp could never be got quite close to the stations on the peaks. During the day this did not matter, but at night, though the distance might not be more than two hundred yards, it was rather a difficult matter to get back from the Observatory tent after the Surveyor had finished taking observations to the lamps. Soon after sunset, the surface of the snow becomes as slippery as glass, affording by no means a satisfactory footing on a narrow ridge with either a precipitous slope, or a precipice on either side.

"The country was found too difficult to admit of the transport of a twenty-four inch theodolite without great delay and expense. Capt. Montgomerie was therefore directed to take the principal observations with a *fourteen-inch* theodolite, a first rate instrument made by Troughton and Simms which gave every satisfaction.

"On the Secondary Series or Minor Triangulation, the ground covered by which is shewn by shade on the chart, twelve, eight and seven-inch Theodolites were used, according to circumstances.

"By means of the principal and secondary triangulations the whole country was covered with Trigonometrical points at an average distance of little more than four miles from each other."

During the first two seasons of the Kashmir Series, no less than sixteen thousand square miles of close triangulation have been executed, i. e. an area of more than half of Scotland has been covered with trigonometrical points and thirty-two thousand square miles of topographical drawing were sent in, giving all the details of the country.

Besides these, numerous valuable sketches, routes, heights of passes, &c. have been added to the survey.

The numerous observations taken to the great Snowy mountain "Nanga Parbut" or "Dayarmur" in latitude  $35^{\circ} 14' 21''$  and longitude  $74^{\circ} 37' 52''$  prove that its mean height is 26,629 feet above the sea. No peak within sixty miles on any side of the general map of the Nanga Parbut comes within 9,000 feet of the same height. This pinnacle of the Himalayas is the highest point in the range between Nepal and Attock. In consequence of its isolation from all peaks of anything like an equal altitude, it naturally forms a noble object in whatever aspect it is viewed.

"The topographical detail was all sketched in the field on Plane Tables, according to the system laid down in Colonel Waugh's pamphlet of instructions on Topographical Surveying, an arduous task in such an elevated country, as it was of course necessary to visit numerous peaks and places on the ridge, in addition to the Trigonometrical stations which include the highest peak in the Pir Punjal.

"The drawing of the Field Sections expresses the ground well, that of Captains P. Lumsden, Bengal Army and Godwin Austen, H. M. Army being more specially artistic.

"The advantage of this system in a country like India, especially in the hilly and mountainous tracts, is that officers with a moderate previous knowledge of military drawing, can be readily trained to fill up the triangles and the work proceeds rapidly, producing a complete and valuable map with the topographical features accurately delineated at small expense."

But the difficulty of sketching ground of such a character may be imagined. To do so with any degree of faithfulness requires a peculiar talent, and is a gift as much as copying the human face. Stevenson, the Civil Engineer, in his evidence before Parliament on the Ordnance Survey of England stated his belief, that there were not above eight persons in England who understood how to pourtray *ground*. If difficult therefore in England, it must be still more so where the relative commands are so immense.

Colonel Waugh proceeds to observe—

"In consequence of the difficulty in obtaining Topographical Assistants Officers of the Quarter Master General's Department were at

first employed on the topography, but they were soon called away by the demands of their own department; consequently a fresh set had to be trained, involving delay and expense, which would have been avoided, if the same assistants could have been employed throughout.

“Lieut. Basevi of the Engineers made a very careful reconnoissance of many of the passes on the Pir Punjal, determined their heights, and drew up an able report of their capabilities; he also sketched a portion of the ground near the ridge, and subsequently reported on the river Vedusta or Jhelum. Lieutenant Basevi is a most energetic talented and able officer and did excellent service, as also did Mr. Bell, who is an able Surveyor.

“Captains P. Lumsden, Allgood, and Johnson, took up their work *con amore*, quickly acquired the requisite knowledge of the system, and their zeal in this arduous and harassing work deserves high praise. They completed three thousand and two hundred square miles on the half inch scale, and the Surveyor General having personally examined their plans, speaks in the highest terms of the same.

“Captain Godwin Austen exhibited special talent for the delineation of ground, and Lieut. Melville’s work was very good. Both of these officers proved themselves indefatigable mountaineers and have altogether exhibited so much zeal as to be deserving of high commendation. Lieut. Murray also did good service, and proved himself a useful Surveyor.

“The success attending this season’s work, the admirable manner in which Captain Austen and Lieuts. Melville and Murray acquitted themselves, induced the Surveyor General to apply to Government for five additional qualified officers, to which sanction was accorded by Government, but he has not been yet able to find any suitable persons. A great deal of floating talent does exist in the army, and qualified young officers are frequently to be met with, but the military operations consequent on the mutiny have absorbed most of the valuable officers and rendered selection difficult.

“Lieut. Elliot Brownlow of Engineers, an officer of the highest promise and beloved by all his contemporaries, volunteered for service and joined at Delhi, in eight days from Kashmir, though too late for the assault; he then proceeded to Agra and Lucknow with the Engineer’s Brigade, and was most lamentably killed at Lucknow after the

siege by an explosion of gunpowder. The mountain survey thus lost a most energetic and valuable member, unrivalled in physical power, endurance and cheerfulness under fatigue, whilst the Engineer Corps lost a talented and amiable officer.

“Poor Elliot Brownlow’s adventures and achievements in the snowy mountains and his hardihood and endurance have been the theme of much praise and admiration amongst his brother Surveyors. He had intended to devote his rare and splendid qualities as a mountain surveyor, had he survived, to the exploration of Central Asia on rigorous principles.

“The merits of the various assistants have been duly reported on. By means of their zealous co-operation alone, was the Surveyor able to finish this difficult piece of work. Though they have had much to contend with in such a country, besides the extremes of heat and cold, their exertions have been most praiseworthy.

“The native establishment has from the commencement consisted of a mixture of men from the plains and from the hills. They were all not a little troubled by the impossibility of boiling or rather softening their rice, dal, &c. at such high elevations. Notwithstanding that, and the general severity of the climate, they have at all times done their work carefully and efficiently.

“There were many difficulties peculiar to surveying in a partially independent state. The natives of the country moreover had prejudices against going up some of the high hills; but the clouds, mist and haze were always by far the worst enemies of the Surveyors.

“During the last year the party were troubled first by cholera and secondly by a flood. The former had stuck to the valley strange to say throughout the winter when the snow was up to a man’s neck. The camp did not suffer much as it was taken up to the high Table Land. During the flood they had to take to the boats; about thirty miles by ten to fifteen were submerged.

“In the after part of the season the triangulation of Little Thibet was finished and a good piece of Ladak, all on the other side of the Himalayas, where the rains did not interfere so much, though the clouds were troublesome.

“The Latitude and Longitude of Skardo have been obtained, but, Leh, has not been laid down yet, though two peaks in its neighbourhood

have been fixed. It is supposed *Leh* will prove considerably to the west of the old position.

“The triangulation was commenced in 1855, and finished in 1856, with, on an average, three Assistants each year.

“The topographical work was taken up in 1856 and completed in 1857 with on an average, four Assistants each year.”

The cost of the entire survey has been only Rs. 4-5-2 per square mile, or say about 8 shillings and 8 pence, a sum believed to be trifling in comparison with the immense advantage gained, and exceedingly moderate when contrasted with similar or easier work in other countries.

The able and successful manner in which Captain Montgomerie with the aid of this small party during his first season accomplished the arduous task allotted to him has been described in full in a previous printed Report of the Survey Operations for 1855-56, and the meritorious services of the Captain and his party obtained the acknowledgments of the Right Hon'ble the Governor General in Council. The Surveyor General of India bears his professional testimony to the fact that the measure of success attained is highly honorable to Captain Montgomerie and all members of the party engaged in the work. Colonel Waugh thus expresses himself; “Considering the stupendous physical difficulties presented by the nature of the country to regular and systematic surveying, the quantity and quality of the work performed, the ability displayed in command of an unusually large party, the quantity of instructions which had to be imparted to so many new hands, the judicious character of his general arrangements combined with minute attention to the smallest details, as well as the prudent policy of his relations with the Maharajah and the people of the country—all the above marks Captain Montgomerie as an officer of no ordinary stamp.” The exertions of the party are, in the Surveyor General's opinion, well deserving of commendation and he particularly solicits that the thanks of the Government may be accorded to Captain Montgomerie, and that the services of Mr. Johnson who has been with the party from the commencement may be noticed favorably as well as those of Messrs. G. Shelverton, W. Beverley and Mr. W. H. Scott, the able Chief Draftsman of the Field Office in connection with the compilation of the map.

But neither the physical character of the country nor the constant task of training new hands formed the chief difficulty of a Survey conducted in a foreign territory, and which at no time could be expected to be agreeable to the ruler, his officials and people. To them the influx of a considerable body of Surveyors spread over the country, however orderly and well-conducted, must bear the aspect of an intrusion. The tact, delicacy and ability with which Capt. Montgomerie maintained amicable relations with the Court, a most difficult one to deal with, and preserved discipline in a large mixed establishment, is deserving of the highest praise, and stamps him as an officer of great policy and judgment.

“His difficulties were much enhanced by the military rebellion of 1857, during the whole of which excited period the party continued its peaceful labours without cessation and with only one serious interruption.

“With the old Maharajah Golab Singh, Capt. Montgomerie was on the most friendly terms and the estimation in which he is held by Maharajah Rumber Singh, can best be estimated from the acknowledgments which his Highness made to the Captain in Durbar, on the resumption of operations in 1859. Without such tact and conciliation, it would have been impossible to carry out the complete and final survey successfully.”

Although the splendid climate of Kashmir added to the special interest attaching to the country, and the unexplored tracts adjoining, made the Survey deservedly a great attraction, still the exposure of surveying in such a country is very trying to the constitution and many persons suffered greatly. The lower valleys are very hot, and the solar radiation on hill sides is very powerful. The labor of climbing to great elevations has often been noticed by explorers. The Surveyor however arriving heated by physical exertion at great elevations has to stand on ridges or peaks exposed to strong cold winds while he is observing angles or sketching the ground. The alternations of heat and cold and the laborious exertion limits success to those persons who to the requisite professional qualifications can add the physical constitution to stand the hardships which the work imposes. It is very doubtful in the opinion of the Surveyor General whether the ability to undergo the requisite amount of fatigue and

exposure which mountain surveys entail can be reckoned on for a long continuance, and he apprehends that, except in rare instances, a frequent succession of well-trained young men would be necessary in extensive mountain surveys.

This map is a first instalment of this survey. The whole mountain tract south of Kashmir Proper has been completely Triangulated and Topographically surveyed, and the map thereof is now in course of construction. Altogether the area already surveyed amounts to twenty-two thousand square miles in three years, and forty thousand square miles of Triangulation, including all little Thibet, in four years, the chief merit of which achievement is due deservedly to Captain Montgomerie. The Surveyor General has requested that this may be submitted for the opinion of the Council of the Royal Geographical Society together with the chart of the Triangulation on which it is based, as a work of accurate geography in a region hitherto imperfectly explored, and it is hoped that it may obtain for Captain Montgomerie some mark of the approbation of that learned body.

The Surveyor General hopes next year to complete the maps of the remaining Sub-Himalayan portion now in hand by the completion of which the entire tract of Mountain Frontier from the Ganges to the Cabul Territory will have been finished under his superintendence, and rendered available for incorporation into the Indian Atlas.

The party under Captain Montgomerie is now engaged in Thibet. The country is exceedingly difficult and the strength of the party much diminished. In the progress of the survey advantage has been taken of the opportunity to extend accurate geographical knowledge by fixing numerous peaks in the Karakoram and Mustag ranges. One of those already determined on the Karakoram range, along which runs the boundary between Ladakh and Yarkund, one hundred and fifty-eight miles N. E. of Srinagar, is 28,278 feet high (provisionally settled only, being liable to a small correction when the levelling operations from the sea level at Karachi, now in progress, are completed). None of the peaks in the neighbourhood of K 2 come nearly up to it though there is one fine group about sixteen miles away that is generally a little over twenty-six thousand. This is probably the second highest mountain in the world, as it exceeds Kauchingga by

122 feet, but is lower than Mount Everest by 724 feet, as measured by the Surveyor General in 1847.

It is expected that Captain Montgomerie will be able to fix points up to  $36^{\circ} 30'$  N. latitude, but it is doubted whether he will be able to get in all the Topography quite so far as that, in consequence of the wild and Yághí state of some of the people.

It has been specially recommended that the map of Kashmir be engraved or at least lithographed in England as soon as possible, in order that its results may be rendered speedily available for geological purposes as well as useful to public officers, travellers and the public generally.

The panoramic sketch exhibited, taken by Captain Montgomerie, which is a fair specimen of Calcutta Lithography, will give some idea of the peaks, if the observer supposes himself to be in any way near the Takt-i-súlímán close to the city. The sketch begins on the left about south-east and goes round nearly to north-west.

The first long low bit without snow, starting from the left, is where the Bamhal road crosses. About  $13\frac{1}{10}$  inches from the left the peak looking over the Peer is one of the principal stations, by means of which the triangulation was brought over the Pir Panjal range. At about eighteen inches come in the craggy Koserin Kútúr peaks described as the three Bs.

The Pir Punjal pass is not visible, it is believed the range is about twenty-seven inches from the left. The highest peak of all is, Tattakúti with a very steep precipice to its right, it is about thirty-two inches from the left. The Baramoula gap is three inches from the right. If the sketch is held over the map the connection will be seen and the cliffs will be made out, coloured burnt sienna on the map, that separate the lower from the upper level ground.

During the present season the snow is very low down and the work is nearly all in high ground, which is very inconvenient. It may be difficult for a Calcutta resident to imagine snow inconvenient, but campaigning on the top of it soon undeceives one.

The party has now gone into Ladakh and hope to fix Leh and some places beyond. The small index plan shews roughly the extent of country embraced by the trigonometrical and topographical operations in the Himalayas tinted yellow up to the parallel of  $36^{\circ}$  N.

latitude. The Punjab Proper tinted pink having been completed by the Revenue Survey operations, the upper portion of the Derajat alone remaining.

The above information is chiefly taken from the reports of Colonel Waugh, Surveyor General of India and Captain Montgomerie, I am also indebted for assistance to Mr. J. O. N. James, Chief Draftsman of the Surveyor General's Office, who has for some years been employed in the survey of the adjoining districts.

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*The Cartilaginous Fishes of Lower Bengal.*—By EDWARD BLYTH.

The following does not profess to be a complete catalogue of the cartilaginous fishes that inhabit the *embouchure* of the Ganges, but merely of those which I have personally obtained in the fresh state, chiefly in the Calcutta fish-bazars; and having lately had occasion to look them over, and paid some attention to the group, it may be useful to give an enumeration of the species observed, especially as in the genus TRYGON it appears that several permanently distinct races or species have been confounded under TR. UARNAK, (Forskål).

The cartilaginous fishes which I have obtained in Calcutta are as follow:—

1. STEGOSTOMA FASCIATUM, Müller and Henle: uniformly spotted variety, figured and described as *St. carinatum* in *J. A. S.* XVI, 725. One specimen only, procured at the Sandheads. Another, like it, is in the museum of the Calcutta Medical College.

2. SQUALUS (SCOLIODON) LATICAUDUS, M. and H. A small species, occasionally brought to the bazar. I have not seen it more than  $1\frac{1}{2}$  ft. in length.

3. SQ. (CARCHARINUS) MILBERTI, (? Val.). One specimen obtained,  $2\frac{1}{2}$  ft. long. A skull from the Bay, of an individual probably about 7 ft. long, has the largest upper teeth measuring  $\frac{1}{2}$  in. and upwards along their lateral margins: other teeth, of apparently the same species, from the Indian Ocean, have a lateral margin of  $1\frac{7}{8}$  in., and extreme breadth at base of  $1\frac{5}{8}$  in.;\* they more nearly resemble the

\* Even these are small, however, in comparison with the huge fossil teeth of the CARCHARIAS MEGALODON and others figured by Agassiz, and those by Dr. Gibbes in the 'Journal of the Academy of Natural Sciences of Philadelphia,' for July, 1848.

teeth of *Sq. LAMIA*, as figured by Müller and Henle; but the fins differ much from those of *Sq. LAMIA*, the pectorals being of moderate size and remarkably falcate: tail and posterior fins conspicuously black-margined. *Sq. MILBERTI* is noted from India in Dr. Gray's British Museum catalogue; and the present is perhaps Dr. Gray's Indian species, though probably distinct from *Sq. MILBERTI (verus)*.

4. *Sq. (C.) GANGETICUS*, (M. and H.) In Müller and Henle's outline of the lower surface of the head, drawn evidently from a dry specimen, the distance from muzzle to mouth is not sufficiently great. I have not known this species to exceed 7 ft. in length, but have seen many of that size.

5. *Sq. (C.) TEMMINCKII*, (M. and H.) Very common; but rarely exceeding 5 ft. long, so far as I have observed.

6. *Sq. (C.) MELANOPTERUS*, (Quoy and Gaymard). Not common: small individuals (under 3 ft.) occasionally brought, but we have the teeth of one which must have been at least 6 or 7 ft.

7. *SPHYRNIA BLOCHII*, (Val.): *Zygæna laticeps*, Cantor, *passim*. Common. The largest specimens rarely exceed 4 ft. in length.

8. *GALEOCERDO TIGRINUS*, M. and H. One large specimen, obtained towards the mouth of the river. Length 11 ft.

9. *PRISTIS ANTIQUORUM*, Latham. Small individuals are not unfrequently brought to the bazar. We have a snout or rostrum in the museum 5 ft. in length and 11 in. broad at the hindmost teeth.

10. *PR. PECTINATUS*, Latham. Much commoner than the other. A mutilated specimen and portion of the snout of a larger one were sent to the museum from Asám (!) some years ago by Col. Jenkins.

11. *RHINOBATUS GRANULATUS*, Cuv. Now and then brought; sometimes from 6 to 7 ft. in length.\*

\* Col. Jenkins heard much of a 'snow fish' of great rarity, the skin of which is prized as a medicine by the people of Asám. It is said by them to inhabit the snows of the Butan mountains! Sending me some fragments of the skin for examination, there was no difficulty in recognising the *RHINOBATUS GRANULATUS*: probably procured towards the sea; but as *PRISTIS PECTINATUS* and *HYPOLOPHUS SEPHEN* ascend many hundred miles up the great rivers, perhaps the *RHINOBATUS* does so likewise.

In *J. A. S. XIII*, 176, the then Lieut. J. T. Cunningham, in his 'General account of Kunáwar,' remarks that "the mysterious *Gangball*, or 'snow fish,'

12. RH. OBTUSUS, M. and H. Comparatively rare. I have not seen it more than  $2\frac{1}{2}$  ft. long.

13. DASYATIS MICROURA, (Bloch); *Raia pæcilura*, Shaw. Rare.

14. HYPOLOPHUS SEPHEN, (Forsk.): *Raia sancur*, B. H. (founded on mutilated individuals, the caudal spine of which had been extracted). Common.

15. AETOBATIS FLAGELLUM, (Bloch.). Of this fine species I lately obtained a small specimen, with tail and spines complete, and another and larger specimen with mutilated tail. Small dried fish of this species are sometimes brought in considerable quantity.

*N. B.*—The *Myliobatis macropterus* of McClelland (*Calc. Journ. Nat. Hist.* I, 60, and pl. II, f. 1.) has never occurred to me. Drs. Cantor and Bleeker refer it to AETOBATIS NARINARI.

The Trygons or ordinary ‘Sting-rays’ are here deferred to the last, because the species of them do not appear to have been properly discriminated. All that I have obtained have the tail wholly finless, or with merely such rudiment as in TR. IMBRICATUS.

The Indian species fall into two principal groups, which might well stand as distinct genera.

In the first the dorsal surface and tail are sprinkled over throughout with detached limpet-shaped tubercles, and there is usually no large globular central tubercle (or tubercles, as generally in the others and also in HYPOLOPHUS SEPHEN).\* Anterior margin of the disk exceedingly obtuse, the expanded pectorals being continued forward almost to a transverse line with the medial peak where they

with four short legs and a human face, may be in fact, as in description, a fabled animal; but it is talked of, and is said to dwell only about the limits of the snow.” What is here referred to are probably certain sand-burrowing Lizards of Afghánistán, which in the dried state are sold as medicine all over India. One is the true Egyptian Scinque, SCINCUS OFFICINALIS, Laurenti. Another sent by the same name by Major Lumsden, late in charge of the Kandahar Mission, is the SPHENOCEPHALUS TRIDACTYLUS, nobis, *J. A. S.* XX, 654. Both were obtained in the vicinity of Kandahar.

\* Since the above was written, I have seen an example of TR. MARGINATUS in the museum of the Calcutta Medical College, which has a central tubercle of moderate size followed by a small one. This, I suspect, is very unusual.

unite, on either side of which the outline describes merely a slight concavity.\*

16. *TRYGON MARGINATUS*, nobis, *n. s.* Grey above, buffy-white below with a dark border except in front; the tail  $1\frac{1}{2}$  the length of the disk. A large species, adults of which are mostly quartered when brought to the bazar, and then more or less sliced up by the dealers, so that it is difficult to examine them properly. Breadth of one 52 in., with tail 83 in.: distance of eyes apart 7 in.† Form a trifle longer than broad, or shorter than broad if the length be measured from front to base of tail. In adults the small limpet-shaped tubercles are disposed not only over the entire upper surface, but also on the broad dark margin of the lower-parts (from which the species derives its trivial name): they are larger and more closely set along the middle, though for the most part not in absolute contact, and are gradually smaller and less crowded laterally, but again become more crowded towards the margin; and there is commonly an irregular range of pointed tubercles larger than the rest on either side, about 3 in. from the median line in adults. Tail tuberculated all round to within  $2\frac{1}{2}$  in. of its base underneath, and having scattered and pointed tubercles much larger than the rest above, from its base to the large caudal spine. The colour of this fish is a light albescent-brown above, with still a faint blackish wash; white, with more or less of a buffy tinge, below, and a broad dark margin to the lower-parts except in front, but including the ventrals, this border consisting of numerous large round spots on its inner edge, some wholly and others partially detached from the rest; a few irregular spots are also generally scattered upon the pectorals. The under-surface of the tail is white, with similar scattered dark spots, which gradually become more numerous and coalescent till they assume a marbled appearance, and the apical half of the tail is wholly dark. This dark colour is more intense in the young, approaching more or less to black: whereas in

\* I presume this form to be characteristic of the division. In the Medical College specimen the peak is stretched out of all shape. However, in a very large example just added to the museum, the narrow medial peak projected more than in the young.

† A large specimen has just been presented to the Society, fresh, by Rája Rádáklánt Deb, 5 ft. across; tail imperfect.

adults it is weaker and more greyish, and in them it is also roughened with minute limpet-shaped tubercles; these appear again about the gill-openings, and more sparingly medially, and a few are scattered over the entire lower surface, which are more readily detected by the feel than by the sight in the fresh specimen. From between the eyes to the sides of the tail, and traceable along two-thirds of that organ, are a couple of series of vermiculated lines; and there is a double series of the same along the middle of the back. In a young female, measuring 18 in. to base of tail, with greatest breadth of disk  $20\frac{1}{2}$  in., and tail 29 in., the tubercles generally are less crowded than in the adult, especially on the tail, where there is little indication of their future development. Although the caudal spine had been broken away in every specimen examined, yet from the groove which it occupied, that of an adult is shewn to be  $7\frac{1}{4}$  in. long.\* It is by no means a rare species, though seldom to be obtained perfect in the fish-bazars.

*TR. ATROCISSIMUS*, nobis, *n. s.* We have in the museum a portion of the tail, above 4 ft. in length, of an enormous *TRYGON*, which is evidently a second species of this particular sub-group. The site of the caudal spine is conspicuous as usual, indicating a much stouter but not so long a weapon as that of *TR. MARGINATUS*. The limpet-shaped tubercles are very much larger and fewer in number than in the other, each being much expanded at base and abruptly rising to a sharp point in the centre; they are of different sizes intermixed, and here and there two or more of them are blended at base, and the tail appears to be naturally much compressed. Below the spine, it is naked underneath along the middle, and beyond the spine this medial portion of the tail underneath is studded with small tubercles. Where broken off, at a distance of 4 ft. from the spine, it seems to expand vertically, being there twice as deep as broad. It is a truly frightful and most

\* The Medical College specimen has a perfect caudal spine. It is larger than the young example above described, with tail about 40 in., and spine  $2\frac{3}{4}$  in.; some small sharp tubercles around the base of the latter. The dorsal tubercles are smaller than in the other; those on the base of the tail more crowded. Sex male, that of the other female. The marginal band of the lower surface is represented only by a few distantly scattered spots.

formidable weapon. Habitat of the species unknown, but probably the Indian Ocean.

The ordinary Trygons are of a more rhomboidal shape, with close-set flattened tubercles on the dorsal surface, occupying its medial third only or less (according to the species), and the lateral border of this tuberculated space is abruptly defined in adults. They have generally one or more large globular bony tubercles in the centre of the dorsal surface.

Some have two spines on a comparatively short tail, as—

17. *TR. IMBRICATUS*, (Bloch), to which I doubt if Russell's fig. IV correctly applies, and upon this is founded *Pastinaca dorsalis*, Swainson. Russell's figure more probably represents the *TR. IMMUNIS*, Raffles (*Zool. App.* to Life of Sir S. Raffles);\* and other double-spined species (also with comparatively short tail) exist in the *TR. LYMNA* figured by Rüppell, and *TR. AKOJU* and *TR. KUHLLI* figured by Müller and Henle. As Buchanan Hamilton approximates his *Raia fluviatilis* to *R. lymna*, though referring merely to "the spine on its tail," I think it likely that the present species is intended by him, especially as it is so very abundant. They are not unfrequently brought to the bazar with one spine only torn away by the fishermen; but this small species is commonly brought with both caudal spines complete. The males are larger than the females, and have proportionally longer tail; and very commonly the second caudal spine of the female more especially does not extend beyond the first one. I have not seen the male larger than  $7\frac{3}{4}$  in. to base of tail, the tail 13 in., and caudal spines  $2\frac{1}{2}$  in. Some have a small lanceolated tubercle on centre of dorsal surface, others two or more even to a series of five or six along the median line. This species is so very often brought in pairs to the bazar, a male and a female, that I cannot help suspecting that it lives in pairs, the two being commonly taken together.

Another type has an equally short tail, armed with one spine only, and no dorsal tubercles whatever. To this appertains—

18. *TR. WALGA*, M. and H.: probably *Tr. sindraki*, Cuv., and

\* "*Tr. corpore subquadrato, omnino lævi, caudâ longiore, spinis duabis serratis citra medium armatâ.*"

*Pastinaca brevicauda*, Swainson, founded on Russell's fig. V; but in this figure the tail is represented as being still shorter than in TR. WALGA. The larger of two specimens (a female) measures  $3\frac{1}{2}$  in. to base of tail, the tail 6 in.; the latter being broad at the base, and very rapidly attenuating from base of spine, which last is  $1\frac{1}{4}$  in. long. These specimens have much the appearance of being the young of some considerably larger species; but the shortness of the tail separates it from any of the following.\*

The remainder have exceedingly long tails, from three to four times the length of the head and body. All have at least one large bony tubercle in the centre of the dorsal surface. At least five species are brought more or less commonly to the Calcutta fish-bazars, which are easily distinguished at any age, though supposed by Dr. Cantor and others to be merely varieties, or characteristic of different ages, of TR. UARNAK, (Forsk.)

19. TR. BLEEKERI, nobis, *n. s.* A large species, plain dark brown above and below with a narrowish white median patch on belly. Peak, or anterior junction of pectorals, considerably more prolonged and pointed than in the others. Medial third of dorsal surface studded with intermixed larger and smaller round flat tubercles, continued along the upper surface of the tail as far as the caudal spines, then thickly covering the whole tail to its extremity in adults, or with a naked line below in specimens more than half-grown. Along the median line of the tail above, the tubercles are not larger than the rest. The usual large round tubercle on centre of back, and commonly three smaller, set in form of a triangle, before it and three similar behind it. In all that I have seen the caudal spine had been broken or entirely torn out by the fishermen. Length of one 25 in. to base of tail, the tail 72 in.; of another 15 and 56 in.

20. TR. ELLIOTTI, nobis, *n. s.* Pale greyish olive-brown above and white below: the united pectorals not more prolonged in front than in TR. UARNAK. Size of last; at least I have obtained one tail 6 ft. in length, but the fish was cut into small slices. A young individual  $8\frac{1}{2}$  in. long to base of tail,  $9\frac{1}{2}$  in. broad, with tail 29 in., has a central

\* Dr. Bleeker gives the breadth of five specimens (four of them females) as 140 to 190 mill.

dorsal tubercle and another behind it, surrounding which is a group of small tubercles that might be covered by a crown-piece, except anteriorly where a few are scattered along the dorsal line and between the eyes,—the rest, including the tail, being wholly naked. A slight marbled appearance on the tail beyond the spine, but no distinct alternating bands. Another, only 10 in. to base of tail, has the dorsal tubercles fully developed, and a band of them upon the tail not reaching so far as the caudal spine. In a specimen 13 in. long, the tail measures 47 in.; and the tubercles on the tail (now that it is dry and shrunk) appear to extend two-thirds round its base anterior to the spine; but in the tail of 6 ft. long before noticed, the upper half only is tuberculated anterior to the spine. The usual central dorsal tubercle, with commonly one smaller before and another behind it; and the small tubercles, which extend over the medial third of the dorsal surface (as also in *TR. BLEEKERI*), are more uniform in size than in the other species. In one specimen of a tail, which I assign to this particular species with some hesitation, there are two sharp erect prickles in the median line towards its base, and others beyond the spine. A commoner species than the last.

21. *TR. RUSSELLII*, Gray; young figured in Hardwicke's *Ill. Ind. Zool.*: *Tr. Gerrardii*, Gray, *Brit. Mus. Catal.*, still younger. A beautiful species, covered above with large round dark spots, a few of which are generally confluent: tail banded throughout. Anterior peak more acute than in *TR. ELLIOTTI*, less so than in *TR. BLEEKERI*. In large specimens (3 ft. across) the spots continue as strongly marked as in the young, and are then more or less pale-centred, forming distinct rings more or less perfect in some specimens. But these markings, however vivid in the recent fish, are apt to disappear in old stuffed specimens, the tail-bands being longest retained; and a smooth young fish, with the spots on the upper surface obliterated, but retaining the bands on the tail, suits the description of *Tr. Gerrardii*, Gray. At the age figured by Hardwicke, the tubercles on the back are sparse and heart-shaped, and a single line of them (prolonged more or less into backward-curving prickles) is continued along the median line of the tail as far as its spine. These are retained in a specimen 12 in. in length (to base of tail); but in another of the same size they had disappeared—or perhaps had never made their

appearance—and the tail is wholly naked. In another, 15 in. (to base of tail), the medial portion of the back is densely tuberculated, and a series of tubercles (about six in number across) is continued along the base of tail to its spine; in another, 19½ in. (to base of tail), with tail 6 ft. in length, the series of caudal tubercles is still scarcely wider proportionally, and the tuberculated portion of the back is comparatively much narrower than in the several preceding species, being little more than a fifth of the entire breadth—instead of fully a third as in *TR. BLEEKERI* of half the size. In the adults, 3 ft. across,—a fresh one before me is 2¾ ft., and 2½ ft. to base of tail, with tail 7½ ft.,—the tubercles of the dorsal surface remain as in the last described, and cover just the upper half of the base of the tail as far as the spine, the lower half being quite naked. In general, there are a few tubercles rather larger than the rest, forming an irregular mesial line from the anterior third of the dorsal surface to the caudal spine. Half-grown individuals have commonly two larger tubercles on centre of back, either both heart-shaped or the anterior globular, while larger specimens shew an intermediate tubercle; and up to a considerable size, the thong of the tail is more sparsely tuberculated than in the others. In this particular species, also, the curious teeth are distinctly of a larger size than in the others, when examples of the same size are compared together.

22. *TR. VARIEGATUS*, McClelland, *Calc. Journ. Nat. Hist.* I, 60, and pl. II, fig. 2. Shaped as in the last, and remarkable—even when half grown—for the caudal tubercles completely surrounding the tail to very near its base,—whereas in *TR. RUSSELLII* they never more than half surround it as far as the spine, even in the largest individuals. In an example of *VARIEGATUS*, measuring 16 in. to base of tail, with tail exceeding 3½ ft., the tubercles already nearly surround it anterior to its spine. Moreover, in examples of equal size, the teeth of *RUSSELLII* are conspicuously larger. The markings, too, are quite different; *TR. VARIEGATUS* having the dorsal surface uniformly and beautifully marked throughout with meandering lines, the dark and pale colour in equal proportions or even the dark predominating—not as represented in McClelland's figure. Length of one 3 ft. to base of tail, and 3 ft. 4 in. in greatest width: tail not quite perfect, but of the same proportionate length as in the others. The bands

on the tail are less conspicuous and distinct than in *TR. RUSSELLII*. In stuffed specimens the markings are apt to disappear totally; and it is as well, therefore, to preserve a portion of the fresh skin of this and other species in spirit.

23. *TR. UARNAK*, (Forsk.) Young figured in Rüppell's *Neue Wirbelthiere*. Much like *TR. RUSSELLII*, but not attaining (I suspect) to nearly so great a size; the dorsal surface speckled with numerous *small spots* (as in Rüppell's figure). The teeth also are considerably smaller than in *TR. RUSSELLII* in specimens of corresponding size. In an example less than a foot in length (*minus* the tail), or of a size at which *TR. RUSSELLII* has few and sparse tubercles on the back and a single row only of curved tubercles at base of tail (as shewn in Hardwicke's figure), *TR. UARNAK* has the dorsal tubercles fully developed, and a broader band of them at base of tail than is seen in *TR. RUSSELLII* of more than double the size,—whence I conclude that it is a much smaller species when full-grown, and that the tubercles probably surround the base of tail in adults, as in *TR. VARIEGATUS*. I have only once obtained it; and the specimen has a single large tubercle on centre of back, and three slightly larger than the rest placed in a triangle behind the principal tubercle.\*

Of these various long-tailed Trygons I have seen no intermediate specimens; and in the fresh state they may be recognised at a glance by the colouring, which unfortunately disappears more or less completely in dry museum specimens. The only species which I have obtained with the caudal spine are the small *TR. IMBRICATUS* and *TR. WALGA*, *HYPLOPHUS SEPHEN* (small), and *AËTOBATIS FLAGELLUM* (small); and I am not aware that any difference occurs in the structure of that formidable weapon in the different species here noticed.

While preparing this paper, I have (in the course of a few weeks) obtained fresh examples in the Calcutta fish-bazars of *TRYGON MAR-*

\* I have since obtained another, not very much smaller, in which the tail is quite naked. Two examples of *TR. RUSSELLII* were procured on the same occasion; and the peak is more obtuse in *TR. UARNAK* than in *TR. RUSSELLII*; as seen in fresh specimens,—the dry being very much subject to be stretched out of the proper shape. Dr. Bleeker gives the breadth of *TR. UARNAK* (fœm.) as 240 et 315 mill. *Virk. Bat. Gen.*, Vol. XXIV, (1852); but then he considers *TR. RUSSELLII* to be identical with it.

GINATUS, TR. IMBRICATUS, TR. WALGA, TR. BLEEKERI, TR. ELLIOTTI, TR. RUSSELLII, TR. UARNAK, and TR. VARIEGATUS; besides HYLOPHUS SEPHEN, AETOBATIS FLAGELLUM, RHINOBATUS GRANULATUS, SPHYRNIA BLOCHEI, PRISTIS ANTIQUORUM and PR. PECTINATUS, and SQUALUS MILBERTI (?), SQ. GANGETICUS, and SQ. TEMMINCKII;—in all seventeen species of cartilaginous fishes.

I add a brief notice of a young TRYGON which I cannot find to be described, obtained on the Arakan coast, and now in the Medical College Museum of Calcutta.

TR. CROZIERI, nobis, *n. s.* Tail twice as long as the disk, compressed, with a considerable membrane on more than half the length of its inferior surface, commencing below the insertion of the spine, being nowhere however so high or deep as the tail itself. United pectorals much prolonged into an acute peak anteriorly. Disk smooth, with a mesial dorsal line of tubercles, beginning a little behind the head, where a line of 11 (the last of them increasing in size) have made their appearance above the surface; the rest are narrower and below the surface of the skin to the base of tail, where a series of ten very stout prickles or decumbent spinelets—compressed and pointing backwards and forming a range like the teeth of a saw,—is continued nearly to the base of the caudal spine; the latter being much as in other Trygons, and having a backward-directed serrature on each side for its terminal third. The colouring appears to have been pale above, but no markings are discernible in the dry specimen. Length of disk 11 in. and breadth the same; tail 23 in. This TRYGON has the appearance of being the young of a very large species. Anterior to the range of 11 developed caudal spinelets, two others can be distinguished of equally large size within the skin, and anterior to these the series consists of much smaller and narrow spinelets, until again the size is abruptly greater a little anterior to the centre of the disk.

*April 2nd, 1859.*

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PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR JANUARY, 1860.

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The Annual General Meeting of the Society was held on the 4th January.

A. Grote Esq., President, in the Chair.

The following gentlemen, duly proposed at the last Meeting, were balloted for and elected Ordinary members.

Prince Mahomed Jallaludin of Mysore.

T. R. Grant, Esq.

H. V. Bayley, Esq., B. C. S. (re-elected).

W. J. Rivett Carnac, Esq. B. C. S.

Baboo Preonath Sett.

Dr. Theodore Duka.

Major J. J. M. Innes, Bengal Engineers.

B. E. E. Lindsay, Esq.

Reverend J. C. Thompson, (re-elected).

C. Oldham Esq. Geological Survey.

Capt. Alexander Fraser, Bengal Engineers.

David K. Mair, Esq. M. A.

The Council proposed for Ballot at the next meeting Mr. Robert Swinhoe, of H. M. Consulate, Amoy, and the Rev. H. Baker, Junior, Alipie, South Malabar, as corresponding members of the Society.

The following gentlemen were named for ballot as ordinary members at the next meeting.

Colonel E. W. S. Scott, Bengal Artillery, proposed by the Ven'ble Archdeacon Pratt, seconded by Colonel Baird Smith.

Major Geo. Pearse, proposed by Mr. Atkinson, seconded by Mr. E. A. Samuells.

Dr. F. J. Mouat, proposed (for re-election) by Mr. Atkinson, seconded by Dr. T. Thomson.

Capt. T. G. Montgomerie, Bengal Engineers, F. R. G. S., Gt. Trigl. Survey of India, proposed by Major H. L. Thuillier, seconded by Col. Waugh.

The Secretary read the following Report for 1859 :

#### ANNUAL REPORT.

The Council of the Asiatic Society have the satisfaction of submitting their usual Annual Report, exhibiting the state of the Society's affairs during the past year.

At the close of the year 1858, there were 132 ordinary members on the Rolls of the Society, of whom 39 were absent in Europe. The number of retirements since that time has been 4, which, with one death, gives a total loss of five; on the other hand, there have been no less than 53 elections of ordinary members, which have brought up the number on the effective list to 135, against

|          | Ordinary. | Paying. | Absent. | 95 of the preceding year. The      |
|----------|-----------|---------|---------|------------------------------------|
| 1851 ... | 130       | 124     | 6       | total number now on the rolls      |
| 1852 ... | 139       | 122     | 17      | is 180, of whom 44 are absent      |
| 1853 ... | 146       | 123     | 23      | from India, and one is a life mem- |
| 1854 ... | 155       | 129     | 26      | ber.                               |
| 1855 ... | 162       | 128     | 34      |                                    |
| 1856 ... | 167       | 131     | 36      |                                    |
| 1857 ... | 147       | 109     | 38      |                                    |
| 1858 ... | 133       | 95      | 38      | The Hon'ble Sir J. W. Colvile,     |
| 1859 ... | 180       | 135     | 45      | Kt., the late President of the     |

Society, has, on his departure for Europe, been added to the list of honorary members and Drs. Max Müller, P. Bleeker, and H. Frederick, have been elected corresponding members of the Society.

In alluding to the obituary of the past year, the Council desire especially to express their regret at the loss which the Society and the cause of science have sustained by the untimely death of one of their corresponding members, Herr Adolphe Schlagintweit, while on his travels in the neighbourhood of Kokan. From the time of his arrival in India in 1855, he devoted his entire energies to the prosecution of physical researches, and contributed several valuable papers to the journal of this Society. Sir George Staunton died in June last. He was one of the oldest Honorary members of the Society and a distinguished Oriental scholar. The only other member lost by death is Col. M. E. Loftie.

## FINANCE.

In April 1859, the Council submitted a report, recommending that, in modification of the provisions of Rules 8, 10, and 11, of the Society's Code, ordinary members should be divided into two classes, Resident and Non-resident; that all members who reside within 30 miles of Calcutta should be deemed resident and required to pay an admission fee of Rupees 32 and a quarterly subscription of Rs. 12, and that Non-residents should pay an admission fee of Rs. 32 and a quarterly contribution of Rs. 6. This report was adopted at a special general meeting held in July last.

In making this recommendation the Council entertained a hope that by rendering the Society more easily accessible to the literary and scientific public of India, they might draw to its ranks many whose co-operation would prove highly valuable. They are glad to find that they were not mistaken. The accessions made to the list of members during the last five months number no less than 36, and the total number for the year stands at 53, against 16 in 1858, and 6 in the preceding year.

The liabilities of the Society amount to Rupees 5,376-9 principally on account of printing Journals and Catalogues; and the Cash assets to Rupees 7,878-13, (including Co.'s paper for Rs. 5000) besides outstanding claims to the extent of Rs. 6,432-2-4 a great portion of which will probably be realised in the course of the current year.

Owing, however, to the heavy outlay this year for the repairs of the Society's premises, the expenditure has been unusually large.

By Statement No. 1, it will be seen that the disbursements amount to Rs. 15,072-12, while the total receipts amount to Rs. 12,921-9.

The Council would again urge on the members the imperative necessity of using every exertion to increase their numbers in order that the Society may meet the expenses of the coming year without being obliged to curtail its usefulness by any untoward retrenchments.

The probable expenses of the ensuing year may be estimated at Rs. 12,603, the estimate under the usual heads being :

## EXPENDITURE.

|                              |     |       |   |   |
|------------------------------|-----|-------|---|---|
| Museum, .....                | Rs. | 5,200 | 0 | 0 |
| Library Establishment, ..... |     | 936   | 0 | 0 |
| Purchase of Books, .....     |     | 1,700 | 0 | 0 |

|                              |        |   |   |
|------------------------------|--------|---|---|
| Book-binding, .....          | 425    | 0 | 0 |
| Contingencies, .....         | 200    | 0 | 0 |
| General Establishment, ..... | 1,700  | 0 | 0 |
| Journal, .....               | 1,500  | 0 | 0 |
| Miscellaneous, .....         | 500    | 0 | 0 |
| Deposit, ... ..              | 100    | 0 | 0 |
| Building, .....              | 1,040  | 0 | 0 |
|                              | <hr/>  |   |   |
| Total, Rs.                   | 13,303 | 0 | 0 |

Monthly Average,.....1,108 9 4

This amount would not be met by the present reduced rates of subscription, unless with an increased number of members, but the Council confidently trust that the late revival of interest in the Society will continue, and that with fresh accessions to its numbers all cause for anxiety regarding the Society's prospects may be removed.

#### INCOME.

|                                            |        |   |   |
|--------------------------------------------|--------|---|---|
| 75 Residents at Rs. 48 per annum, .....Rs. | 3,600  | 0 | 0 |
| 60 Non-residents at Rs. 24 per annum,..... | 1,440  | 0 | 0 |
| Admission Fees, .....                      | 544    | 0 | 0 |
| Government Grant, .....                    | 3,600  | 0 | 0 |
| Sale of Books, .....                       | 780    | 0 | 0 |
| Journal, .....                             | 925    | 0 | 0 |
| Interest, .....                            | 245    | 0 | 0 |
| Miscellaneous, .....                       | 50     | 0 | 0 |
|                                            | <hr/>  |   |   |
| Rs.                                        | 11,184 | 0 | 0 |

Making up the probable Income of the forthcoming year.

#### PROPOSED IMPERIAL MUSEUM.

The subject having remained for some time in abeyance on account of the disturbances in the N. W. Provinces, the Council, in October 1858, under Authority delegated to them by the Society in May 1857, submitted a proposition to the Government of India for the establishment of a public Museum, to which, under certain restrictions the whole of the Society's collections might be transferred, except the Library.

The Government of India having intimated their inability for the present to entertain the proposition, the correspondence on the subject has since been submitted to the Secretary of State for India, and copies have been printed and laid before the members of the Society.

#### LIBRARY.

The Library has received an accession of 345 volumes, among which are some important works on Natural History purchased at the sale of the late Dr. Walker's Library. The Society has regularly received the publications of the different learned and Scientific Institutions with which it is in correspondence, and the purchases include all important Oriental works together with most of the leading scientific and other periodicals of the day.

#### MUSEUM.

Number of visitors from January to December, 1859, exclusive of Sundays and other Christian holidays.

|            |            |        |
|------------|------------|--------|
| Natives.   | { Males,   | 59,123 |
|            | { Females, | 3,288  |
| Europeans. | { Males,   | 2,964  |
|            | { Females, | 1,260  |

Total 66,635

Several valuable additions have been made to the Museum during the past year, and it continues to be resorted to largely by the European and Native community. The average number of visitors, as per margin, appears to exceed 185 persons per day.

Dr. Falconer's important Catalogue of Fossil Remains of Vertebrata from the Sewalik Hills, the Nerbudda, Perim Island, &c., has been completed and copies have been distributed under the orders of the Council.

Mr. W. Theobald, Junior, has been engaged in arranging the shells in the Society's Cabinet and in compiling a Catalogue for publication; and Mr. H. F. Blanford has undertaken to arrange and catalogue the Fossil remains in the Society's collection which are not included in Dr. Falconer's work.

#### JOURNAL.

Four Nos. of the Journal have been published during the year and a fifth is in the Press.

The Council are gratified to notice that the contributions received have been of more than usual interest and importance, and they trust that with the restoration of peace the cause of Literature and

Science in India may keep pace with the advancing prosperity of the country.

#### ORIENTAL FUND.

The Society in October last adopted a recommendation of the Council to commence a new series of the *Bibliotheca Indica*, which was to open with a translation of the *Surya Siddhanta* by Pundit Bapu Deva Shastri, the Ven'ble Archdeacon Pratt having undertaken to aid in carrying it through the press. The Council is glad to be able to announce that the printing of this work has already commenced. Meanwhile the editors of the old series are busily employed in completing their several works. In August last the Society adopted the proposal of the Council that one of the large Arabic works left unfinished at the suspension of the *Bibliotheca Indica* in 1856, should be completed, viz., the Dictionary of technical terms. At the suggestion of Captain Lees an arrangement has been made by which the expenses of printing and editing will be materially reduced.

The number of Fasciculi issued during the year is 8, of these 6 have been carried through the press by Baboo Rajendralal Mittra, one by Mr. F. E. Hall, and one by Dr. Roer and Mr. Cowell, (Dr. Roer's official duties occupying too much of his time to permit of his continuing the work under his own sole editorship as heretofore.)

The titles of the Fasciculi published during the year are

1. Taittiriya Brahmana of the Black Yajur Veda, Fasc. IV. to IX., being Nos. 150 to 155, edited by Baboo Rajendralal Mittra.
2. Vasavadatta, Fasc. III., finishing the work, being No. 148, edited by F. E. Hall, M. A.
3. Sanhita of the Black Yajur Veda, Fasc. IX., being No. 149, edited by Dr. E. Roer and Mr. E. B. Cowell.

#### OFFICERS.

The Assistant Secretary Baboo Gour Doss Bysack is still absent on leave, and Baboo Bhobany Persaud Dutt has continued to act as his substitute.

The Council have every reason to be satisfied with the zeal and assiduity with which the Curator and the acting Assistant Secretary have discharged their duties.

The President observed that the report was one which would he hoped be considered satisfactory by the meeting. It remained to be seen how far the late reduction of subscription would succeed in its object, but so far as could be judged from the large accession of members during the year, he thought the experiment promised well. Although 36 elections only out of the 53 had occurred since the reduction was made, the others he thought were in a great measure due to the expectation that it would be made. He thought the Council were justified in pointing to the improved character of the numbers of the Journal which had been published during the year, several of the papers published in them having been very interesting. He hoped that in the course of the coming year the Council would be able, besides the Catalogues on which Mr. Blanford and Mr. Theobald were engaged, to bring out another of the Mammal specimens contained in the Society's Museum. Their Curator Mr. Blyth had already made some progress in this compilation and had undertaken soon to complete it.

The meeting then proceeded to ballot for the Council and Officers for the ensuing year.

A. Fisher, Esq. and D. M. Gardner, Esq. were appointed scrutineers, and at the close of the ballot the Chairman announced the following result.

A. Grote, Esq. *President.*

Major R. Strachey,

Dr. T. Thompson,

Baboo Ramapersaud Roy,

Colonel R. Baird Smith.

Baboo Rajendralal Mitra.

E. A. Samuells, Esq.

Baboo Ramgopal Ghose.

T. Oldham, Esq.

Capt. C. H. Dickens.

Capt. W. N. Lees.

Dr. W. Crozier.

R. Jones, Esq.

W. S. Atkinson, Esq.,

E. B. Cowell, Esq.,

} *Vice-Presidents.*

} *Joint Secretaries.*

ABSTRACT STATEMENT  
OF  
RECEIPTS AND DISBURSEMENTS  
OF THE  
ASIATIC SOCIETY,  
FOR  
THE YEAR, 1859.

STATEMENT  
Abstract of the Cash Accounts

| RECEIPTS.                                                                  |           | 1858.                    | 1859.     |
|----------------------------------------------------------------------------|-----------|--------------------------|-----------|
| CONTRIBUTIONS, ...                                                         | 6,923 8 0 |                          | 6,750 0 0 |
| Received from Members,                                                     |           |                          |           |
| ADMISSION FEES.                                                            |           |                          |           |
| Received from New Members, ...                                             | 96 0 0    |                          | 1,248 0 0 |
| JOURNAL.                                                                   |           |                          |           |
| Sale proceeds and Subscriptions to the Journal of the Asiatic Society, ... | 496 3 0   |                          | 339 0 0   |
| LIBRARY, ...                                                               | 784 12 3  |                          | 552 6 0   |
| Sale proceeds of Books.                                                    |           |                          |           |
| MUSEUM OF ZOOLOGY.                                                         |           |                          |           |
| Received from the General Treasury at 300 Rs. per month, ...               | 3,600 0 0 |                          | 3,600 0 0 |
| SECRETARY'S OFFICE, ...                                                    | 22 10 6   |                          |           |
| Discount on Postage Stamps, ...                                            |           | 0 12 6                   |           |
| Refund of Postage, ...                                                     |           | 9 9 0                    |           |
|                                                                            |           | 10 5 6                   |           |
| VESTED FUND.                                                               |           |                          |           |
| Interest on Company's Paper from the Bank of Bengal, ...                   | 286 1 3   |                          | 245 0 0   |
| GENERAL ESTABLISHMENT.                                                     |           |                          |           |
| Savings, ...                                                               | 36 10 5   |                          | 4 10 6    |
| DEPOSIT, ...                                                               | 74 4 0    |                          |           |
| W. Theobald, Esq. Junr. ...                                                |           | 32 0 0                   |           |
| E. B. Cowell, Esq. ...                                                     |           | 12 13 0                  |           |
| Baboo Nobinchunder Roy, ...                                                |           | 5 4 0                    |           |
| Rev. F. Mason, ...                                                         |           | 0 8 0                    |           |
| Moonshee Narain Doss, ...                                                  |           | 10 0 0                   |           |
| C. W. Wilmot, Esq. ...                                                     |           | 0 7 0                    |           |
| Col. J. Abbott, ...                                                        |           | 19 7 0                   |           |
| Major S. R. Tickell, ...                                                   |           | 18 0 0                   |           |
|                                                                            |           | 98 7 0                   |           |
| MESSES. WILLIAMS AND NORGATE, ...                                          | 90 8 0    |                          |           |
| Received through Rajah Radhacant Deva, duty on parcels, ...                |           | 1 12 0                   |           |
| Proceeds of Sundry Books sold on their account :                           |           |                          |           |
| Weber's Modern Investigation on Ancient India, ...                         |           | 1 0 0                    |           |
| A Copy of Bopp's Comparative Grammar, ...                                  |           | 25 0 0                   |           |
| A Copy of Muller's Buddhism, ...                                           |           | 1 0 0                    |           |
| Goldstucker's Sanskrit and English Dictionary, Vol. I. P. I. II. ...       |           | 5 0 0                    |           |
| Ditto Ditto, Vol. I. P. III. ...                                           |           | 2 8 0                    |           |
|                                                                            |           | 36 4 0                   |           |
|                                                                            |           | Carried over, 12,884 1 0 |           |

No. 1.

of the Asiatic Society, for 1859.

## DISBURSEMENTS.

|                                                                                       | 1858.      | 1859.                           |
|---------------------------------------------------------------------------------------|------------|---------------------------------|
| <b>JOURNAL,</b> ... ..                                                                | 352 11 10  |                                 |
| Freight, ... ..                                                                       | ...        | 98 2 3                          |
| Printing Charges, ... ..                                                              | ...        | 1,559 6 0                       |
| Commission on Sale of Books, ... ..                                                   | ...        | 6 15 6                          |
| Purchase of Postage Stamps, ... ..                                                    | ...        | 31 4 0                          |
| Engraving, ... ..                                                                     | ...        | 3 0 0                           |
| Copying Charges, ... ..                                                               | ...        | 4 0 0                           |
| Packing Charges, ... ..                                                               | ...        | 11 4 0                          |
| Purchasing a large Tin Box for Journal MSS. ... ..                                    | ...        | 2 4 9                           |
|                                                                                       |            | <hr/> 1,716 4 6                 |
| <b>LIBRARY,</b> ... ..                                                                | 1,595 3 10 |                                 |
| Salary of the Librarian 12 months at 70 per month, ... ..                             | ...        | 840 0 0                         |
| Establishment ditto, ... ..                                                           | ...        | 78 0 0                          |
| Purchase of Books, ... ..                                                             | ...        | 573 8 0                         |
| Book Binding, ... ..                                                                  | ...        | 357 12 0                        |
| Commission on Sale of Books, ... ..                                                   | ...        | 58 6 0                          |
| Printing Receipts, &c. ... ..                                                         | ...        | 10 8 0                          |
| Stone Pedestals for Admirals, ... ..                                                  | ...        | 3 1 6                           |
| A new Teak wood double folding-door glass Case, ... ..                                | ...        | 350 0 0                         |
| Landing Charges, ... ..                                                               | ...        | 1 12 9                          |
| Petty Charges, ... ..                                                                 | ...        | 3 1 0                           |
|                                                                                       |            | <hr/> 2,276 1 3                 |
| <b>MUSEUM,</b> ... ..                                                                 | 5,463 15 0 |                                 |
| Salary of the Curator E. Blyth, Esq. at 250 per month<br>12 months, ... ..            | ...        | 3,000 0 0                       |
| House-rent at 40 per month, 12 months, ... ..                                         | ...        | 480 0 0                         |
| Establishment, ... ..                                                                 | ...        | 612 5 2                         |
| Extra Taxidermists' Salary, ... ..                                                    | ...        | 772 13 0                        |
| Contingent Charges, ... ..                                                            | ...        | 326 13 11                       |
| 2 Teak wood Glass Shell-cases and a case for pre-<br>serving Skeletons, ... ..        | ...        | 381 4 0                         |
| Freight and Godown rent on a case of Ethnological<br>Copper Casts, ... ..             | ...        | 11 15 3                         |
| Bullock Train hire, ... ..                                                            | ...        | 6 11 0                          |
| Making a mould from a piece of Iron Stone and taking<br>two casts of the same, ... .. | ...        | 13 0 0                          |
|                                                                                       |            | <hr/> 5,604 14 4                |
| <b>SECRETARY'S OFFICE,</b> ... ..                                                     | 1,661 0 9  |                                 |
| General Establishment, ... ..                                                         | ...        | 822 0 0                         |
| Secretary's Office Establishment, ... ..                                              | ...        | 672 0 0                         |
| Petty Charges, ... ..                                                                 | ...        | 14 3 9                          |
| Stationery, ... ..                                                                    | ...        | 62 13 6                         |
| Purchase of Postage Stamps, ... ..                                                    | ...        | 40 13 0                         |
| Postage, ... ..                                                                       | ...        | 6 11 6                          |
| Three Blank Books for Writing, ... ..                                                 | ...        | 10 12 0                         |
| A Sheet Almanac for 1859, ... ..                                                      | ...        | 1 0 0                           |
| Printing 300 Copies of Society's Rules, &c. ... ..                                    | ...        | 85 8 0                          |
|                                                                                       |            | <hr/> 1,715 13 9                |
|                                                                                       |            | <hr/> Carried over, 11,313 1 10 |

|                                                                                                                        |     |       |     |                      |       |           |
|------------------------------------------------------------------------------------------------------------------------|-----|-------|-----|----------------------|-------|-----------|
|                                                                                                                        |     |       |     | Brought over, 12,884 | 1     | 0         |
| PROFIT AND LOSS.                                                                                                       |     | 122   | 0   | 0                    |       |           |
| Received from Muddoosoodun Dey, Sale proceeds of a Copy of the Mahabharata, in part of amount written off in 1856, ... | ... | ...   | ... |                      | 10    | 0 0       |
| BUILDING.                                                                                                              |     |       |     |                      |       |           |
| Sale proceeds of 9 Old Beams, ...                                                                                      | ... | ...   | ... |                      | 27    | 8 0       |
| BALANCE OF 1858.                                                                                                       |     |       |     |                      |       |           |
| Bank of Bengal, ...                                                                                                    | ... | 3,442 | 3   | 5                    |       |           |
| In hand, ...                                                                                                           | ... | 9     | 8   | 10                   |       |           |
|                                                                                                                        |     |       |     | <hr/>                | 3,451 | 12 3      |
| Inefficient Balance, ...                                                                                               | ... | ...   | ... |                      | 1,578 | 3 9       |
|                                                                                                                        |     |       |     | <hr/>                | <hr/> | 5,030 0 0 |

Co.'s Rupees. ... 

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 17,951 9 0

*The Asiatic Society's Rooms,*  
31st Dec. 1859.

Examined.  
BHOBANYPROSAD DUTT,  
*Offg. Asst. Secy.*

|                                                                                                                       |     |     |       |     |                      |     |                         |
|-----------------------------------------------------------------------------------------------------------------------|-----|-----|-------|-----|----------------------|-----|-------------------------|
|                                                                                                                       |     |     |       |     | Brought over, 11,313 | 1   | 10                      |
| BUILDING,                                                                                                             | ... | ... | 356   | 4   | 0                    |     |                         |
| Assessment, ...                                                                                                       | ... | ... | ...   | ... | 270                  | 0   | 0                       |
| Ditto for Lighting, ...                                                                                               | ... | ... | ...   | ... | 72                   | 0   | 0                       |
| Thoroughly repairing the Society's Premises as per Estimate, after deduction on account of sundry works not done, ... | ... | ... | ...   | ... | 2,206                | 3   | 0                       |
| Sundry Contingent Charges on account of the repairs for removing Cases and other Articles, ...                        | ... | ... | ...   | ... | 180                  | 10  | 0                       |
|                                                                                                                       |     |     |       |     |                      |     | 2,728 13 0              |
| DEPOSIT ACCOUNT, ...                                                                                                  | ... | ... | 167   | 15  | 0                    |     |                         |
| E. B. Cowell, Esq. ...                                                                                                | ... | ... | ...   | ... | 9                    | 12  | 0                       |
| Major J. G. Stephen, ...                                                                                              | ... | ... | ...   | ... | 32                   | 0   | 0                       |
| W. Theobald, Esq., Junr. ...                                                                                          | ... | ... | ...   | ... | 24                   | 0   | 0                       |
|                                                                                                                       |     |     |       |     |                      |     | 65 12 0                 |
| VESTED FUND, ...                                                                                                      | ... | ... | 502   | 15  | 9                    |     |                         |
| Paid Commission for the Collection of Interest on Company's Paper, ...                                                | ... | ... | ...   | ... | ...                  | ... | 0 9 10                  |
| MESSRS. WILLIAMS AND NORGATE, ...                                                                                     | ... | ... | 702   | 1   | 11                   |     |                         |
| Purchase of Books on their account:                                                                                   |     |     |       |     |                      |     |                         |
| A Copy of Earase Buzurgan, ...                                                                                        | ... | ... | ...   | ... | 1                    | 0   | 0                       |
| A Copy of Bahar Ajum, Vol. I. and II. ...                                                                             | ... | ... | ...   | ... | 50                   | 0   | 0                       |
| Freight for ditto, ...                                                                                                | ... | ... | ...   | ... | 6                    | 14  | 0                       |
|                                                                                                                       |     |     |       |     |                      |     | 57 14 0                 |
| CONTRIBUTIONS.                                                                                                        |     |     |       |     |                      |     |                         |
| Refund of Contributions to Major A. Fytche, ...                                                                       | ... | ... | ...   | ... | 64                   | 0   | 0                       |
| Ditto of ditto to Captain G. H. Saxton, ...                                                                           | ... | ... | ...   | ... | 64                   | 0   | 0                       |
|                                                                                                                       |     |     |       |     |                      |     | 128 0 0                 |
| MISCELLANEOUS, ...                                                                                                    | ... | ... | 279   | 8   | 6                    |     |                         |
| Repairing the Monument to the Memory of Sir William Jones, ...                                                        | ... | ... | ...   | ... | 30                   | 0   | 0                       |
| Advertising Meetings, ...                                                                                             | ... | ... | ...   | ... | 23                   | 4   | 0                       |
| Meeting Charges, ...                                                                                                  | ... | ... | ...   | ... | 113                  | 4   | 3                       |
| Subscription to the Oriental Translation Fund from 1855 to 1859, ...                                                  | ... | ... | ...   | ... | 533                  | 5   | 4                       |
| Repairing 4 Argand Circular Hanging Lamps, ...                                                                        | ... | ... | ...   | ... | 10                   | 0   | 0                       |
| Printing 25 Copies of Annual Accounts for 1857, ...                                                                   | ... | ... | ...   | ... | 24                   | 0   | 0                       |
| New Mat for small room, ...                                                                                           | ... | ... | ...   | ... | 7                    | 5   | 9                       |
| Oiling, Cleaning and regulating a Clock, ...                                                                          | ... | ... | ...   | ... | 6                    | 0   | 0                       |
| Petty Charges, ...                                                                                                    | ... | ... | ...   | ... | 31                   | 6   | 0                       |
|                                                                                                                       |     |     |       |     |                      |     | 778 9 4                 |
| Balance, ...                                                                                                          | ... | ... | ...   | ... | ...                  | ... | 15,072 12 0             |
| Bank of Bengal, ...                                                                                                   | ... | ... | 2,796 | 14  | 3                    |     |                         |
| In hand, ...                                                                                                          | ... | ... | 9     | 14  | 9                    |     |                         |
|                                                                                                                       |     |     |       |     | 2,806                | 13  | 0                       |
| Inefficient Balance, ...                                                                                              | ... | ... | ...   | ... | 72                   | 0   | 0                       |
|                                                                                                                       |     |     |       |     |                      |     | 2,878 13 0              |
|                                                                                                                       |     |     |       |     |                      |     | Co.'s Rs.... 17,951 9 0 |

E. E.  
EDW. B. COWELL,  
*Secy. As. Socy.*

STATEMENT  
*Abstract of the Oriental*

|                                           | 1858. |       |    | 1859. |              |                  |
|-------------------------------------------|-------|-------|----|-------|--------------|------------------|
| <b>SALE OF ORIENTAL PUBLICATIONS, Rs.</b> |       |       |    |       |              |                  |
|                                           | 1,015 | 6     | 9  |       |              |                  |
| Received by Sale of Bib. Indica, ...      | ...   | 1,150 | 15 | 6     |              |                  |
| Ditto by Subscription to ditto, ...       | ...   | 108   | 10 | 0     |              |                  |
| Ditto by Sale of White Yajur Veda, ...    | ...   | 57    | 8  | 0     |              |                  |
|                                           |       |       |    |       | 1,317        | 1 6              |
| <b>GOVERNMENT ALLOWANCE.</b>              |       |       |    |       |              |                  |
| Received from the General Treasury, at    |       |       |    |       |              |                  |
| 500 per month, ...                        | ...   | 6,000 | 0  | 0     | ...          | 6,000 0 0        |
| <b>VESTED FUND.</b>                       |       |       |    |       |              |                  |
| Interest on Company's Paper from          |       |       |    |       |              |                  |
| the Bank of Bengal, ...                   | ...   | 140   | 0  | 0     | ...          | 140 0 0          |
| <b>DEPOSIT.</b>                           |       |       |    |       |              |                  |
| Received from Mahomed Hajee, ...          | ...   | 43    | 11 | 0     | ...          | 89 4 0           |
| <b>CUSTODY OF ORIENTAL WORKS.</b>         |       |       |    |       |              |                  |
| Savings of Establishment, ...             | ...   | 3     | 0  | 0     | ...          | 6 10 3           |
| <b>BIBL. INDICA.</b>                      |       |       |    |       |              |                  |
| Received discount on Postage Stamps, ...  | ...   |       |    |       | ...          | 0 2 6            |
|                                           |       |       |    |       |              | <u>7,553 2 3</u> |
| <b>BALANCE OF 1858.</b>                   |       |       |    |       |              |                  |
| Bank of Bengal, ...                       | ...   | 5,052 | 1  | 7     |              |                  |
| In hand, ...                              | ...   | 5     | 0  | 5     |              |                  |
|                                           |       |       |    |       | 5,057        | 2 0              |
| Inefficient Balance, ...                  | ...   | 2,116 | 12 | 2     |              |                  |
|                                           |       |       |    |       | <u>7,173</u> | 14 2             |

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 Co.'s Rs. 14,727 0 5
 

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*The Asiatic Society's Rooms,*  
31st Dec. 1859.

Examined.  
BHOBANYPROSAD DUTT,  
*Offy. Asst. Secy.*

No. 2.

Fund for the year 1859.

|                                                                                       | 1858.              | 1859.                |
|---------------------------------------------------------------------------------------|--------------------|----------------------|
| SALE OF ORIENTAL PUBLICATIONS.                                                        |                    |                      |
| Commission on Sale of Books, Rs.                                                      | 42 8 0             | ... 134 2 0          |
| VESTED FUND.                                                                          |                    |                      |
| Commission paid to the Bank of Bengal for collecting Interest on Company's Paper,...  | 35 0 9             | 0 5 8                |
| Fee for renewing a piece of Company's Paper,...                                       | ... 1 0 0          |                      |
|                                                                                       |                    | <u>1 5 8</u>         |
| DEPOSIT.                                                                              |                    |                      |
| Paid Mahomed Hajee,...                                                                | ... ..             | 12 5 0               |
| CUSTODY OF ORIENTAL WORKS, ...                                                        |                    |                      |
| Salary of Librarian at Rs. 30 per month,                                              | 911 4 9            | 360 0 0              |
| Establishment at Rs. 14 per month, ...                                                | ...                | 168 0 0              |
| Book binding, ...                                                                     | ...                | 192 8 0              |
| Books cleaning, ...                                                                   | ...                | 34 4 3               |
| A Blank Book for writing, ...                                                         | ...                | 3 12 0               |
| Printing 1000 Copies of a Nagree and Bengali list of works for sale, ...              | ...                | 20 0 0               |
| Petty Charges, ...                                                                    | ...                | 1 4 0                |
|                                                                                       |                    | <u>779 12 3</u>      |
| BIBL. INDICA, ...                                                                     |                    |                      |
| Freight, ...                                                                          | 30 11 4            | 42 15 9              |
| Packing charges, ...                                                                  | ...                | 5 10 0               |
| Bullock train hire on two parcels of Bibl. Indica, received from Mr. R. Griffith, ... | ...                | 4 7 0                |
| Printing 250 Copies of a Persian list of works for sale, ...                          | ...                | 1 8 0                |
| Purchase of Postage Stamps, ...                                                       | ...                | 5 0 0                |
|                                                                                       |                    | <u>59 8 9</u>        |
| COPYING PURAN.                                                                        |                    |                      |
| Copying Charges, ...                                                                  | ...                | 31 8 0               |
| VEDANTA SUTRAS.                                                                       |                    |                      |
| Editing Charges, ...                                                                  | 36 8 0             | 186 10 8             |
| TAITTIIRIYA SANHITA.                                                                  |                    |                      |
| Editing Charges, ...                                                                  | ...                | 1,150 8 0            |
| TAITTIIRIYA BRAHMANA.                                                                 |                    |                      |
| Printing Charges, ...                                                                 | 1,141 14 0         | 224 0 0              |
|                                                                                       |                    | <u>2,579 12 4</u>    |
| BALANCE.                                                                              |                    |                      |
| Bank of Bengal, ...                                                                   | 11,166 11 11       |                      |
| In hand, ...                                                                          | 25 15 8            |                      |
|                                                                                       | <u>11,192 11 7</u> |                      |
| Inefficient Balance, ...                                                              | 954 8 6            |                      |
|                                                                                       |                    | <u>12,147 4 1</u>    |
|                                                                                       |                    | Co.'s Rs. 14,727 0 5 |

E. E.  
EDW. B. COWELL,  
Secy. As. Society.

## STATEMENT No. 3.

*Liabilities.*

|                                         | <i>Assets.</i> |            | <i>Liabilities.</i> |           |
|-----------------------------------------|----------------|------------|---------------------|-----------|
|                                         | 1858.          | 1859.      | 1858.               | 1859.     |
| <b>CASH.</b>                            |                |            |                     |           |
| Bank of Bengal, .....                   | Rs. 3,442 3 5  | 2,796 14 3 | 276 8 0             | 276 8 4   |
| Cash in hand, .....                     | 9 8 10         | 9 14 9     | 418 7 4             | 418 7 0   |
| Inefficient Balance, .....              | 1,578 3 9      | 73 0 0     | 58 0 0              | 90 11 0   |
| Company's Paper, .....                  | 5,000 0 0      | 5,000 0 0  | 0 0 0               | 1,383 2 8 |
|                                         | 0,030 0 0      | 7,878 13 0 | 0 0 0               | 1,600 0 0 |
|                                         |                |            | 0 0 0               | 600 0 0   |
| <b>OUTSTANDINGS.</b>                    |                |            |                     |           |
| Contributions, .....                    | 5,409 5 3      | 4,607 5 4  | 0 0 0               | 665 8 0   |
| Admission Fees, .....                   | 64 0 0         | 192 0 0    | 0 0 0               | 300 0 0   |
| Library Sale of Books, .....            | 178 8 0        | 212 0 0    | 0 0 0               | 42 4 0    |
| Journal Subscription to end of 1857, .. | 630 5 0        | 415 5 0    | 0 0 0               |           |
| Ditto, for 1858-59, .....               | 0 0 0          | 1,000 0 0  |                     |           |
| Ditto, Sale of, .....                   | 7 8 0          | 5 8 0      |                     |           |
|                                         | 6,289 10 3     | 6,432 2 4  |                     | 5,376 9 0 |

E. E.  
EDW. B. COWELL,  
*Secretary, Asiatic Society.*

Examined.  
BHOBANYPROSAD DUTT,  
*Offg. Asst. Secy.*

*The Asiatic Society's Rooms,  
—The 31st December, 1859.*

LIST OF ORDINARY MEMBERS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
ON THE 31ST DECEMBER, 1859.

The \* distinguishes non-subscribing and the † non-resident Members.

- 
- †Abbott, Lieut.-Col. J. Bengal Artillery, Lucknow.  
 †Alabaster, C. Esquire, China.  
 †Alexander, Lieut. W. G. 93rd Highlanders, Rohileund Horse,  
 Pillabheet.  
 \*Allen, C. Esquire, B. C. S., Europe.  
 \*Anderson, Lieut.-Col. W. Bengal Artillery, Europe.  
 Archer, C., Esq. M. D., B. M. S. ; Calcutta.  
 Atkinson, W. S. Esquire, M. A. ; Calcutta.  
 Avdall, J. Esquire, Calcutta.  
 \*Baker, Lieut.-Col. W. E., F. G. S. ; Bengal Engineers, Europe.  
 †Batten, J. H. Esquire, B. C. S., Mynpoorie.  
 †Bayley, E. C. Esquire, B. C. S., Allahabad.  
 †Beadon, C. Esquire, B. C. S., N. W. Provinces.  
 Beaufort, F. L. Esquire, B. C. S., Calcutta.  
 \*Beckwith, J. Esquire, Europe.  
 \*Benson, Lieut.-Col. R., Europe.  
 †Birch, Major Genl. R. J. H., C. B., N. W. Provinces.  
 \*Bivar, Capt. H. S. 18th Regt. B. N. I., Europe.  
 \*Blagrove, Capt. T. C. 26th Regt. B. N. I., Europe.  
 Blane, Major S. J., H. M. 52nd Regt., Calcutta.  
 Blanford, H. F. Esquire, Geological Survey.  
 †Blanford, W. T. Esquire, Geological Survey.  
 †Blundell, E. A. Esquire, Singapore.  
 \*Bogle, Lieut.-Col. Sir A. Kt., Europe.  
 Boloi Chund Singh Bábu, Calcutta.

- †Bowring, L. B. Esquire, B. C. S. ; N. W. Provinces.  
 Boycott, T. Esq., Bombay M. S., Calcutta.  
 \*Brodie, Capt. T. 5th Regt. B. N. I., Europe.  
 Busheerooddeen Sultan Mahamed, Saheb, Calcutta.  
 †Calcutta, Right Rev. Lord Bishop of, N. W. Provinces.  
 †Campbell, A. Esq., M. D. Darjiling.  
 †Chapman, C. E. Esquire, B. C. S., Bijnour.  
 Chapman, R. B. Esquire, B. C. S., Calcutta.  
 \*Colvin, J. H. B. Esquire, B. C. S., Europe.  
 Cowell, E. B. Esquire, M. A., Calcutta.  
 Crozier, William, Esq. B. M. S., Calcutta.  
 †Dalton, Capt. E. S. 9th Regt. B. N. I., Chota Nagpore.  
 De Bourbel, Capt. R., Bengal Engineers, Calcutta.  
 Dickens, Capt. C. H., Bengal Artillery, Calcutta.  
 Douglas, Major C., Bengal Artillery, Calcutta.  
 Drummond, Hon'ble E., B. C. S., Calcutta.  
 Eatwell, W. C. B., Esq. M. D. ; F. L. S., Calcutta.  
 \*Edgeworth, M. P. Esquire, B. C. S., Europe.  
 †Edmonstone, Hon'ble G. F., B. Lieut.-Govr. N. W. P., Allahabad.  
 \*Elliott, Hon'ble Walter, M. C. S., Europe.  
 †Elliott, C. A. Esquire, B. C. S., Lucknow.  
 \*Ellis, Major R. R. 23rd Regt. B. N. I., Europe.  
 \*Elphinstone, Lieut. N. W. 4th Regt. B. N. I., Europe.  
 \*Erskine, Major W. C., 73rd Regt. B. N. I., Europe.  
 Fayrer, J., Esq. M. D. ; F. R. C. S., B. M. S., Calcutta.  
 Fisher, A. Esquire, Calcutta.  
 †Fitzpatrick, D. Esquire, B. C. S., N. W. Provinces.  
 †Forlong, Capt. J. G. R., Maulmein.  
 †Freeling, G. H. Esquire, B. C. S., Bolundshuhur.  
 Futteh Ally, Moulvie, Calcutta.  
 †Fytche, Major A., 70th Regt. B. N. I., Bassein.  
 Gardner, D. M. Esquire, B. C. S., Calcutta.  
 †Gastrell, Capt. J. E. 13th Regt. N. I. Serampoor.  
 †Geoghegan, J. Esquire, B. C. S., N. W. Provinces.  
 \*Gladstone, W. Esquire, Europe.  
 Goodenough, F. A. Esquire, Calcutta.  
 Goodeve, E. Esq., M. D. ; B. M. S., Calcutta.

- Govinchundér Sen, Bábu, Calcutta.  
 Grant, Hon'ble J. P., Lieut.-Govr. of Bengal, Calcutta.  
 \*Grapel, W. Esquire, M. A., Europe.  
 Grote, A. Esquire, F. L. S., B. C. S., Calcutta.  
 \*Hall, F. E. Esquire, M. A., America.  
 Halsey, W. S. Esquire, B. C. S., Calcutta.  
 †Hamilton, R. Esquire, China.  
 \*Hamilton, Sir R. N. E. Bart., B. C. S., Europe.  
 Hannington, Lieut.-Col. J. C., 63rd Regt. B. N. I., Calcutta.  
 Hardie, G. K., Esq. M. D., Staff Surgeon, Calcutta.  
 †Haughton, Capt. J. C., 54th Regt. B. N. I., Port Blair.  
 Hearsay, Major Genl. Sir J. B., K. C. B., F. L. S., Barrackpore.  
 †Henessey, J. B. N. Esquire, Mussooree.  
 †Herschel, W. J. Esquire., B. C. S., Shahabad.  
 \*Hichens, Capt. W. Bengal Engineers, Europe.  
 †Hopkinson, Capt. H., 70th Regt. B. N. I., Moulmein.  
 †Ishureepershad Singh Rajah, Bahadoor, Benares.  
 \*Jackson, L. S. Esquire, Europe.  
 \*Jackson, W. B. Esquire, B. C. S., Europe.  
 Jadava Krishna Singh Bábu, Calcutta.  
 \*James, Capt. H. C. 32nd Regt. B. N. I., Egypt.  
 †Jerdon, T. C. Esquire, M. M. S., Darjiling.  
 \*Johnstone, J. Esquire, Europe.  
 Jones, R. Esquire, Calcutta.  
 Joygopaul Bysack, Bábu, Calcutta.  
 †Kabeeroodeen Ahmed Shah, Bahadoor, Sassaram.  
 Kaliprusunno Singh, Bábu, Calcutta.  
 Kassinath Roy Chowdry, Babu, Cossipore.  
 Kay, Rev. W., D. D., Bishop's College.  
 \*Laidlay, J. W. Esquire, Europe.  
 †Layard, Capt. F. P. 19th Regt. B. N. I., Berhampore.  
 Lees, Capt. W. N., L. L. D. 42nd Regt. B. N. I., Calcutta.  
 Leonard, H. Esquire, C. E., Calcutta.  
 \*Liebig, G. Von, M. D., B. M. S., Europe.  
 Loch, G. Esquire, B. C. S., Calcutta.  
 \*Low, Major Genl. J., Europe.  
 Lushington, F. A. Esquire, B. C. S., Rampore Beaulca.

- †Maclagan, Capt. R., Bengal Engineers, Roorkee.  
 \*Macleod, D. F. Esquire, B. C. S., Europe.  
 Macrae, A. C., Esq. M. D., B. M. S., Calcutta.  
 Manackjee Rustomjee, Esquire, Calcutta.  
 \*Marshman, J. C. Esquire, Europe.  
 Mazzuchelli, Rev. F. F., D. D., Calcutta.  
 Medlicott, J. G. Esquire, Geological Survey.  
 \*Middleton, J. Esquire, Europe.  
 \*Mills, A. J. M. Esquire, B. C. S., Europe.  
 \*Money, D. J. Esquire, B. C. S., Europe.  
 Money, J. W. B. Esquire, Calcutta.  
 †Morris, G. G. Esquire, B. C. S., Moorshedabad.  
 \*Muir, J. Esquire, Europe.  
 †Muir, W. Esquire, B. C. S., Allahabad.  
 †Murray, Lieut. W. G. 68th B. N. I., Rawul Pindee.  
 †Narendra Narian Bhupa, Maha Rajah, Kooch Behar.  
 †Nicholls, Capt. W. T. 24th Regt. M. N. I., Burmah.  
 Nundolala Bose, Bábu, Calcutta.  
 Obbard, J. Esquire, Calcutta.  
 Oldham, T. Esquire, F. R. S., F. G. S., Calcutta.  
 O'Shaughnessy, Sir W. B., M. D., F. R. S., Calcutta.  
 \*Ouseley, Major W. R., Europe.  
 †Phayre, Lieut.-Col. A. P., Rangoon.  
 †Prasunnonath Roy, Rajah Bahadoor, Degaputti Rajshye.  
 Pratabchundra Siñha, Rajah, Calcutta.  
 Pratt, the Ven'ble Archdeacon, J. H., M. A., Calcutta.  
 \*Prinsep, C. R. Esquire, Europe.  
 Prosonocoomar Tagore, Bábu, Calcutta.  
 Rádhanáth Sikdar, Bábu, Calcutta.  
 Rajendrá Dutt, Bábu, Calcutta.  
 Rajendralál Mitra, Bábu, Calcutta.  
 Ramánáth Tagore, Bábu, Calcutta.  
 Ramáprasad Roy, Bábu, Calcutta.  
 †Rámchandra Siñha, Rájá, Moorshedabad.  
 Rámgopál Ghose, Bábu, Calcutta.  
 Riddell, H. P. Esquire, B. C. S., Calcutta.  
 †Roberts, A. Esquire, B. C. S., Lahore.

Röer, E., Esq. Ph. D., Calcutta.

\*Rogers, Capt. T. E., Europe.

†Russell, R. H. Esquire, B. C. S., Bancoorah.

†Russell, A. E. Esquire, B. C. S., Balasore.

Samuells, E. A. Esquire., B. C. S., Calcutta.

Sanders, J. Esquire, Calcutta.

†Saxton, Capt. G. H. 38th M. N. I., Cuttack.

Schiller, F. Esquire, Calcutta.

†Scott, W. H. Esquire, Dehra Dhoon.

Sherwill, Major, W. S. 66th Regt. B. N. I.; F. G. S.; F. R. G. S.,  
Dum Dum.

†Sherwill, Capt. J., Darjiling.

\*Smith, Col. J. T., Europe.

Smith, Colonel R. Baird, C. B., F. G. S., Bengal Engineers, Calcutta.

Smith, H. Scott, Esquire, B. A., Calcutta.

†Spankie, R. Esquire, B. C. S., Saharunpore.

\*Sprenger, Dr. A., Europe.

Stainforth, H. Esquire, B. C. S., Calcutta.

\*Stephen, Major, J. G. 8th N. I., Europe.

Strachey, Lieut.-Col. R., F. R. S.; F. G. S.; F. L. S.; F. R. G. S.;  
Bengal Engineers, Calcutta.

†Strachey, J. E. Esquire, B. C. S., Moradabad.

†Stubbs, Capt. F. W. Bengal Artillery, Rawul Pindee.

†Sutherland, H. C. Esquire, B. C. S., Tipperah.

†Suttischunder Roy, Maharaja, Krishnagur.

Suttyasharana Ghosal, Rajah, Calcutta.

†Theobold, W. Esquire, Geological Survey.

\*Thomas, E. Esquire, B. C. S., Europe.

Thomson, T., Esq. M. D.; F. R. S.; F. L. S.; F. R. G. S.; F. H. S.,  
Botanical Gardens.

†Thornhill, C. B. Esquire, B. C. S., Allahabad.

Thuillier, Major, H. L.; F. R. G. S.; Bengal Artillery, Calcutta.

†Tickell, Major, S. R., 31st B. N. I., Moulmein.

Trevor, C. B. Esquire, B. C. S., Calcutta.

Tytler, Major, R. C., 38th Regt. B. N. I., Barrackpore.

†Ward, J. J. Esquire, B. C. S., Cuttack.

Warrand, R. H. M. Esquire, B. C. S., Calcutta.

\*Watson, J. Esquire, B. C. S., Europe.

†Waugh, Col. A. S., F. R. S.; F. R. G. S; Bengal Engineers, Dehra Dhoon.

Wells, Sir Mordaunt, Kt., Calcutta.

Williams, F. Fisk, Esquire, Calcutta.

†Wilmot, C. W. Esquire, Pakour, Sontal Pergunnahs.

†Willsons, W. L. Esquire, Beerbhoom.

Woodrow, H. Esquire, M. A., Calcutta.

†Wortley, Major, A. H. P. Stuart, Indore.

Young, Lieut.-Col. C. B., Bengal Engineers, Calcutta.

†Yule, Lieut.-Col. H., Bengal Engineers, N. W. Provinces.

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ELECTIONS IN 1859.

*Ordinary Members.*

C. Alabaster, Esq., China.

Maha Rajah Suttis Chunder Roy Buhadoor, Krishnagur.

Major A. H. P. Stuart Wortley, Indore.

H. Stainforth, Esq., B. C. S., Calcutta.

Bábu Kassy Nauth Roy Chowdry, Cossipore.

H. Scott Smith, Esq., B. A., Calcutta.

W. Theobald, Esq., Jr., Geological Survey.

Lieut. W. G. Alexander, 93rd Highlanders, Pillibheet.

Capt. F. W. Stubbs, Bengal Artillery, Rawulpindee.

Sir Mordaunt Wells, Kt., Calcutta.

Colonel R. Baird Smith, C. B., Calcutta.

Bábu Nundolala Bose, Calcutta.

The Right Rev. Lord Bishop of Calcutta, Calcutta.

E. C. Bayley, Esq. B. C. S., Allahabad.

Honorable G. F. Edmonstone, Lieut.-Govr. N. W. P.

Major R. C. Tytler, 38th Regt. B. N. I., Barrackpore.

R. H. M. Warrand, Esq., B. C. S., Calcutta.

Capt. J. E. Gastrell, 13th Regt. N. I., Serampoor.

C. W. Wilmot, Esq., Pakour.

Maha Rajah Narendra Narain Bhupa, Cooch Behar.

Bábu Boloi Chund Singh, Calcutta.

J. Obbard, Esq., Calcutta.

W. T. Blanford, Esq., Geological Survey.

- W. H. Scott, Esq., Dehra Dhoon.  
 Lieut. W. G. Murray, 68th N. I., Rawulpindee.  
 J. B. N. Henessey, Esq., Mussooree.  
 A. Campbell, Esq. M. D., Darjiling.  
 Capt. J. Sherwill, Darjiling.  
 Capt. H. Hopkinson, 70th Regt. B. N. I., Moulmein.  
 A. E. Russell, Esq., C. S., Balasore.  
 W. L. Willsons, Esq., Beerbhoom.  
 Rev. F. F. Mazuchelli, D. D., Calcutta.  
 Major S. J. Blane, H. M. 52nd Regt., Calcutta.  
 J. Geoghegan, Esq., N. W. Provinces.  
 E. Goodeve, Esq. M. D., Calcutta.  
 Major C. Douglas, Bengal Artillery, Calcutta.  
 R. Jones, Esq., Calcutta.  
 D. M. Gardner, Esq., B. C. S., Calcutta.  
 Capt. J. G. R. Forlong, Moulmein.  
 L. B. Bowering, Esq., B. C. S., N. W. Provinces.  
 Capt. J. C. Haughton, 54th Regt. B. N. I., Port Blair.  
 C. Archer, Esq. M. D., Calcutta.  
 D. Fitzpatrick, Esq., B. C. S., N. W. Provinces.  
 G. K. Hardie, Esq., M. D. Staff Surgeon, Calcutta.  
 A. Fisher, Esq., Calcutta.  
 Major S. R. Tickell, 31st Regt. B. N. I., Moulmein.  
 J. Sanders, Esq., Calcutta.  
 C. A. Elliott, Esq., B. C. S., Lucknow.  
 The Honorable J. P. Grant, Lieut.-Govr. of Bengal, Calcutta.  
 Moulvie Futteh Ally, Calcutta.  
 F. Fisk Williams, Esq., Calcutta.  
 F. A. Goodenough, Esq., Calcutta.  
 H. Leonard, Esq., C. E., Calcutta.

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CORRESPONDING MEMBERS.

- Dr. Max. Müller, Oxford, London.  
 Dr. P. Bleeker, Batavia.  
 Dr. H. Frederick, Batavia.

*Honorary Member.*

- Right Hon'ble Sir James W. Colville, Kt., Europe.

## LOSS OF MEMBERS DURING THE YEAR 1859.

*By retirement.*

B. J. Colvin, Esq., B. C. S., Calcutta.

Rev. W. O. Smith, Calcutta.

Dr. D. T. Morton, Tounghoo.

*By death.*

Lieut.-Col. M. E. Loftie, Nuseerabad.

Adolphe Schlagintweit, (Corresponding Member,) Thibet.

Sir G. T. Staunton, Bart. F. R. S., (Honorary Member,) London.

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 LIST OF HONORARY MEMBERS.

M. Garcin de Tassy, Membre de l' Institut, Paris.

Sir John Phillippart, London.

Count De Noe, Paris.

Prof. Francis Bopp, Memb. de l' Academie de Berlin.

Sir J. F. W. Herschel, F. R. S., London.

Col. W. H. Sykes, F. R. S. Do.

Prof. Lea, Philadelphia.

Prof. H. H. Wilson, F. R. S., London.

Prof. C. Lassen, Bonn.

M. Reinaud, Memb. de l' Institut. Prof. de l' Arabe, Paris.

Dr. Ewald, Gottingen.

His Highness Hekekyan Bey, Egypt.

Right Hon'ble Sir Edward Ryan, Kt., London.

Prof. Jules Mohl, Memb. de l' Institut, Paris.

Col. W. Munro, C. B., H. M. 39th Regt., London.

His Highness the Nawab Nazim of Bengal, Murshedabad.

J. D. Hooker, Esq. M. D., R. N., F. R. S., F. G. S., F. L. S., London.

Prof. Henry, Princeton, United States.

Lieut.-Col. Sir C. H. Rawlinson, K. C. B. Persia.

Lieut.-Col. Sir Proby T. Cautley, K. C. B., F. G. S., London.

Rájá Rádhákánta Devá Bahádur, Calcutta.

B. H. Hodgson, Esq., F. R. S., Europe.

H. Falconer, Esq. M. D., F. R. S., F. G. S., F. L. S., B. M. S., Europe.

Right Hon'ble Sir J. W. Colvile, Kt., Europe.

## CORRESPONDING MEMBERS.

- Kremer, Mons. A. Von, Alexandria.  
Porter, Rev. J., Damascus.  
Schlagintweit, Herr H.  
Schlagintweit, Herr R.  
Smith, Dr. E. Beyrout.  
Tailor, J. Esq., Bussorah.  
Wilson, Dr., Bombay.  
Nietner, J. Esq., Colombo, Ceylon.  
Max. Müller, Dr., Oxford.  
Bleeker, Dr. P., Batavia.  
Frederick, Dr. H., Batavia.
- 

## ASSOCIATE MEMBERS.

- Blyth, E. Esq., Calcutta.  
Káramut Ali, Syud, Matawalli, Hooghly.  
Long, Rev. J., Calcutta.  
MacGowan, Rev. J., Europe.  
Stephenson, J. Esq., Europe.

FOR FEBRUARY, 1860.

At a meeting of the Society held on the 1st Instant.

A. Grote, Esq., President in the chair.

The Proceedings of the last meeting were read and confirmed.

Presentations were received—

1. From Dr. F. J. Mouat, a Jacket &c., worn by the Angami Naga Hill chief who killed the French Missionary.

2. From Dr. W. Hardinger of the Austrian Academy, several volumes of the Transactions of that Academy.

3. From the Secy. to the Royal Society of Sciences at Stockholm, Parts 1 to 5 of a Voyage round the world of the R. Swedish Frigate Eugenie.

4. From H. M. the Ex-King of Oudh, a dead monkey, *Presbytes Cephalopterus*.

5. From Mrs. Turnbull, a fine stuffed specimen of *Petaurus Sciaurus*, Shaw.

6. From J. J. Atkinson, Esq., a few Birds' skins procured at Singapore.

7. From Alex. Thomas, Esq., in medical charge of Khyuk Phyoo, Ramsee, Arakan, a fine specimen of *Platydictylus gecko*.

8. From F. E. Hall, Esq., an inscription stone found among the ruins of Pátan, a decayed city near Rátgurh in the Saugor district.

9. From Major R. R. W. Ellis (through F. E. Hall, Esq.,) a copper-plate land grant, dated in the year of Vikramáditya answering to A. D. 1097. This grant was translated by Mr. Hall in the Journal of 1858.

A letter was read from C. E. Chapman, Esq., desiring to withdraw from the Society.

The following gentlemen duly proposed at the last meeting were balloted for and elected ordinary members.

Col. E. W. S. Scott. Bengal Artillery.

Major G. Pearse.

Dr. F. J. Mouat, re-elected.

Capt. T. G. Montgomerie, B. E., F. R. G. S.

Mr. Robert Swinhoe and Rev. H. Baker were also elected corresponding members of Society.

The following gentlemen were named for ballot as ordinary members at the next meeting.

Dr. D. Brandis, proposed by Dr. Thomson seconded by Mr. Atkinson.

Sir H. Bartle Frere, K. C. B. proposed by Capt. Lees, seconded by the President.

H. S. Reid, Esq., Director of Public Instruction, N. W. P. proposed by Capt. R. Maclagan seconded by Mr. W. Muir.

Major J. Hovenden, Bengal Engineers, proposed by Capt. Stubbs seconded by Major Thuillier.

Major F. D. Atkinson proposed by Mr. Atkinson seconded by Major Thuillier.

Stephen Lushington, Esq., B. C. S. proposed by the President seconded by Mr. Samuells.

Capt. A. D. Turnbull, Bengal Engineers, Superintendent General Irrigation N. W. P., proposed by Lieut.-Col. A. S. Waugh, seconded by Capt. R. Maclagan.

H. B. Medlicott, Esq., F. G. S. Professor of Geology at the Thomason College, Roorkee, proposed by Capt. R. Maclagan, seconded by Mr. T. Oldham.

Lieut. H. Sconce, Assistant Commissioner Assam, proposed by Dr. Thomson seconded by Mr. Atkinson.

Rev. J. Cave Brown, proposed by the President seconded by Rev. Dr. Kay.

W. S. Fitz William, Esq., proposed by Mr. Atkinson, seconded by Mr. Schiller.

S. Wauchope, Esq., B. C. S., proposed by the President, seconded by Major Thuillier.

The Council Submitted the following report recommending that Professor Max Müller be elected an Honorary Member.

#### REPORT.

“The Council beg to recommend Professor Max Müller of Oxford for election as an Honorary member of the Society.

“For the last ten years no name has been more distinguished in Europe in connection with the ancient literature of India. His edition of the Rig Veda, with the commentary of Sáyánachárya, (three volumes of which have appeared, containing five of the eight ashtakas,) is alone sufficient to win him a very high place among

Oriental scholars. He has also laboured successfully in the fields of comparative philology and mythology; and his paper on the latter subject in the Oxford essays has been translated into two of the continental languages.

“His last work which has only lately arrived in this country, on the “History of ancient Sanskrit Literature so far as it illustrates the primitive religion of the Brahmans,” not only brings within the reach of the general reader, the results of the labours of various Orientalists, but it also abounds with new and interesting materials for future investigations. Of this kind is the chapter on the history of writing in India, which first appeared in the Society’s Journal, the author having contributed it when he was elected a corresponding member in the February meeting of 1859.”

The Council reported that they had appointed the following gentlemen as members of the Sub-Committees for the year 1860.

#### FINANCE.

Capt. C. H. Dickens.  
Baboo Rajendra Lal Mittra.

#### PHILOLOGY.

E. A. Samuells, Esq.  
Rev. J. Long.  
Dr. E. Röer.  
Capt. W. N. Lees.  
Baboo Rajendra Lal Mittra.

#### LIBRARY.

E. A. Samuells, Esq.  
Baboo Ramapersaud Roy.  
Major R. Strachey.  
Capt. W. N. Lees.  
R. Jones, Esq.  
Baboo Rajendra Lal Mittra.

#### NATURAL HISTORY.

E. A. Samuells, Esq.  
T. Oldham, Esq.  
Dr. T. Thomson.  
Dr. W. Crozier.  
W. Theobald, Esq.

Major R. Strachey.

H. F. Blanford, Esq.

METEOROLOGY AND PHYSICAL SCIENCE.

The Ven'ble J. H. Pratt.

Major H. L. Thuillier.

Major R. Strachey.

Baboo Radha Nauth Sikdar.

T. Oldham, Esq.

Communications were received—

1. From Baboo Radha Nauth Sikdar, an abstract of the Meteorological Observations taken at the Surveyor General's Office in the months of June, July, and August, 1859.

2. From R. B. Chapman, Esq., Under-Secretary to the Government of India, copy of a Statement of Doolum, a Convict in Port Blair.

Major Thuillier, F.R.G.S. informed the meeting that he had recently had the pleasure of receiving from the Messrs. de Schlagintweit now at Berlin, some excellent specimens of Chromo-Lithographs and Chromo-Photographs of their series of views of the most interesting subjects taken during the course of their magnetical survey of India. These pictures he placed on the Table for the inspection of members, the smaller ones being described as Chromo-Photographs and the larger as Chromo-Lithographs.

It was proposed by the Messrs. de Schlagintweit to produce a collection of no less than 700 Panoramas and views from India and High Asia, the aquarells and drawings from nature by Hermann and Adolphe de Schlagintweit, with some Photographs by Robert de Schlagintweit, taken between the years 1854 to 1858.

These views of which a catalogue has been forwarded, are divided into 20 groups as follows:

| <i>Groups.</i>                           |     |     | <i>Plates.</i> |
|------------------------------------------|-----|-----|----------------|
| 1. General Panoramic Views, 1 to         | ... | ... | 22             |
| 2. Konkun and Western Dekhan,            | ... | ... | 45             |
| 3. Bengal to Panjab,                     | ... | ... | 73             |
| 4. Khassia Hills and surrounding Plains, | ... | ... | 89             |
| 5. Central India, ...                    | ... | ... | 110            |
| 6. Eastern Ghats and Karnatik,           | ... | ... | 128            |

|     |                                                       |     |     |     |     |
|-----|-------------------------------------------------------|-----|-----|-----|-----|
| 7.  | Maissur and Nilgiris,                                 | ... | ... | ... | 150 |
| 8.  | Rivers,                                               | ... | ... | ... | 200 |
| 9.  | Trees and groups of Vegetation,                       | ... | ... | ... | 249 |
| 10. | Temples, Monumental Buildings, European Residences,   | ... | ... | ... | 277 |
| 11. | Native Buildings, Bridges, Villages, &c...            | ... | ... | ... | 353 |
| 12. | Panoramas from the Himalaya, Tibet and Turkistan,     | ... | ... | ... | 354 |
| 13. | Eastern Himalaya,                                     | ... | ... | ... | 412 |
| 14. | Western Himalaya,                                     | ... | ... | ... | 469 |
| 15. | Gnari, Khorsum, Central Tibet,                        | ... | ... | ... | 496 |
| 16. | Western Tibet and Karakorum (Muskta),                 | ... | ... | ... | 551 |
| 17. | From Ladak by the Karakorum and Kuenlun to Turkistan, | ... | ... | ... | 579 |
| 18. | Salt-lakes and Thermal springs,                       | ... | ... | ... | 598 |
| 19. | Snow-peaks and Glaciers,                              | ... | ... | ... | 646 |
| 20. | Indian Ocean to Egypt,                                | ... | ... | ... | 700 |

From the above, the meeting would observe that the series embraced a wide range of interest, and from the specimens on the Table, he (Major Thuillier) thought that the collection was well worthy of a place in the archives of the Society. He could not inform the meeting what the probable cost of the entire set would be, but he hoped the object would not be lost sight of. The catalogue shewed a long list of subjects which appeared to be of special interest to a Society like this and the superior and artistic manner in which such publications were brought out in Germany, rendered them valuable.

With respect to the Chromo-Photographs, he would read an extract from Mr. Hermann de Schlagintweit's letter to his address, dated the 9th November last.

“The three Photographs are aquarell fac-similes and reductions to one uniform size of our large originals. By a peculiar combination partly of tinted Paper, on which the Photographs are printed, and partly of colour put on, they resemble, as near as possible, our originals.” And as regards the larger pictures, he states :

“The objects of the Chromatic Lithographs are the two highest Peaks till now measured, which we thought to be of particular interest for you, our atlas will consist of 80 similar Plates.” These two views the meeting would observe, represented the celebrated moun-

tains called "Kanchinjunga" and "Mount Everest" the former being 28,156 feet and the latter 29,002 feet above mean sea level. To the latter Mr. de Schlagintweit had added the name of "Gourisanker," a name which he (Major T.) did not remember to have before heard. It would be in the recollection of the Society that there was a very animated discussion some time back on the subject of the native or local appellation of this stupendous mountain, and that Mr. Brian Hodgson had affixed to it the name of "Deodhunga." It had been very clearly shewn to the Society, by his friend Colouel Waugh, how impossible it was for any person, without entering Nipal and conducting measurements there in the vicinity of the great snowy mass in question, to identify the peak which he had, after years of research and computation, fixed by actual observation, and declare it to be one and the same. For this reason he had therefore maintained his right to assign to the highest known mountain in the world, until its own native designation could be established beyond all doubt, a distinguished modern name, which had met with entire approval from the Royal Geographical Society at home, as well as with scientific men on the continent, and which, no doubt, would now be inseparably connected with the mountain for generations to come.

Mr. de Schlagintweit had made no allusion to the point, and it was therefore not known from whence he had obtained the name of "Gourisanker" or from what authority he had deduced it. Probably he had been able to derive information on this important subject when he visited Katmandhoo from which place also, it was most likely the view was taken, although this was not specified on the picture, a point to be regretted, looking to the discussions which had taken place and to the great interest which attached to the subject.

Major Thuillier also informed the meeting that Mr. de Schlagintweit's letter stated that the King of Bavaria whose subjects they were, had been pleased to confer on both brothers, titles of nobility, a distinction which they believed they owed to their important Mission to India and to the liberal views and arrangements with which the Indian Government at all times assisted them in completing it.

Major Douglas exhibited a calculating machine, and explained the

principle on which it was constructed, and the mode in which various arithmetical operations were effected by it.

The thanks of the meeting were voted to Major Thuillier and to Major Douglas.

The Officiating Librarian submitted the usual monthly report.

#### LIBRARY.

List of accessions to the Library since the meeting in January last.

#### *Presentations.*

Journal of the Academy of Natural Sciences of Philadelphia, New Series, vol. IV. Part 1.—BY THE ACADEMY.

List of Fellows of the Royal Society for 1858.—BY THE ROYAL SOCIETY.

Address of the President delivered at the Anniversary Meeting, 30th November, 1858.—Ditto.

Zwei Vedische Texte über Omenà und Portenta. Von. A. Weber, Berlin, 1859.—BY THE AUTHOR.

1. Jahrbuch der Kaiser-Königlichen, Geologischen Reichsanstalt vols. VII. VIII. and IX. *Vienna*.—BY THE SOCIETY.

List of members of the Royal Asiatic Society, 1858.

Report of the Joint Committee of the Royal Society and the British Association for procuring a continuance of the Magnetic and Meteorological Observatories.

2. Uebersicht der resultate Mineralogischer Forschungen from 1844 to 1852, 3 vols. Von. Dr. Gustav. Adolph. Kenngott.

3. Katalog der Bibliothek des K. K. Hof—Mineralien—Cabinets in Wien.

4. Abhandlungen der Mathemat, Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften, vols. 30, 31, *München*.

5. Ditto Historischen Classe, vol. 32.

6. Ditto Philosoph Philologischen Classe, vol. 3rd Parts 1, 2 and 3.

7. Naturwissenschaftliche Abhandlungen, Von Wilhelm Haidinger, Bands 1, 2 3 and 4.

Auszug aus dem Monatsbericht der Königlichen Akademie der Wissenschaften Zu Berlin for January and February 1859, 2 pamphlets.

8. Gelehrte Anzeigen herausgegeben Von Mitgliedern der K. Bayer. Akademie der Wissenschaften Parts 42 and 47.

9. Berichte über die mittheilungen von Freunden der naturwissenschaften in Wien, Von Wilhelm Haidinger, Parts 1 and 7.—*Wien*.

An unpointed Phonetic Alphabet based upon Lepsius' Standard Alphabet by J. G. Thompson, M. C. S. Mangalore 1859.—BY THE AUTHOR.

Oriental Christian Spectator for December, 1859.—BY THE EDITOR.

Calcutta Christian Observer for January, 1860.—BY THE EDITORS.

Oriental Baptist for January, 1860.—BY THE EDITOR.

1. A paper and Resolutions on the Uniform System of Meteorological Observations.—BY MAJOR R. LACHLAN.

2. Journal of the Royal Geographical Society, vol. 27, 1858.

3. Zeitschrift der Deutschen Morgenländischen Gesellschaft Dreizehnter Band. 4th Heft, *Leipzig*, 1859.

The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science, Fourth Series. No. 121, November, 1859.

4. Denkrede auf Johaun Nepomuf von Fuchs. By Franz von Kobell, *München*. 1856.

5. Ueber die Physic der Molecularkräfte. By Prof. Dr. Jolly. *München*, 1857.

6. Wissenschaften altderscher Sprache und Literatur. By Dr. Konrad Hoffman, *München*, 1857.

7. Die deutsche Politik König Heinrich I.—BY FRANZ LOHER, *München* 1857.

8. Francesco Petrarca's Vortrag.—BY PROF. GEORG MARTIN THOMAS. *München*, 1858.

9. Ueber die geschichtlichen Porstufen der neueren Rechts philosophie. —BY PROF. DR. CARL PRANTL. *München*, 1858.

10. Ueber Johannes Müller.—BY DR. TH. L. W. BISCHOFF. *München*, 1858.

11. Philosophical Transactions of the Royal Society of London, Parts, 1 and 2 of 1858.

12. Fisher's Mosaic account of the Creation.

13. Weber's Zwei Vedische Texte uber Omina und Portenta.

*Purchased.*

1. Le Bouddha et Sa Religion. By J. Barthelemig Saint-Hilaire, *Paris*.

2. Annales des Sciences Naturelles. By M. Milne Edwards and By M. M. A. D. Brongniart Et J. Decaisne. *Paris* 1859.

3. Revue des Deux Mondes, XXIX. Annee, Seconde Periode. *Paris* October 1859, and November 1859. Tomes XXIII. and XXIV.

4. Vergleichende Grammatik. Von Bopp. Zweiter Band Zweite Hälfte, *Berlin*, 1859.

5. Chalef Elahmar's Qasside. Von W. Ahlwardt. *Greifswald*, 1859.

6. Die Herabkunft Des Feners und Des Göttertrunks. Von Adalbert Kuhn. *Berlin*, 1859.

7. The Literary Gazette. Nos. 69, 70, 71, 72 of vol. 3rd.
8. Comptes Rendus Des Seances De L'Academie des Sciences. Tome 49. Nos. 12, 13, 14 and 15.
9. The Annals and Magazine of Natural History. No. 23, November, 1859. London.
10. Haji Khalfa, a Biographical Dictionary of the Mahomedans, vol. 7.

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FOR MARCH, 1860.

The Monthly General Meeting of the Asiatic Society was held on the 7th instant.

A. Grote, Esq., President, in the chair.

The proceedings of the last meeting were read and confirmed :—

Presentations were received :—

1. From Rajah Kundurpeshwar Singh, Zemindar of Sarun, six gold coins of his predecessors of different sizes.

2. From the Bombay Government, No. 54, of the selections from its records.

3. From the Madras Government, No. 61, of the records of that Government.

4. From the Superintendent, Bombay Government Observatory, a copy of the Magnetical and Meteorological Observations made in 1858.

5. From M. Zill, a fragment of the egg-shell of the large Dodo-like bird of Madagascar, the *Alpiornis maximus*. (*J. Geofroy*,) an egg, beside which that of the Ostrich is comparatively diminutive, and which holds about two gallons.

6. Captain Eales, of the *Fire Queen*, S. V., a specimen of the *Chiloscyllium plagiosum*, (*Bennett*,) six feet in length, from the Aguada Reef, the "Sun-fish" of seamen in the Bay of Bengal, found only in shoal water.

7. Capt. Niblett, of the *Sydney* S. V. a small specimen of the curious crustacean, *Thalasinia scorpionedes*, (*Leach*) forwarded by Mr. Voule of Rangoon, who remarks that "This is a land animal, which the Burmese call *Padzoon Kea* or 'scorpion prawn.' It does not live on the surface of the ground, but burrows to a depth of three or four feet in the mud. This specimen was found at that depth."

8. From Rajah Radha Kanth Deb, Bahadoor, a huge Sunkarra Fish (trygon).

Professor Max Müller, of Oxford, was balloted for, and elected an Honorary Member of the Society.

The following gentlemen duly proposed at the last meeting were balloted for and elected ordinary members :—

Dr. D. Brandis.

The Hon'ble Sir H. Bartle Frere, K. C. B.

H. S. Reid, Esq. B. C. S.

Major Hovenden.

Major F. D. Atkinson.

Stephen Lushington, Esq., B. C. S.

Capt. A. D. Turnbull.

H. B. Medlicott, Esq.

Lieut. H. Sconce.

Rev. J. Cave Browne.

W. S. Fitzwilliam Esq.

S. Wauchope, Esq., B. C. S.

The following gentlemen were named for ballot as ordinary members at the next meeting.

J. E. T. Aitchison Esq., M. D. proposed by Major F. W. Stubbs and seconded by Col. Baird Smith.

A. K. Dyer, Esq., proposed by Dr. T. Thomson, seconded by Mr. Atkinson.

H. Braddon, Esq., proposed by Mr. Atkinson and seconded by the President.

Alonzo Money, Esq., B. C. S., proposed by Mr. Atkinson, seconded by Mr. Samuells.

The Council also proposed Dr. M. Haug of Poonah, a corresponding member of the Society.

Col. Strachey suggested that a statement should be prepared and laid before the next meeting showing, as far as could be at present ascertained, the financial result of the recent reduction in the rate of subscription.

The Secretary said he should be most happy to prepare such a statement. He could at once state, that since the beginning of last year upwards of 70 new members had been elected.

Capt. Lees enquired what number had been elected in previous years.

The Secretary replied that the average of the three preceding years had been only nine.

Communications were received—

1. From Baboo Radhanauth Sikdar, abstract of the result of the Meteorological observations taken at the Surveyor General's office in the month of September, 1859.

2. From W. T. Blanford, Esq., a paper on the Indian Malacology, No. 1, by Messrs. W. T. and H. F. Blanford.

3. From Major H. L. Thuillier, a paper by Capt. Montgomerie on the great flood of the river Indus which reached Attock on the 10th August, 1858.

4. From Col. R. Strachey a memo. on Mr. Blyth's paper on the animals known as wild asses.

Received the following letter from Major H. L. Thuillier:—

To W. S. ATKINSON, ESQ.,  
*Secy. Asiatic Society.*

SIR,—I have the pleasure to return the Society's atlas of district lithographed maps which I have completed. After adding all the maps recently published, an index to the whole set has been prepared, the maps numbered, and an index map of Bengal prepared, which I hope will make the record more worthy of a place in the Society's library.

I would suggest that a separate volume of the *engraved* sheets of the Indian Atlas be prepared for the library. I should be happy to supply all the sheets published up to the present time from the Surveyor General's Office, and to arrange them with proper list and index map. The cost of the atlas will not be more than about 20 Rupees.

Your's obediently,

(Sd.) H. L. THUILLIER, Major.

The hearty acknowledgments of the meeting were given to Major Thuillier for his liberal and valuable assistance in completing and arranging the Society's atlas.

His offer to furnish the engraved maps, as they were issued, was accepted with thanks.

*Report from the Council.*

The Council beg to submit for the approval of the Society the following report of the Philological Committee recommending the publication of *Zeeah Burneah* in the *Bibl. Indica*.

*Report.*

The Philological Committee recommend to the Council that the *Zeeah Burneah*, a Persian History of the reign of Firuz Shah Toghluks, should be published in the new series just commenced of the *Bibl. Indica*. Several MSS. have been collected to form an accurate text, and Moulavi Syud Ahmed Khan of Moradabad has offered to edit it. The work will fill about seven Fasciculi, and as it relates to a very important and but little known period in the history of Muhammadan India, and as the book itself is extremely rare, it appears to the Committee on every account desirable to have it printed.

The report was adopted.

The Council reported that they had addressed the following letter to the Supreme Government:—

*From W. S. ATKINSON, Esq. Secy. Asiatic Society of Bengal,  
To W. GREY, Esq., Secy. Govt. of India, Home Dept.  
Asiatic Society's Rooms, Calcutta, 27th Feb. 1860.*

SIR,—I am directed by the Council to bring to the notice of the Honorable the President in Council the opportunity afforded by the present expedition to China of investigating the Physical Geography and Natural History of portions of that country to which access may hereafter be difficult or impossible.

2. The Council have felt so deeply the importance of not neglecting this opportunity, that they recently requested their President to ascertain the views of the Viceroy, but at that time it appeared to His Lordship that he would not be warranted in exposing a naturalist to such risk of life, as would be incurred by prosecuting Natural History researches in a hostile country.

3. Since that time considerable extension has been given to the force intended to operate in China, and it appears probable that posts must be established to serve as a basis for operations inland, in northern China, a country little known to naturalists and of very great interest.

4. A naturalist would thus be able either from on boardship or from the posts on the seaboard to make good collections and obtain valuable information, even if unable to accompany the force into the interior in whatever direction it may proceed.

5. The Council however venture to think that a naturalist would find it possible to accompany the advance of the army without serious danger, and they are further convinced that an equally good opportunity is not likely to occur again, and that it would hereafter be a matter for regret if no use were made of it; nor do they think it immaterial to add, in confirmation of their own views, that the French Government, as they have recently ascertained, has already dispatched a naturalist to the East to accompany the allied forces.

6. The Council have learnt from the public journals that attention has already been called to the subject at home, and they have reason to believe that H. M. Government have been addressed on the subject by leading men of science in England. They nevertheless feel it a duty to lay the subject before the Government here, because they believe that a man possessing special qualifications for such a task, by his previous studies and by his extensive knowledge of the Zoology of Asia, is present on the spot and ready to undertake the duties and the risk. Moreover, the name of Mr. Blyth, who has a high reputation in Europe, has been prominently put forward in the London *Times* and *Athenæum* as the gentleman best suited for such a commission.

7. The Council therefore, while fully appreciating the motives which influenced His Excellency in declining to entertain their proposal when first submitted to him, still venture to hope that the great importance of such a mission in a scientific point of view, the probability that so favorable an opportunity may not occur again, and the fact that Mr. Blyth is quite willing to encounter the danger, whatever it may be, may lead to a reconsideration of the question, and an affirmative decision.

8. The Council have given some attention to the matter of expense and think a personal salary of Rs. 500 with travelling expenses would be a fair remuneration.

In addition to this some allowance would be required to provide a staff of native taxidermists and collectors.

These might be procured partly in this country and partly in China.

I have, &c.,

(Sd.) W. S. ATKINSON,

*Secretary, Asiatic Society.*

Mr. R. Jones previously to giving a microscopic demonstration of Diatomaceæ offered a few remarks descriptive of these organisms. They were described as a family of confervoid Algæ differing from other unicellular Algæ, in being furnished with an external coating of siliceous valves and to the difficulty of making out their true condition. The method of determining the structure of the Diatomaceous frustule was explained, and attention was directed to the singular beauty of the traceries and markings exhibited by the silicious valves and to the difficulty of making out their true condition. The mode of increase of the cells was stated to be, like that of all vegetable cells, a process of division—the only other mode of reproduction known certainly to exist in this class, being that in which the operation of conjugation takes place. It was remarked however that these phenomena required for their satisfactory demonstration quiet and a happy concurrence of other circumstances. It was further stated that the reproduction of Diatomaceæ, by the breaking up of the Endochrome into Gonidia, was doubtful. Various causes were mentioned as having been assigned to account for the motion observable in these organisms; but it was added that, our knowledge on this point was still very imperfect. The habitats of the Diatomaceæ were described, and numerous fossil specimens from the Himalayas, the Arctic regions, America, and various other localities, were exhibited during the evening; and it was mentioned, as an interesting fact, that the same species were found under conditions widely differing, and in places distantly remote from each other.

Dr. Crozier remarked that the description of the organization of the Diatomaceæ with which Mr. Jones had so ably favoured the meeting and the microscopic demonstrations which would now be given of them, both recent and fossil, were very interesting, especially as these minute organized beings have only very lately been brought to our knowledge by the valuable assistance our sense of sight receives from the compound achromatic microscope; and they were, though invisible to the naked eye, found wherever there is fresh or salt water—in

the smallest quantity of water, on the surface or in the deepest fathomable part of the ocean, in the tropical and in the polar regions. Some recent Diatomaceæ in fresh water would be shown under the microscope, some from Atlantic soundings 2,070 fathoms, after which he, Dr. C., would exhibit some in a state intermediate between recent and fossil from guano, the urinary and fœcal excrement of sea-birds. The silicious cases of the Diatomaceæ which have been taken by the birds with their food, generally fish, who also have previously taken these Diatomaceæ as food, (most likely in eating seaweed on which they are always very abundant) were not acted upon at all by the alimentary secretions but passed out with the fœces unaltered; besides which they were found in innumerable numbers in many strata of the earth in different localities, some of which would also be demonstrated. From their numbers both recent and fossil, and their peculiar indestructible and often beautifully formed silicious cases they were a very interesting study, besides which, though their remains were so permanently preserved for an almost indefinite time, owing to their indestructible silicious cases, they were amongst the lowest organized beings, yet they possessed some motive power and have been placed by some naturalists in the animal kingdom. But this motive power in all of the lowest organized beings arose generally from cilia; now these peculiar incessant motive organs were found on some particular part of many of the lowest organized beings both animal and vegetable and therefore were not recognized now as the distinctive character of an animal. The Diatomaceæ were now placed in the vegetable kingdom as they do not possess any internal assimilating or digestive organs. The great distinction between the animal and vegetable kingdoms (which is very well marked in the higher organized plants and animals) in the lower organized beings was this, the *animal* requires for its nourishment, its life, matter organized either by its own or vegetable processes, which it takes some way or other into the interior of its body, the *vegetable* for its nourishment, its life, possesses the power of obtaining it by absorbing the inorganic elements on its exterior. Wherever any organized beings under the influence of sun-light were found to decompose carbonic acid and to set free oxygen they might be ranked in the vegetable kingdom, however active their motions may be from cilia or other unknown agents.

This peculiar power of vegetables was strikingly and instructively demonstrated to us in an aquarium ; put fish in an aquarium and they soon die, though they may be well fed, if the water is not renewed, and this mortality arises from want of oxygen ; but put a water plant in the aquarium and the fish will live for days weeks and months without the water being changed, and this arises from the peculiar power the vegetable possesses of decomposing carbonic acid, appropriating the carbon to its own life and giving off oxygen for the support of the life of the fish.

Mr. Jones and Dr. Crozier then exhibited numerous specimens of Diatomaceæ, several members of the society having obligingly lent their microscopes for the occasion.

The cordial thanks of the meeting were voted to Mr. Jones and Dr. Crozier.

The Officiating Librarian submitted the usual monthly report.

#### LIBRARY.

The Library had received the following accessions since the meeting in February last.

#### *Presentations.*

Journal of the Academy of Natural Sciences of Philadelphia, New Series, vol. 4th, Part 2nd.—BY THE ACADEMY.

Proceedings of the Academy of Natural Sciences of Philadelphia, 1859.—BY THE ACADEMY.

Description of some Asiatic Lepidopterous Insects belonging to the tribe Bombyces.—BY FREDERIC MOORE. (From the proceedings of the Zoological Society of London, May 1859.)—BY THE AUTHOR.

A Monograph of the Genus *Adolias*.—BY FREDERIC MOORE. (From the Trans. Ent. Society vol. 5, N. S., Part 2nd).—BY THE AUTHOR.

Synopsis of the known Asiatic species of Silk-producing Moths with descriptions of some new species from India, 2 copies.—BY FREDERIC MOORE. (From the proceedings of the Zoological Society of London, June 1859.)—BY THE AUTHOR.

The Quarterly Journal of the Geological Society, vol. 15, Part 4, No. 60.—BY THE EDITOR.

Journal of the Statistical Society of London, vol. 22, Part 4.—BY THE SOCIETY.

Proceedings of the Royal Geographical Society of London, vol. 3, No. 6.—BY THE SOCIETY.

The Philosophical Magazine. Fourth Series, Nos. 122, 123, for December 1859.—BY THE EDITORS.

The Athenæum for November 1859.—BY THE EDITOR.

Calcutta Christian Observer for February and March 1860.—BY THE EDITORS.

Oriental Baptist for February and March 1860.—BY THE EDITOR.

Preliminary Map of India exhibiting the lines of Electric Telegraph in 1860.—BY MAJOR THUILLIER.

Coal and Iron in the Punjab.—BY THE PUBLIC WORKS DEPARTMENT.

Report on the Survey Operations in the Lower Provinces.—BY THE BENGAL GOVERNMENT.

Selections from the Records of the Bombay Government, No. 54, New Series.—BY THE BOMBAY GOVERNMENT.

Selections from the Records of the Madras Government, No. 61.—BY THE MADRAS GOVERNMENT.

Report on certain Projects.—Ditto Ditto.

Magnetical and Meteorological observations made in 1858.—BY THE SUPERINTENDENT, BOMBAY GOVERNMENT OBSERVATORY.

Selections from the Public correspondence of the Punjab Government, vol. 4, No. 3.—BY THE PUNJAB GOVERNMENT.

Bibidharta Sangraha, No. 60, for Choit.—BY THE EDITOR.

*Purchased.*

Comptes Rendus. Tome 49, Nos. 16 to 23.

Tables Des Comptes Rendus of Tome 48.

Journal Des Savants for October 1859.

The American Journal of Science and Arts for November 1859.

Revue des Deux Mondes for 15th November and 1st Dec. 1859. 2 Nos.

Das Leben Muhammed's, vols. 3 and 4.—BY DR. FERDINAND WUSTENFELD.

Lexicon Persico-Latinum—Fasciculi 6 of Part I and of Part II.

Mötanabbii Carmina cum Commentario Wahidii, Fasciculus 5.

Journal Asiatique, No. 54, of Tome 14.

Annales des Sciences Naturelles No. 4, of Tome 11, Fourth Series.

Revue de Zoologie, No. 10, 1859.

The Natural History Review, vol. VI. No. 4.

The Annals and Magazine of Natural History vol. 4, No. 24.

The Literary Gazette Nos. 73 to 76.

Darwin on the Origin of Species.

Sir Emerson Tennent's Ceylon.

*Report of Curator, Zoological Department.*

The following collections have been received :

1. R. Swinhoe, Esq., of H. M. Consulate, Amoy. Numerous specimens of mammalia and birds, and some in other classes, additional to the birds noticed in XXVIII, 280,—collected chiefly about Amoy, but some from Formosa ; and among the latter the skull and horns of an undescribed Stag, of the *Elaphine* type of Deer, which cannot but be regarded as an interesting discovery.

MAMMALIA.

MACACUS — ? Skull of a young animal, sent as that of “ the small Formosa Monkey.” I am not aware that any species of Monkey has been described from that island ; and the present specimen exhibits no special characteristic at so early an age, when the second true molars had not been developed. A Monkey of this genus (*M. SPECIOSUS*, F. Cuv.,) inhabits Japan. Mr. Swinhoe since writes—“ The MACACUS from Formosa must have been at least two years old. I procured him in spring and kept him alive for several months. I have one still alive, with an unamputated tail, which I will send you as it is, and you will be able to form your own views of the species from the living animal. It is very difficult to get an animal of the kind with a full tail, as the Chinese are in the habit of docking the tail before Europeans can get hold of them. This is the small species and inhabits the camphor forests of the Formosa mountains. Its colour is grey with pale under-parts, and it has yellowish-brown eyes. The large species which frequents the rocks on the coast of Formosa, especially in the neighbourhood of *Sakow* or ‘Ape’s hill,’ is about twice the size and rather darker in colour (both have rough coats), with redder face, and with two *bright* red callosities on the rump. This I take to be the Japanese animal, as also identical with the Monkeys found in the island of Lintin near Hong-kong, but this only on conjecture. The small species stands about 2 ft. high, the larger about 3 ft. A sporting friend has lately gone over to Formosa, and having sent a stuffer with him, I hope to procure some of these animals.”—*Qu.* Has the very short tail of *M. SPECIOSUS*, as figured by M. Fr. Cuvier, been docked of its natural proportions ?—Again, Mr. Swinhoe subsequently writes—

“ I have ascertained that the *large* Formosa Monkey is identical with the Japanese one, and it will therefore stand as *M. SPECIOSUS*. The small kind, which I am about to send you alive, is undoubtedly distinct and probably new. The large are found on the coast, the small in the forests of the interior of the island.\*

NYCTICEJUS (?) SWINHOEI, nobis, *n. s.* I can find no description of a Bat at all applicable to this species; and can discover in the specimen no trace of upper incisors. It is rather a robustly formed Bat, with the alar membrane continued to the base of the toes; with unusually short linguiform tragus, and short anti-helix. Fur mostly straight and silky, even glossy above, but a little frizzled on the forehead and about the neck; its surface-colour on the upper-parts an umbre-brown with pale tips, below much paler and a little albescent; membranes dark, with numerous transverse stripes of minute hairs on the lower surface of the interfemoral; the extreme tip of the tail exerted. Head and body about  $2\frac{1}{2}$  in. long, the tail  $1\frac{1}{2}$  in.; expanse about 12 in.: length of fore-arm 2 in.; longest finger  $3\frac{1}{2}$  in.; tarse  $1\frac{1}{8}$  in.; hind-foot with claws  $\frac{1}{2}$  in.; ears (posteriorly) about  $\frac{5}{8}$  in. in the fresh specimen; tragus barely  $\frac{3}{8}$  in. This with other species not expressly stated to be from Formosa, I conclude are from Amoy.

SCOTOPHILUS PUMILOIDES, R. F. Tomes, *Ann. Mag. N. H.*, XX. (1857), p. 228. After much consideration, I think this small species is correctly identified.

CANIS (FAMILIARIS). Skull of a short-faced Dog, from Formosa, *minus* the lower jaw and wanting several of the upper teeth.

C. (FAMILIARIS). Skull of another short-faced Dog, of smaller size, and similarly imperfect, from Amoy,—most remarkable for possessing no second true molar, nor space for its insertion.†

\* The living monkey has arrived just as this sheet was going to press. It is a half-grown female, and differs in no respect (that I can perceive) from the common *M. RADIATUS* of the peninsula of India, except in being a shade or two darker in colouring, with a nigrescent wash on the face and ears.

† The Tiger is an occasional visitor in the island of Amoy. In a letter from Mr. Swinhoe, dated Nov. 21st, 1859, he writes—“ I have, since my last, met with little of interest except a Royal Tiger of large size in a Chinese village. I attacked him at close quarters with a fowling-piece and made him bleed; but to avoid an awkward spring at me, I fell down a precipice and nearly killed myself. No assistance being at hand and the Chinese not daring to come near the beast, I need not tell you that I missed getting his skin. One was killed last year at Amoy, and I once bought a cub out of three that a Chinese had for sale, but I never met the brutes before in my rambles. I was out after specimens, and was not of course provided with ball; my stock being only shot and cartridges.

MUSTELA SIBIRICA, Pallas : *M. Hodgsoni*, Gray, *Ann. Mag. N. H.*, XI (1843), p. 118. A fine skin of a female, and an imperfect skull.

SOBEX MURINUS (?), L. : *S. Swinhoei*, nobis, *J. A. S.* XXVIII, 285. The specimen formerly described was but half-grown, and has the surface-colour of the upper-parts much darker than in four adults now sent. In the young of *S. MURINUS*, Dr. Cantor states (*J. A. S.* XV, 191), that "the colour is more of a bluish grey, slightly mixed with brown on the back." In the young of our present animal, the

When I reflect on this adventure, it seems a wonder that I was not killed, but a sight of that *glossy striped skin* emboldened me to try the odds." I sincerely trust that my esteemed friend will admit "discretion" to be "the better part of valour" on any future similar occasion. He since writes (Jan. 5th)—"Tigers, I am told, are greatly increasing in the neighbouring high hills. The villagers report a number of lives lost; and numerous small cattle carried away."

Tigers appear to be very troublesome in the new Russian territory of the Amûr. "In the same places where the Elk is found, the Tiger prowls; and the latter animal may be called quite common, its constant abode being there. I was informed by some Zolons, that there are always a great number of Tigers in the mountains on the opposite or Chinese side. During winter they cross the river and seize the horses of the Zolons, who hunt them at that time." *Journ. Roy. Geogr. Soc.* XXVIII (1858), p. 420. Again, p. 424. "The enquiries I made of those few Tunguses confirmed the fact of the Tiger being found all over the Hing-gan, especially at its central and lower parts. The population are accordingly prevented from hunting there, as the Tiger destroys their Horses, particularly during winter.\*\*\* The Tiger always follows the fresh tracks of the wild Boar, which constitutes its principal food."...And p. 440, "The inhabitants of both banks of the Usuri are employed in agriculture, which the extent and fecundity of their lands render very successful. They have bred cattle for cultivating their fields, but being often attacked by Tigers, it is very difficult to keep cattle in any number." *Vide* also Atkinson's *Siberia*, and Humboldt's notice of Tigers in Northern Asia in *Asie Centrale*. However, they do not quite range to America, albeit the poet Campbell places them on the banks of Lake Erie! "On Erie's banks where Tigers steal along." Nor to Africa; though Sir Walter Scott locates them in "Lybia!" (*Bridal of Triermain*.) The Russian Expedition employed on the Survey of Lake Aral, found them their troublesome even there *in mid-winter!* (*Vide J. R. Geog. S.* Vol. XXIII, 95).

Here it may be remarked that Tigers appear to be fast multiplying in Pinang, where notices of the occurrence of this animal have several times appeared in the Journals from about the middle of 1859. In the Island of Singapore, where they are now so numerous and destructive, they made their first appearance five or six years after the establishment of the British settlement; and but three or four years ago, Dr. Oxley wrote—"The channel between Pinang and the main is two miles broad; and this has been sufficient to exclude the Tiger: for although there have been examples of individuals having crossed over, it has been in an exhausted state, and they have been immediately destroyed." Since this was written, the Tiger would appear to have fairly established itself on the island.

In another communication, dated Dec. 8th, Mr. Swinhoe notices two other species of FELIS. He remarks—"A wild FELIS is found in Hongkong marked like the domestic Cat, but much larger; and an animal known to Anglo-Chinese as the 'Tiger cat.'" From the description sent, evidently *F. MACROCELI*, or *F. MACROCELOIDES* if this be distinct, or an animal very closely akin: a specimen is promised shortly.

brown of the upper-parts all but totally conceals the dark grey: in the adults the brown tips are much less developed, and there is scarcely any difference in colour above and below. The largest specimen (a skin) has the tarse  $\frac{7}{8}$  in. A female skin in spirit measures about 5 in., with the tail nearly 3 in.; tarse *plus*  $\frac{3}{4}$  in. Amoy.\*

S. — ? The young of a large species of Shrew, which at first sight might be deemed an *albino*, but on closer examination is seen to be of a very albescent grey colour, which is probably typical. Extremely doubtful as a *leucoid* variety of the preceding.

SCIURUS CASTANEOVENTRIS, Gray, *Br. Mus. Catal. : Sc. griseopectus, nobis, J. A. S. XVI, 873.*

MUS DECUMANUS, L.

M. FLAVESCENS, Gray. Not full-grown apparently.

M. — ? A diminutive species seemingly; rather than the young of a Mouse affined to M. MUSCULUS; approximating the description of M. VAGUS, Pallas, only the tail is of the same length as the head and body. Entire length about 4 inches only; the tarse with toes  $\frac{5}{8}$  inch, or decidedly long in proportion. Ear-conch as in M. MUSCULUS; but more clad with small hairs within. It is not desirable to name it from a single skin.

CERVUS TAIUANUS, nobis, *n. s.*† The 'Spotted Deer' of China has been currently but vaguely identified with the Axis or 'Spotted Deer' of India; but I have long doubted the correctness of that identification. The question is completely decided, so far at least as the Deer of the island of Formosa is concerned—and I am tolerably sure that this is the (imported?) 'Spotted Deer' of China,—by a skull now sent by Mr. Swinhoe, which belongs strictly to the *Elaphine* and not to the *Axine* group of Deer: being the smallest and southernmost in its distribution of that group, the northern tropic crossing the middle of the island, and the southern cape of Formosa lying in about the same

\* I have since obtained what seems to be the same species from the vicinity of Calcutta; and Major Tytler assures me that he has several specimens collected at Barrackpore: but it seems distinct from a still darker Shrew sent from S. Malabar, my dubious S. VIRIDESCENS, *J. A. S. XXVIII, 285.* More extensive comparison of the skulls, especially, is needed to determine the identity or non-identity of these Shrews from various localities satisfactorily. I had long been assured of the existence of a large black Shrew in Lower Bengal, which the natives imagine to be fearfully venomous!

† This name is suggested by Mr. Swinhoe, in reference to the island's name of Taiwan, *seu* Formosa.

parallel as our Bengal Sandheads. All that Mr. Swinhoe says of the animal is that "the Formosa Deer are of a reddish colour with white spots, and may probably be the Indian species." The spots, I suspect, indicate the summer coat of the animal, as in various other species more or less (*e. g.* our Indian *Bára-sing'ha* and Hog Deer, the European Fallow Deer, &c.), and are not permanent at all seasons as in the Axis.\* Whether in the details of the skull, or in the ramification of the horns, there can be no hesitation about the affinities of the Formosan Deer. It has well developed upper canines, which are wanting in the Axis; and the same large round infra-orbital foramina as in *C. ELAPHUS* and its immediate congeners. The skull is indeed a diminutive of that of *C. ELAPHUS*: but while all the permanent teeth are complete and well worn down (far more so than in an Axis skull with fully developed horns), the horns might be supposed to indicate an immature animal, and their pedicles are elongated as in a two or three year old *C. ELAPHUS*! Either, therefore, the skull is that of an aged animal with declining horns, which is scarcely consistent with the condition of the frontal and other sutures (any more than with the length of the horn-pedicles, as compared with other species), or the horns may be supposed to represent the typical development, corresponding to that occasional in a young animal of the larger typical Stags! They are little longer than the skull, do not spread much, and incline inwards at the tips; are slender, and the branches or antlers are mere snags; there is no 'bez-antler,' as commonly in young *C. ELAPHUS* and constantly (?) in *C. BARBARUS*;† but the

\* In a letter received as this was going to press, Mr. Swinhoe describes the animal in its winter vesture. "The Stag from the north I only know from hearsay. A species from Japan a neighbour has in keeping, and this I take to be true *C. SIKA*. Both are evidently distinct from the Formosan species, of which a fine male and female are lodged in quarters close to my house. A young male has just been shipped for Leyden. I give a few remarks as to the peculiarities of the living pair. They were too wild to permit of my taking exact measurements of them. The buck stands about 4 ft. from the forehead to the ground; the doe 3 ft. The buck has horns of about a foot long, with three anterior snags and one posterior. General tint reddish mouse-colour, with a black dorsal line from the shoulders to the tail, where it expands into the latter T (as it were), the buttocks beneath it and each side of the short tail being pure white. Inside of ears, base of the back of ears, under muzzle, throat, belly and inner thighs, also white. The top of the head is redder. Some long whitish hair on the throat and between the legs: a roundish tuft of long white hair on the outer side of each tibia. These last characters are more prominent in the buck."

† In the series of horns of *C. ELAPHUS* figured in Prof. T. Bell's 'History of British Quadrupeds,' the 'bez-antler' is omitted throughout!

beam is trifid, the first or lowest snag being *external* and inclining forward (representing the 'royal-antler'), beyond which the final division is transverse to the axis of the body. Extreme length of horn (measured by callipers) 13 in.; greatest distance of pair apart (measured externally) 11 in.; tips apart  $7\frac{1}{2}$  in.; girth of beam, above frontal snag,  $2\frac{5}{8}$  in.; length of skull, inclusive of lower jaw *in situ*,  $10\frac{3}{4}$  in.; extreme breadth of orbits (posteriorly)  $4\frac{3}{4}$  in.: upper series of molars 3 in.

There is a C. SIKA, Schlegel (*Fauna Japonica*, t. 17), from Japan, cited by Dr. J. E. Gray (*P. Z. S.* 1850, p. 228), and thus briefly noticed by him. "Dark brown; cheeks and throat rather paler; rump brown, without any pale spot; tail pale, white beneath; hair harsh; horns rather slender, with a basal and a medial snag, and a subapical internal one." This description of the horn suits very well the Formosan animal; but the size is unnoticed, which could hardly be were C. SIKA to be *comparatively* so small an animal as C. TAOUANUS, and it may be, judging from Dr. Gray's mode of describing the horn, that the *Elaphine* type of ramification is a degree more developed in the Japanese species. He does not, however, mention the age of the animal he describes; and it is quite possible that it may temporarily represent, at a certain age, the particular development of horn which in C. TAOUANUS is characteristic of maturity. The colouring described may very well be that of the winter coat of the little Stag of Formosa.\*

\* Mr. Swinhoe since writes—"A Stag has just arrived here from the north, and is in the possession of a gentleman next door to me. It stands nearly 3 ft. at the shoulder, has a short head, and horns about 10 or 11 in. long, shaped thus \*\*\* Its face and over the eyes are black, neck and ears blackish-grey. Median line of back black, blending on the sides with blackish chesnut. Legs black, getting grey towards the hoof. Tail and buttocks white." Pretty clearly the Siberian Roe, CAPREOLUS PYGARGUS, (Pallas). But what is the so called 'Roe-buck' of the Amûr territory, noticed in the 'Journal of the Royal Geographical Society,' Vol. XXVIII, 397 (1858)?—CERVUS WALLICHI, or a kindred species? "The Roe-buck," we are told, "is an animal resembling the Elk, but has a smaller body, although the head is comparatively larger [!] Its flesh is savoury and nutritious; but the principal value of this animal lies in its horns, which contain at a certain period of the year—I think in March—a marrow [!], of peculiar medicinal properties, which is highly prized by the Chinese, who at the best season of the year, pay as much as sixty roubles (9l. 10s.) for a pair of good horns," &c. &c. This animal is mentioned in addition to "the Elk," the common Roe, and others.

Further particulars of the Chinese Deer have again since been received from Mr. Swinhoe, dated Dec. 8th, 1859. "The skull I sent you," he remarks, "was that of an elderly buck, one of a pair in the possession of a gentleman here. It died

CERVULUS REEVESII, (Ogilby). The small Chinese Muntjac. A skull with horns.

MANIS PENTADACTYLA, L. Skull and flat skin. This particular species of Pangolin has long been identified as an inhabitant of China, and was obtained by Dr. Cantor in Chusan.\*

while in his care, and its skin was so worthless that I did not keep it. The doe is still alive and in good health, and from her personal appearance I observe that your surmise as to the summer duration of the white spots is quite correct. She has already nearly lost all the white marks. I hear that there are several more of the same species, in the possession of a Mandarin here, and I intend shortly visiting him to inspect them. As far as I have yet ascertained, the species is purely Formosan. A larger Stag replacing it in Shantung and North China with large branching horns, and having a redder coat [*i. e.* summer vesture]. This other species I am assured is also found in Formosa, but this requires confirmation. The small Muntjac (CERVULUS REEVESII), 'kina' of this dialect, is abundant in Formosa, having myself met with it there and seen skins. The other Deer-skins shewn me on my tour round Formosa were all of the spotted species. You say that no *Elaphine* Deer are found [in India] south of the Himalayas. Let me remark that this Deer is from Formosa, where I have seen mountains covered with snow in summer; and it is most probable that these animals are sold by the savages to the Chinese settlers, as in our inland tour over the hills for some 40 miles we met none, and the Chinese spoke of them as coming from the mountains, and of their skins as forming articles of barter.

"We have a Japanese Deer at Amoy with horns short and somewhat like those of the Formosan. It is not so elegant as mine, shorter in the legs, about the same height, and of a far more *Stag* aspect. This I doubt not is the C. SIKA of Schlegel, but what our large northern Stag can be I have not had the opportunity to ascertain. There are a few of the horns of the Formosan species to be got, which I will try to procure for you."

\* The Chinese, like the natives of India, class the Pangolin as a fish, and it is curious that both people approximate it to certain Carps. Thus in India this animal is known as the *Jungli-mâtch* (Jungle-fish), or *Bân Rohi* (Jungle Rohi), in reference to the ROHITA VULGARIS, or *Cyprinus rohita* of B. Hamilton. In some amusing notices of Chinese Natural History, published in the 'Chinese Repository' for 1838, we find the Pangolin thus described (p. 48). "The *ling-le*, or 'Hill Carp,' is so called, says the *Pun Tsaou*, because its shape and appearance resembles that of the *le* or Carp; and since it resides on land, in caves and hills, it is called *Ling*, a character compounded of *yu* fish, joined to the right half of *ling*, a high rocky place. It has by some been termed the *Lung-le*, or 'Dragon-carp,' because it has the scales of the Dragon; and by others *Chuen shan kéas*, or 'boring hill-scales,' because it is the scaly animal that burrows in the hills: the last name is the one by which the creature is best known among the people of Canton. An ancient name is *Shih ling yu* or 'stony hill-fish,' given to it because the scales on its tail have three corners like the *ling kéa*, or 'water calthrops,' and are very hard. This animal, for which the Chinese have as many synonyms as some anomalous Perch or *Hedysarum*, is the Manis, Pangolin, or Scaly Ant-eater, and is often seen in the hands of the people of Canton, by whom it is regarded as a very curious 'muster.' They consider it as 'a fish out of water,' an anomaly irreconcilable with any classification; and in the standard treatises on Natural History, it is placed among the Crocodiles and fishes." Further details are given; but I pass to an amusing description of this animal by the old Dutch traveller Linschoten, translated into quaint old English. He, too, describes it as "a strange Indian fish," caught in the river of Goa,—“the picture whereof, by commandment of the Archbishop of that city was painted, and for a wonder sent to the king of Spaine.” He says:—"It was in bignesse as great as a middle-

sized Dog, with a snout like a Hog, small eyes, no eares [the particular species has a small ear-conch], but two lobes where his eares should be; it had foure feete like an Elephant, the tayle beginning somewhat upon the backe, broad and then flat, and at the very end round and somewhat sharpe. It ranne along the hall upon the floore, and in every place in the house snorting like a Hog. The whole body, tayle, and legs being covered with scales of a thumbe breadth, harder than iron or steel [!]. We hewed and layed upon them with weapons, as if men should beate upon an anvill, and when we strooke upon him, he rouled himself in a heape, head and feet together, so that he lay like a round ball, we not being able to judge whether he closed himself together, neyther could we with any instrument or strength of hands open him againe, but letting him alone and not touching him, he opened himself and ranne away, as I said before."

So little is known of the mammalia of China that any contribution on the subject is of interest to zoologists. There is an animal known at Shanghai as the 'Musk Cat,' which I suspect is a species of Marten unknown to naturalists. It is thus described:—

"A beautiful animal, of about the size of the common Cat, but longer in form; in fact, somewhat resembling the Marten, with a long bushy tail, like the brush of a Fox. Emits an exceedingly powerful and by no means disagreeable musky odour. Lives in holes of the ground, and also climbs into trees and bushes in search of birds and their nests. Exceedingly destructive to the Pheasants (*PHASIANUS TORQUATUS*) when sitting; and is much hunted by the natives for its fur." *Bengal Sporting Magazine*, n. s. II, 642 (1845). Probably identical with the "large Marten" of the Amûr territory noticed in *Journ. Roy. Geogr. Soc.*, XXVIII (1858), p. 424.

Again, in the bird class, there is a Chinese Bustard well known to sportsmen from Amoy and also to the northward, but which has not yet been systematically described, so far as I can learn. The following is a notice of it from the same paper, p. 529.

"A species of Bustard, somewhat like the common mottled English Turkey, only smaller. These birds are generally found singly, at least during the time we were there (November and the winter months being the season in which we beat for them): they are exceedingly shy and difficult of approach, and are usually found in the long grass and fir-clumps: they seem to rise with difficulty, running a considerable distance preparatory to their taking wing, during which time they call and cackle, which seems extraordinary, as they are generally found as odd birds." Mr. Swinhoe is well aware of the existence of this Bustard, but hitherto has been unable to procure a specimen, on account of the estimation in which it is held for the table.

For the same reason, comparatively few skins of Bustards are preserved anywhere, especially of the larger species; and so it happened that the Great Bustard of Australia, though met with even by Cook and repeatedly mentioned by Flinders and other early navigators, remained unknown to European naturalists until Mr. Gould's visit to that country! Capt. Cook, it may not be remembered, on his first voyage, proceeding northward from Botany Bay, landed a second time on the continent of Australia, a little to the south of the Tropic of Capricorn, and there he shot "a kind of Bustard weighing 17 lbs.," and named the landing-place *Bustard Bay!*

From a notice published in the 'Journal of the Royal Geographical Society,' Vol. XXVIII, 148 (1858), it appears that—"Of birds, the black and the white Cockatoos, bronze-winged Pigeons of various kinds, and the Bustard (or 'wild Turkey' of the colonists), were all found in the valley of the Victoria, but they were all much smaller than their kindred of the south." Probably, therefore, distinct species, according to the common acceptation of the phrase, or such as would be figured as different species by Mr. Gould.

In a collection of Chinese paintings of birds, among numerous species at once recognisable, was one of a very fine *BONASA* or 'Ruffed Grouse,' as yet undescribed. The collection referred to was taken to England by the late Viscount Hardinge.

## AVES.\*

CIRCUS — ? Female. Affined in general appearance to *C. æRUGINOSUS*, but apparently distinct. Mr. Swinhoe writes—" I have at last succeeded in procuring what I take to be the male of this species, bluish-grey on the wings and white on the under-parts with a few streaks. *C. CYANEUS* is also common with us.

*BUTEO VULGARIS*, Bechstein; *B. vulgaris*, var. *japonicus*, Temminck and Schlegel (apud Swinhoe), though why so distinguished I cannot perceive.

*MILVUS MELANOTIS*; *Haliaëtus melanotis*, Gray, Hardw. *Ill. Ind. Zool.* Like *M. GOVINDA*, Sykes, but having a stouter beak, and the plumage of the *mature* bird marked with pale streaks on the upper-parts.

CYPSELUS — ? Like *C. AFFINIS*, Gray, of India, but with the crown and tail conspicuously blacker, and the tail distinctly sub-furcate.

*CORVUS SINENSIS*, Gould; Horsfield, *Ind. Mus. Catal.*, II, 556. Exceedingly near to the common *C. CULMINATUS*, Sykes, of India, Burma, and the Malayan peninsula, but decidedly larger, and I now doubt if either can be correctly identified with *C. ORIENTALIS*, Eversmann, of Middle Asia.†

\* For other Chinese birds sent, vide Vol. XXVIII, p. 280.

† *C. ORIENTALIS* is thus distinguished by Prof. Eversmann from the European *C. CORONE*, of which latter the late Dr. Horsfield notes in his Catalogue two specimens from Pushut, and also *C. CORNIX* from Mesopotamia and Afghānistān!

"*CORVUS CORONE. Cæruleo ater, rostro modice acuminato, lined elevatâ horizontali infra nares, tomium in rostri medio attingente.*

"*CORVUS ORIENTALIS. Cæruleo-ater, rostro valido, crassiusculo, incurvo, tomis continue involutis, mandibulari apice recto, spatio inter nares et tomium maxillare rotundato, lævi.*

"*Exemplaria mea circa fluvium Narym, ultra oppidam Buchtarma, occisa sunt.*" (*Addenda ad celeberrimi Pallasii Zoographiam Rosso-asiaticum. Fasciculus II, A. D. 1841.*)

Over India generally and Ceylon, we have only *C. CULMINATUS* and *C. SPLENDENS*; the latter found exclusively where there is a considerable human population. It is only of late years that *C. SPLENDENS* has found its way into Arakan; but in Pegu there is a black race of it, and a nearly black race of it in Ceylon. Mr. F. Moore, however, describes a *C. TENUIROSTRIS* from Bombay. "Plumage above glossy purple-black, palest on the head, neck, back, and body beneath, and these having an ashy cast; forehead jet-black, and contrasting with the ashy cast of plumage of the crown. Length 18 in.; of wing  $12\frac{1}{2}$  in.; tail 7 in.; bill to gape  $2\frac{1}{4}$  in.; and tarse  $2\frac{1}{4}$  in."

*C. CULMINATUS* we have received from Malacca, where it co-exists with *C. MACRORHYNCHOS*, Vieillot, a species with remarkably long and slender bill, measuring  $2\frac{3}{4}$  in. to gape; and this again appears to differ from *C. ENCA*, Horsfield,

C. TORQUATUS, Cuv. : *C. pectoralis*, Gould, *P. Z. S.* 1836, p. 18 ; *C. dominicanus*, Bonap. ; *C. dauricus* apud G. R. Gray, *Gen. Birds*, II, 315.

PICA MEDIA, nobis : *P. sericea*, Gould.

PARUS MINOR, Temminck and Schlegel (figured in Gould's 'Birds of Asia'). Like *P. CINEREUS*, Vieillot, but with green on the fore-part of the back.

LEUCODIOPTRON CANORUM, Schiff. ; *Turdus canorus*, *T. sinensis*, et *Lanius faustus*, L. ; *Garrulax sinensis* apud Gray, nec *G. chinensis*, nobis, Catal. No. 483, which is a Tenasserim species, doubtful if likewise inhabiting China. Fowchow.

GARRULAX PERSPICILLATUS, (Gm.)

TEMENUCHUS CINERACEUS, (Tem.)

PASSER MONTANUS, (L.), var. Although alike in size and markings, specimens of this bird from different regions are readily distinguishable. The British are much darker ashy underneath, like *P. DOMESTICUS* as compared with its Indian representative ; those from Arakan are considerably more rufous on the back ; while the Chinese race is simply whiter underneath than the European. The Sikhim race, if I remember rightly, resembles the Chinese one ; while specimens from Singapore and Java are probably like those from Arakan. I have never seen this bird from the N. W. Himaláya ; and the Afghán *P. MONTANUS* of Capt. T. Hutton proved to be *P. SALICICOLUS* (v. *hispaniolensis*). Nevertheless, in Dr. Horsfield's Catalogue, examples of the present species are noted from Kandahar.

EUSPIZA PERSONATA, (Tem.) Specimen of a female.

ALAUDE GULGULA (?), Franklin ; *A. calivox*, Swinhoe, 'Zoologist,' p. 6723 (1859). I have only recently seen the true *A. MALABARICA*, Scopoli, from S. India, which differs from *A. GULGULA* of Bengal and

of Java, according to Mr. F. Moore's description and admeasurements of the latter.

In the N. W., the true British Raven (*C. CORAX*) is common in the Punjáb and Afghánistán ; but is replaced by a still larger race in Tibet, the *C. TIBETANUS*, Hodgson. In Pesháwur, Kohát, Afghánistán, and Kashmir, the European Rook (*C. FRUGILEGUS*) occurs ; and in Kashmir also the European Jackdaw (*C. MONEDULA*) ; but the Chinese and Japanese Rook (*C. PASTINATOR*, Gould,) is distinct, and also the Chinese Jackdaw (*C. DAURICUS*, Pallas). The Hooded Crow (*C. CORNIX*) extends eastward to Afghánistán, and the European Carrion Crow (*C. CORONE*) to Pushut, as noticed in the text.

Upper India, by having a well developed pointed crest, as in the GALERIDÆ. An Amoy specimen approximates the true GULGULA.

MOTACILLA LUGUBERIS, Pallas (apud Swinhoe) : M. LUZONIENSIS in winter dress *apud nos*, *J. A. S.* XXVIII, 280 : but very like M. ALBA (*vera*) in winter dress.

LANIUS SCHACH, Gmelin.

DRYMOICA EXTENSICAUDA, Swinhoe, *n. s.*

PRINIA SONITANS, Swinhoe, *n. s.*

ORTHOTOMUS PHYLLORAPHEUS, Swinhoe, *n. s.*

CISTICOLA TINNABULANS, *n. s.* (?)

} These have been  
} described by Mr.  
} Swinhoe in an  
} article on the

birds of Amoy forwarded to the Society for publication.

MERULA MANDARINA, Bonap.

TURDUS RUFULUS, Drapiez (*T. modestus*, Eyton). Var. ?

T. DAULIAS, Tem. et Schl., *Fauna Japonica* (apud Swinhoe). To me this appears to be a mere variety of the last.

PETROCOSSYPHUS MANILLENSIS, (Gm.)

PRATINCOLA INDICA, nobis.

ERYTHROSTERNA LEUCURA, (Gm.)

ZANTHOPYGIA NARCISSINA, (Tem.) : *Z. chrysophrys*, nobis, *J. A. S.* XVI, 124. Male, differing from the female described (*loc. cit.*) by the much brighter and more flame-coloured tint of the yellow generally, which on the chin and throat is of a deep orange-colour ; the difference, however, being far less than in the sexes of *Z. tricolor*, (Hartlaub), v. *Z. leucophrys*, nobis, of the Malayan peninsula.

CURRUCA (?) CANTILLANS, Swinhoe.

ACROCEPHALUS MAGNIROSTRIS, Swinhoe, *n. s.* : *Salicaria turdina orientalis*, T. et Schl. (apud Swinhoe).

PHYLLOSCOPUS SYLVICULTRIX, Swinhoe, *n. s.*

PH. TENELLIPES, Swinhoe, *n. s.*

PERICROCOTUS CINEREUS, Strickland, *fœm.* Amoy.

PYCNONOTUS ATRICAPILLUS, (Vieillot), apud Lord A. Hay, *Madr. Journ.* XIII, pt. II, 160 ;\* nec *Ægithina atricapilla*, Vieillot, which is another PYCNONOTUS from Ceylon, the *Sylvia nigricapilla*, Drapiez, *Rubigula aberrans*, nobis, *J. A. S.* XV, 287, XVI, 272, and *G. meropinus*, Bonap.,—Levaillant, *Ois. d' Afr.* pl. 140, where much too dully coloured). The Chinese species being *le Gôbe-mouche à tête*

\* If I mistake not, *Muscicapa atricapilla* of Vieillot (nec Lin.)

*noire de la Chine* of Sonnerat, described *J. A. S.* XIV, note to p. 569, also *Hæmatornis chrysoorrhoides*, Lafresnaye, *Rev. Zool. &c.* 1845, p. 367, and *P. hæmorrhous* apud Hartlaub, *Rev. Zool. &c.* 1846, p. 1. I have no means of determining upon which of the two species M. Vieillot first bestowed the name *ATRICAPILLUS*; but as both cannot bear it in the same genus, I propose to retain *ATRICAPILLUS*, (Vieillot), for the Chinese bird, and *NIGRICAPILLUS*, (Drapier,) for that of Ceylon.\*

*P. SINENSIS*, (Gmelin): *Turdus occipitalis*, Tem.

*ORIOLOUS CHINENSIS*, Gmelin.

*HIATICULA PHILIPPINA*, (Scopoli).

*TRINGA ALPINA*, L.; *TR. SUBARQUATA*, (Gm.), *apud nos*, XVIII, (280.)

*BUPHUS CABOGA*, (Pennant).

*ARDEOLA SPECIOSA*, (Horsfield, *vera*), in summer and winter dress.

*ARDETTA SINENSIS*, (Gm.)

*LARUS FUSCUS*, L.

*L. KITTLITZII* (?), Bruch: *GAVIA KITTLITZII* (?), Bonap.

*THALASSEUS PELICANOIDES*, (King): *Sterna cristata*, Stephens (nec Swainson); *St. velox*, Rüppell. Specimens from the Bay of Bengal, the Maldives, and from China, appear to be perfectly identical; and correspond, so far as can be adjudged, with Rüppell's figure.

*ANOUS STOLIDA*, (Gm.)

*PODICEPS CRISTATUS*, L. Winter dress.

*P. MINOR*, Gm. (or *P. PHILIPPENSIS*, Gm., if this be considered separable). Winter dress.

#### REPTILIA.

*PYTHON MOLURUS*, (L.) A flat skin, more than 13 feet long without the head, from Formosa!

*BUNGARUS MULTICINCTUS*, nobis, *n. s.* Another flat skin, obviously of a *BUNGARUS*, nearly affined to *B. FASCIATUS*, (Schneider); but the golden bands only one-sixth as broad as the black bands, and numbering more than fifty in a specimen 4 ft. in length *minus* the head.†

\* The late Prince of Canino proposed the generic name *MEROPIXUS* for the Ceylon species.

† Mr. Swinhoe writes, Dec. 8th—"In Davis's 'China,' II, 333, mention is made of a *very* poisonous striped *black and white* Snake having reached England

## MOLLUSCA.

A few marine and fresh-water shells, already in the museum with the exception of a small *LYMNEA* and a minute *PLANORBIS*.

2. From E. L. Layard, Esq., on behalf of the Government Museum, Cape-town.

A fine collection of skins of mammalia and birds; those quite new to the museum being here distinguished by an asterisk prefixed.

## MAMMALIA.

*CYNOCEPHALUS PORCARIUS*, (Bodd.) The Cape Baboon, or *Chacma*. Adult male.

\**XANTHARPYIA HOTTENTOTA*, (Tem.)

\**MEGALOTIS CAAMA*, (A. Smith).

\**PROTELES CRISTATUS*, (Sparrman). Tail wanting.

\**GENETTA TIGRINA*, (Schn.) 2.

\**HERPESTES ICHNUEMON*, (L.): *Ichn. Pharaonis*, Geoff.

\**H. CAFFER*, Wagner.

\**H. PALUDOSUS*, Cuv.: *Managusta urinatrix*, A. Smith.

\**FELIS SERVAL*, Schreber.

\**F. CAFFRA*, Desmarest.

\**ZORILLA STRIATA*, (Shaw).

\**CHRYSOCHLODIS HOLOSERICEA*, Licht.: *Chr. hottentota*, A. Smith.\*

*XERUS SETOSUS*, (Forster).

\**GERBILLUS AFER*, Gray. 2.

\**MUS PUMILUS*, Sparrman. 2.

*BATHYERGUS MARITIMUS*, (Gm.) 3.

from Canton. This must be our *BUNGARUS* which you propose to name *MULTICINCTUS*. Its venom is indeed poisonous, and a gentleman at Swatow was nearly dying from the effects of the bite of one that had concealed itself in his room. It haunts sewers and chinks in the jetties and such places, where it subsists on Rats. It is not by any means common, but in very high tides the overflowing water often drives these animals from their holes and lurking-places; but they are difficult to procure as the natives are paid to attack them. It is called here the *Pivâ-ke-ka* and *How-swanchwa* ('umbrella snake')." I should say, both from the name 'Umbrella Snake' and from the habits indicated, that a *Cobra* (*NALIA*) was intended; and, so far as I am aware, the nearly affined *BUNGARUS FASCIATUS* subsists entirely on other Snakes, of which it is a great devourer; hence it is styled *Râj-sâmp* by the natives of Bengal, as realizing their idea of the attributes and prowess of a ruler!

\* A species previously in the museum, presented by Major W. S. Sherwill and considered heretofore as *CHL. HOLOSERICEA*, proves to be *CHL. DAMARENSIS*, Ogilby, *P. Z. S.* 1838, p. 5.

\*GEORHYCHUS CAPENSIS, (Pallas).

G. CÆCUTIENS, (Licht.)

\*LEPUS SAXATILIS, F. Cuv.

\*L. CAPENSIS, L.

HYRAX CAPENSIS, Pallas.

OREOTRAGUS SALTATRIX, (Bodd.). 'Klip-springer.'

\*CALOTRAGUS MELANOTIS, (Thunb.) 'Grys-bok.'

\*C. TRAGULUS, (Forst.) 'Stein-bok.'

\*ELEOTRAGUS CAPREOLUS, (Thunb.) 'Rey-bok.'

\*CEPHALOPHUS GRIMMIA, (L.) apud Gray (*mergens*, Blainville).

'Duiker-bok.'

\*C. MONTICOLUS, (Thunb.) 'Blau-bok.'

ORYCTEROPUS CAPENSIS, Geoffroy. 'Aard-vark.'

#### AVES.

\*SERPENTARIUS SECRETARIUS, (Scop.)

TINNUNCULUS RUPICOLUS, (Daud.) 2.

\*BUTEO JACKAL, (Daud.) 2.

BUBO (?) MACULOSUS, (Vieillot). Identical in species with the Somâli specimen correctly referred to *Bubo (?) africanus*, (Tem.), in *J. A. S. XXIV*, 298, though very differently coloured. Mr. G. R. Gray notes this species both from S. and W. Africa.

STRIX FLAMMEA, L.

LÆMODON NIGER, (Tem.)

TURACUS PERSA, (L.)

\*CORVUS CAPENSIS, (Licht.)

PYROMELANA CAPENSIS, (L.) Male in winter dress.

HYPHANTORNIS AURIFRONS, (Tem.)

H. ——— ? With yellow crown and under-parts, black forehead, cheeks, chin and throat; upper-parts greenish-yellow, with dusky striæ; wing-edgings whitish, forming two cross-bands. Wing  $3\frac{1}{4}$  in.\*

\*SERINUS CANICOLLIS, (Sw.), 2. 'Cape Canary.'

\*ALAUDA MAGNIROSTRIS, (Stephens).

\*AGRODROMA SORDIDA (?) Rüppell). 2. Bill shorter and hind-

\* Perhaps *H. MELANOTIS*, (Lafresnaye), *Mag. de Zool.* 1839, pl. 7 (which I have not for reference); but not *melanotis*, (Sw.), which = *PERSONATA*, (Vieillot); nor *melanotis*, Guérin, *hodié* GUERINI, G. R. Gray.

claw longer than in Rüppell's figure of his *Anthus sordidus*, the latter also rather longer than in specimens from Abyssinia and from the Punjab Salt Range (*vide J. A. S. XXIV, 258*). The latter are also a shade more rufescent, have less distinct pale supercilia, and the penultimate tail-feather has a well defined pale mark at tip, which is not the case with the Cape specimens.

LANIUS COLLARIS, L. 2.

TELOPHONUS BACBAKIRI, (Shaw).

MERULA OLIVACEA, (L.)

COLUMBA ARQUATRIX, (L.) 2.

ÆNA CAPENSIS, (L.)

\*PTEROCLES NAMAQUA, (Gm.) 2.

FRANCOLINUS (SCHLOPTERA) AFER, (Latham.)

STREUTHIO CAMELUS, L. Chick. Also imperfect skin of a superb wild-shot male, with head and neck, wings, and tail; the value of which at Cape-town is £5.

\*CHORIOTIS CRISTATA, (Sc.): *Otis kori*, Burchell. Head of a specimen weighing 25 lbs. This is the largest of the Bustards, and is immediately congeneric with the great Bustards of India, Arabia, and Australia respectively. *Pauw* (or 'Peacock') of the Dutch colonists.

\*EDICNEMUS CAPENSIS, Licht.

STEPHANIBIS CORONATA, (L.)

\*HOPLOPTERUS SPECIOSUS, (Wagler).

\*CHARADRIUS MARGINATUS (?), Vieillot.

\*RHYNCHEA CAPENSIS, (L.). By no means satisfactorily distinguishable from RH. BENGALENSIS.

FULICA CRISTATA, Gm.

\*PORZANA NIGRA, (Gmelin).

\*LARUS (GABIANUS, Bonap.) PACIFICUS, Lath. Adult. Rather smaller than the Australian species figured by Gould under this name, and without (?) the black bar on the tail. Tail mutilated. The late Prince of Canino referred Gould's species to J. GEORGI, King.

PHAËTON ÆTHEREUS, L.

\*PHALACROCORAX CAPENSIS, (Sparman).

\*HYPOLEUCUS MELANOGENIS, nobis, *n. s.* Very like H. VARIUS, (Gm., *Ph. hypoleucos*, Gould), of Australia, but distinguished by its

black cheeks and crest-feathers  $1\frac{3}{4}$  in. long. Wing  $10\frac{1}{2}$  in. Tail 5 in. Bill to forehead  $2\frac{1}{16}$  in. Foot 4 in. From the 'Crozettes.'

CHENALOPEX ÆGYPTIACA, (Gm.)

ANAS FLAVIROSTRIS, A. Smith (*A. Ruppelli*, nobis).

QUERQUERDULA ERYTHORHYNCHA, (Gm.)

PODICEPS CRISTATUS, L.

APTENODYTES PENNANTII, G. R. Gray.

\*CHEYSOCOMA CATARRACTES, (Gm.) Feet wanting.

3. From Capt. Hodge, commanding the guard-ship 'Sesostris,' at Port Blair.

Two additional collections of sundries from that locality. The list of Andamánese mammalia is now extended to five species; *viz.*

PARADOXURUS MUSANGA (♂ Marsden), *v. typus* (?), F. Cuvier. Skull and other bones of a very aged individual, having naturally lost all of its true molars and most of its præ-molars, and the sockets of most of those of the lower jaw being completely closed up by deposition of bone; a single root only remains of three of the upper præ-molars respectively, and three præ-molars remaining in the lower jaw are worn away nearly to their bifurcation. The bones of the skull and face had long been completely united. The incisors, also, had been naturally dropped, save the outermost above, which is almost worn to the root; and the canines are excessively abraded, but what remains of them is remarkable for extraordinary size, considerably exceeding those of the common *P. MUSANGA* of Bengal, &c. This disposes me to hesitate in identifying the species positively, though in other respects the size and form of the skull accord satisfactorily with *P. MUSANGA*. Dr. Gray, in his British Museum catalogue, and the late Dr. Horsfield, in his catalogue of the specimens of mammalia in the India-house museum, regard the Malayan *P. MUSANGA* and the Indian *P. typus*, F. Cuv., as distinct species; but in Lower Bengal this animal varies much, some individuals being without markings and others being marked very strongly and undistinguishably from the Malayan specimens in our collection. It inhabits the whole eastern coast of the Bay of Bengal and Malacca Straits; and as it is quite impossible to distinguish many Bengal specimens from ordi-

nary Malacca specimens, I have no hesitation in following Dr. Cantor in regarding them as one and the same species.

The Andamán animal, with its extraordinarily large canines, may prove to be different; but it is likely that we shall soon receive a skin of it, that would help to decide the question. It is the species which has been lately noticed in various Indian Journals as "a sort of Mongoose" and "a kind of wild Cat;" and it is the only one as yet discovered in the Andamán islands appertaining to the Linnæan order *Feræ*.

MUS (LEGGADA ?) ANDAMANENSIS, nobis, *n. s.* The indigenous Rat of the Andamans,—a gigantic representative of the group LEGGADA, Gray, founded on the MUS PLATYTHRIX, Bennett, and M. LEPIDUS, Elliot, and to which my M. SPINULOSUS (*J. A. S. XXIII, 734*), obtained both in the Pánjáb and in S. Malabar, is likewise referable. Size about half that of full-grown MUS DECUMANUS, with tail fully as long as in that species; the colour of the upper-parts a shade or two darker, and of the lower-parts pure white. Form more slender, and the limbs proportionally less robust, than in M. DECUMANUS. Fur much coarser and conspicuously spinous, with a few long black fine hairs intermixed; passing the hand along the fur in a backward direction, a very audible crackling sound is produced. The flat spines are similar in character to those of my Prickly Dormouse from Malabar (PLATACANTHOMYS LASIURUS, *J. A. S. XXVIII, 289*), but are very much weaker; and the fur of the under-parts is soft. In fact this species is a magnified representative of M. SPINULOSUS, but with the rodent tusks proportionally much more robust; the two holding the relationship of Rat and Mouse towards each other. Length 8 or 9 in., and tail equal to the head and body; hind-foot with claws  $1\frac{1}{2}$  in.: ear-conch (posteriorly)  $\frac{3}{4}$  in. Length of dorsal spinous fur  $\frac{5}{8}$  in.; the spines being whitish on their basal half, and there is a soft dark ashy felt below the surface.

MUS MANEI, Gray. Taken from the stomach of a venomous Snake, from Port Blair; but too far softened by digestion to permit of the species being determined with absolute accuracy. (A good specimen has since been received entire in spirit.)

SUS ANDAMANENSIS, nobis (*J. A. S. XXVII, 267, XXVIII, 271*).

A nearly perfect skeleton of an adult boar ; the tail being, however, unfortunately again deficient.\*

HALICORE INDICUS, Owen, *vide* (J. A. S. XXVIII, 271.

\* Since mounted ; and the height at the shoulder is 19 or 20 in.—Can this be the species noticed in Bingley's *History of Quadrupeds*, as an inhabitant of Sumátra, and which certainly cannot be the *SUS VITTATUS*, S. Müller, which is the only species of wild Swine at present recognised as inhabiting that island, being also found in Java and Banka? For an enumeration of the wild Swine of the archipelago, *vide* J. A. S. XXVII, 268.

“ A species of wild Hog in Sumátra, of a grey colour, and smaller than the English Swine, frequents the impenetrable bushes and marshes of the sea-coast ; they associate in herds, and live on crabs and roots. At certain periods of the year they swim in herds, consisting of sometimes 1000, from one side of the river Siak to the other at its mouth, which is three or four miles broad, and again return at stated times. This kind of passage also takes place in the small islands, by their swimming from one to the other. On these occasions they are hunted by the Salettians, a Malay tribe, residing on the coasts of the kingdom of Siak.

“ These men are said to smell the Swine long before they see them, and when they do this they immediately prepare their boats. They then send out their Dogs, which are trained for this kind of hunting, along the strand, where, by their barking, they prevent the Swine from coming ashore and concealing themselves among the bushes. During the passage the boars precede, and are followed by the females and young, all in regular rows, each resting its snout on the rump of the preceding one. Swimming thus in close rows, they present a singular appearance.

“ The Salettians, men and women, meet them in their small flat boats. The former row and throw large mats, made of the long leaves of the *Pandanus odoratissima*, interwoven through each other, before the leader of each row of Swine, which still continue to swim with great strength, but soon pushing their feet into the mats, they get so entangled as to be either disabled altogether from moving, or only to move very slowly. The rest are, however, neither alarmed nor disconcerted, but keep close to each other, none of them leaving the position in which they were placed. The men then row towards them in a lateral direction ; and the women, armed with long javelins, stab as many of the Swine as they can reach. For those beyond their reach they are furnished with smaller spears, about six feet in length, which they dart to the distance of thirty or forty feet with a sure aim. As it is impossible for them to throw mats before all the rows, the rest of these animals swim off in regular order, to the places for which they had set out, and for this time escape the danger ; and the dead Swine, floating around in great numbers, are then pulled up and put into larger boats, which follow for the purpose.

“ Some of these Swine the Salettians sell to the Chinese traders who visit the island ; and of the rest they preserve in general only the skins and fat. The latter, after being melted, they sell to the Maki Chinese ; and it is used by the common people instead of butter, as long as it is not rancid, and also used for burning in lamps, instead of cocoa-nut oil.”

I have somewhere read a similar account of the habits of *S. PAPUENSIS*.

Of the large Indian Hogs, I am now satisfied of the existence of three well marked races, or species, which are quite as distinct from each other as are the various species of the archipelago, figured and described by Dr. S. Müller and others.

One is the proper Bengal boar, found also in Kuták, which is by far the most powerful, as shewn by the entire skeleton, and which has the longest and most formidable tusks of any, the lower commonly protruding from the socket from 3 to 3½ in. over the curve. It is specially distinguished by the breadth of its

Of birds, fifteen additional species have been added to the sixteen mentioned in p. 272 *et seq.* and p. 412; but as yet we have hardly made a beginning with the ornithology of the Andamans.

Of new species, the most notable is a superb large black Woodpecker of the division MULLERIPICUS of the late Prince of Canino (*Hemilophus*, Swainson).

M. HODGEE, nobis, *n. s.* Wholly black in both sexes, except the crown, occiput, and moustaches of the male, which are vivid crimson as usual, and the occiput only of the female. It is smaller than M. HODGSONII, (Jerdon), of Malabar, or M. JAVENSIS, (Horsfield), of the Malayan peninsula and more western islands; the closed wing measuring but  $7\frac{1}{4}$  in., the middle tail-feathers 6 in., and the beak to forehead  $1\frac{3}{4}$  in.

ANTHUS RUFOSUPERCILIARIS, nobis, *n. s.*; *A. pratensis* apud nos, J. A. S. XXIV, 473, from Pegu. Like *A. PRATENSIS*, but with the

occipital plane, which is 2 to  $2\frac{1}{4}$  in. where narrowest, and by the shortness of the tail, which numbers only 13 or 14 vertebræ. This may be distinguished as *S. BENGALENSIS*, nobis.

Another is the ordinary *S. INDICUS*, Gray (*S. cristatus*, Wagler), as noticed by Dr. Gray from the Madras Presidency; it being found over the whole of India, the highlands of Ceylon, and also in Arakan, but I cannot pronounce on its diffusion further. It is likewise an inhabitant of Lower Bengal, as we have a stuffed specimen of a particularly fine boar of this race that was speared near Calcutta. The domestic Pigs of India appear to be mainly (if not wholly) derived from it. The entire skeleton is conspicuously less robust than in the preceding, the tusks less developed, the lower rarely projecting  $2\frac{3}{4}$  in. from the socket; the occipital plane where narrowest rarely exceeds  $1\frac{3}{8}$  in., and the tail is conspicuously much longer, consisting of about 20 vertebræ. We have the skull of a sow of this race, which has the fully developed tusks of the boar,—of course a rare anomaly.

The third is the species with very elongated skull and narrow occipital plane, where narrowest 1 in. only, inhabiting the lowlands of Ceylon, which I denominated *S. ZEYLANENSIS* in J. A. S. XX, 173, and which may also be *S. AFFINIS*, Gray, from the Nilgiris, mentioned in the *List of the Osteological Specimens in the Collection of the British Museum*, where *S. INDICUS* is cited from the Nepal hills and *tarai*, and also Malabar.

I have no skull of an European wild Boar for comparison, but judging from Blainville's figures, our *S. INDICUS* approximates it more nearly than *S. BENGALENSIS* or *S. ZEYLANENSIS*.

In the new Russian territory of the Amûr, it appears,—“Of Cattle or Horses few were seen, but many *Swine of a peculiar kind*, and Fowls.” *Journ. Roy. Geogr. Soc.* XXVIII (1858), p. 381. Wild Hogs are found at all elevations in the Himalaya, and generally over Asia. Those of Indo-China, China, and the Malayan peninsula require to be carefully examined. As many as three species are reported to inhabit the plain of Mesopotamia. Wood, in his *Journey to the Source of the Oxus*, remarks that—“Descending the eastern side of Junas Darah, our march was rendered less fatiguing by following Hog-tracks in the snow. So numerous are these animals, that they had trodden down the snow as if a large flock of Sheep had been driven over it.”

supercilium and moustachial streak of a ruddy rust-colour. Closed wing  $3\frac{1}{4}$  in., tail  $2\frac{1}{4}$  in., and bill and hind-claw as in *A. PRATENSIS*, of which it may be regarded as a local variety or sub-species.

*OREOCINCLA INFRAMARGINATA*, nobis, *n. s.* Uniform dark olive above, with conspicuous pale rufescent-whitish supercilia, and light rufescent spots tipping the wing-coverts; beneath pale, inclining to rufo-fulvous on the breast and front of the neck, pure white at centre of belly; the lower tail-coverts dark olive largely tipped with white; each feather of the lower-parts, except on middle of throat and of belly, somewhat narrowly tipped with the colour of the back; outer caudal feathers successively more largely tipped with dull white, though even on the outermost these white tips are but slight. The usual *OREOCINCLA* markings on the inner surface of the wing. Bill dusky, and legs pale corneous. Closed wing  $4\frac{5}{8}$  in.; tail  $3\frac{1}{2}$  in., its outermost feathers  $\frac{3}{8}$  in. shorter than the middle pair; bill to gape  $1\frac{3}{16}$  in.; tarse  $1\frac{1}{16}$  in. Short first primary  $\frac{3}{4}$  in. long, the second equalling the fourth and a little shorter than the third. This bird approximates the female of *MERULA WARDII*, Jerdon.

Three other species of true Thrushes inhabiting the Andamans are—*Turdus rufulus*, Drapiez (*modestus*, Eyton), *Geocichla innotata*, nobis, and *Petrocosyphus pandoo*. The following have likewise to be added,—*Merops philippinus*, L., *Lanius phenicurus*, L., *Arundinax olivaceus*, nobis, *Pericrocotus speciosus*, (Lath.), *Hirundo rustica*, L. (juv.), *Osmotreron chloroptera*, nobis (heretofore only known from the Nicobars), *Chalcophaps indicus* (identical with the Indian race, but different from a pair received from the Nicobars, which seem to be *Ch. marlæ*, C. L. Bonap.); *Thalasseus affinis* (*Sterna affinis*, Raffles, *St. bengalensis*, Lesson, &c.), and *Onychoprion anasthætus*, (Scopoli).

The *Edolius* of the Andamans appears to be constantly a little larger than Malayan peninsula specimens, with more tendency to shew a rudimental frontal crest; this, however, is less developed than in Burmese and Tenasserim specimens.

Of *Temenuchus erythropygus*, nobis, I have seen no Andaman example yet with distinctly rufescent upper tail-coverts.

The black-naped Oriole I think will prove to be *Oriolus coronatus*, Sw. (*hippocrepis*, Wagler), being quite distinct from that of the neighbouring Nicobar islands, *O. macrourus*, nobis.

The *Dháyal* (*COPSYCHUS SAULARIS*) is common, and differs in no respect from that of Bengal and of India generally, as distinguished from the larger race of *W. Malasia*; but the *Sháma* (*KITTACINCLA ALBIVENTRIS*, nobis,) has much the appearance of being a fertile hybrid between *K. MACROURUS* and *COPSYCHUS SAULARIS*! In several specimens of it, however, I can detect no variation whatever, nor transitional examples variously intermediate; and the female more nearly resembles the male than in *K. MACROURUS*. I have a fine healthy pair of the Andamán *Sháma* alive, and the male is a fair songster, with some very deep notes alternating with some shrill and very *Dháyal*-like notes; and, so far as I have heard as yet, the song is more broken or delivered in snatches, like that of the *Dháyal*, or less continuous than in the common *Sháma*. The bird is also rather larger, with the bill somewhat larger in proportion; but I doubt if any practised ornithologist would hesitate about classing it in *KITTACINCLA* rather than in *COPSYCHUS*. There is a third *Sháma*, with a white head (as I am informed), in Borneo (*K. STRICKLANDI*, Mottley and Dillwyn); and a fourth species exists in *K. LUZONIENSIS*, (*Kitlitz*), of the Philippines. The female of the Andamán *Sháma* is of a duller colour than the male, especially on the wings and breast, which latter is glossless black; tail also shorter; and the legs in both sexes are carneous.

Of reptiles, the marine *Testudinata* of the Bay occur of course; but we have only received a very large skull of the common 'Loggerhead' Turtle (*CAOUANA OLIVACEA*), a species which is common towards the mouths of the Gangetic streams, and is often eaten here for the true edible Turtle (restricted *CHELONIA*); and here I may remark that I once received a young living 'Hawk's bill' or tortoise-shell producing Turtle (*CARETTA IMBRICATA*) from the interior of the Sundarbáns, which I kept alive for many months in fresh water. The 'Loggerhead' skull from the Andamáns measures  $8\frac{1}{4}$  in. long, inclusive of occipital projection, and  $4\frac{3}{4}$  in. in extreme breadth.

Of the *Loricata* or Crocodiles, it does not appear that any have yet been observed about the islands.

Of *Varanidæ*, a *HYDROSAURUS* quite similar to one before received from the Nicobar group. I can perceive no difference from the common *H. SALVATOR*, (*Laurenti*) *v. Varanus bivittatus*, (*Kuhl*), in

structure; but it wants the pale neck-streaks and body and caudal rings of ordinary *H. SALVATOR* of Bengal, Ceylon, &c., while the upper-parts are freckled throughout (save on the head) with white scales and tips of scales interspersed among the black scales, more copiously on the tail, and tending to form close and narrow transverse lines on the sides. I have never seen this marking in specimens of true *H. SALVATOR* obtained elsewhere; and it may be remarked that this species commonly attains the dimensions assigned by Dr. Gray to his Australian *H. GIGANTEUS*, viz. 78 in. We have examples of that length both from Lower Bengal and from Ceylon; and the occurrence of this reptile in Ceylon is the more remarkable, as it does not appear to have been hitherto observed in the peninsula of India.

No *Scincidæ* have yet been received.

Of *Geckotidæ*, two species, both of which appear to be undescribed.

*PHELSUMA ANDAMANENSE*, nobis, *n. s.* Differs from *PH. CEPEDIANUM*, (Peron), of the Mauritius, by having a rather (yet distinctly) less obtuse muzzle, which is conspicuously longer from the eye to the nostril; the auditory orifice is also much smaller, and round instead of oval; and the pattern of the markings of the dorsal surface is different. In *PH. CEPEDIANUM*, there are two sub-lateral pale lines, with intermediate pale spots more or less irregularly disposed: in *PH. ANDAMANENSE*, there are no sub-lateral lines, but a mesial one commencing on the nape and continued half-way along the back, the rest of the upper-parts being sprinkled with numerous spots which appear to have been bright red or orange: the *palettes* at the tips of the toes are pale in the Mauritius species, dark in the other; and I can distinguish no femoral or præ-anal pores in *PH. ANDAMANENSE*, but a fold of skin in place of them along the thighs: in *PH. CEPEDIANUM* the femoral pores are continued to meet the opposite series, at an angle which completes a triangle with the transverse vent. On the chin of our present species, there is a series of five plates of equal size and larger than the rest, anteriorly adjoining the labial plates. Length of head and body 2 in.; the tail, which had been renewed,  $1\frac{5}{8}$  in.

There can be no hesitation in referring this Gecko to *PHELSUMA*, Gray, though the former has hitherto been known to exist only in Madagascar and the Mascarine islands. The other appears to be a new form altogether;—

PUELLULA, nobis, *n. s.* Aspect of a HEMIDACTYLUS, but with no dilated palette on the toes, which are distinctly ribbed excepting on the unguinal phalanges. No femoral or præ-anal pores, but a large raised glandular space at the base of the thighs underneath, divided by a slight median groove on the anterior half, which deepens to form a large glandulous cavity on the posterior half, the labia of which are covered with scales larger than the rest; this structure being much less developed in the female sex. A very remarkable feature, for a Gecko, consists in a distinct rudimentary dorsal crest; and there is also a lateral fold of skin from the fore to the hind limbs, dividing the scales of the back from those of the belly, and another such fold margining the thighs anteriorly. The pupils of the eyes close vertically.

P. RUBIDA, nobis, *n. s.* Back and limbs above covered with minute tubercles, and also thickly studded with tubercles of a larger and uniform size, the former requiring a lens for their easy detection; on the tail are few only of the larger kind, and those disposed in transverse series on its basal half: scales of the head minute and uniform, those of the throat very minute, and those of the lower-parts small and uniform, save on the borders of the glandulous fissure, where they are a little larger; on the lower surface of the tail the scales are also larger. Bordering the lower labial shields in front are four large plates, the medial of which exceed the outer in size. Colour of the fresh animal very ruddy, a hue which soon disappears by exposure to the light in spirit. In the stronger-marked specimens a dark line passes backward from the eye, and meets its opposite upon the occiput; this V-like marking being succeeded by one or two others like it, and there are irregular narrow transverse bands throughout, composed of black tubercles interspersed among the rest, and a series of broad dark annuli on the tail. Length about 5 in., of which the tail is half. A common species at Port Blair. The young, 2 in. long, show some white specks on the neck, and the labial plates are alternately dark brown and white. This is also seen in the adults, but less conspicuously.

Of *Agamidæ*, a species of TIARA, D. and B.

TIARA SUBCRISTATA, nobis, *n. s.*: DILOPHYRUS apud nos, *J. A. S. XXVIII, 275.* Occiput and nape with a low crest, and merely a slight

serrated ridge along the back : gular pouch in the males only, covered with small keel-less scales of equal size ; the other scales of the lower-parts conspicuously carinated ; those of the upper-parts minute, arranged in irregular transverse series (as best seen by aid of a lens), their keels presenting a tuberculated appearance except towards the ridge of the back : a row of about ten large tubercles on each side commencing from the occiput. Colours various, but fugitive in spirit ; the young being much speckled and reticulated with greyish-black, and the full-grown mostly plain, with dark bands on the tail more or less distinct. Length 12 in., of which tail  $8\frac{1}{2}$  in. Common at Port Blair.

Of Snakes, we have received five harmless and two venomous species. The former are—

LYCODON AULICUS, (L.). Uniformly coloured variety.

DENDROPHIS PICTUS, (Gm.). Some beautiful varieties.

DIPSAS HEXAGONOTUS, nobis, *J. A. S.* XXIV, 360. Several young specimens. The adult remains to be described.

HERPETODRYAS PRASINUS ; *Coluber prasinus*, nobis, *J. A. S.* XXIII, 291. Large. Also inhabits the base of the Himaláya, Asám, Tenasserim, &c.

CERBERUS BÖEFORMIS, (Schneider).

The latter—

HAMADRYAS VITTATUS, (Elliot).

TRIMESURUS VIRIDIS, (Lacepède), var. *Cantori*, nobis, *J. A. S.* XV, 377. A TRIMESURUS which appears to be exceedingly common both in the Andamán and Nicobar islands is altogether similar in structure to the common TR. VIRIDIS, but varies much in colouring, being grass-green, brown, or blackish, either uniformly coloured or variously mottled ; but only in one mottled specimen from the Nicobars do I perceive the lateral line on the scales bordering the abdominal plates, which is commonly seen in continental examples of TR. VIRIDIS. In a green example from Port Blair, 4 ft. in length (!), there is no trace of this ; but I may here call attention to the fact that there are certainly two nearly affined species confounded under TR. VIRIDIS. One common in Lower Bengal has the scales more strongly carinated, very conspicuously so on the sides of the head, while those of the crown are roughly granular (a modification of the more developed keels), instead of being flat or almost flat as in the

other. In this race there is usually no lateral streak, and at most I have only seen it obscurely indicated; but there is a fine porphyraceous lustre on the grass-green scales of the head and body, which does not occur in the true VIRIDIS. If considered worthy of a name, it may therefore bear the appellation PORPHYRACEUS.

Of *Batrachia*, I cannot learn that any species has yet been observed at Port Blair.

The collection of fishes is so large and important that I have made it the subject of a special report. As many as 106 osseous species have already been received from Port Blair;\* the genera SALARIAS, GLYPHISODON, and MURENA, being extraordinarily developed. Of MURENA alone, I make out sixteen species already received! A considerable proportion of the species appear to be quite new, being described neither in the *Histoire des Poissons*, in the more recent elaborate essays by Dr. Bleeker, nor by Sir J. Richardson and other authorities. No fresh-water species has been received; but a few mud-skippers, as the PERIOPHTHALMUS PAPILIO, (Bloch),—a fine series, and the young of which species is *P. fuscatus*, nobis, *J. A. S.* XXVII, 271.†

A considerable number of *Crustacea*, *Mollusca*, and *Radiata* have likewise been received from Port Blair; but though I have mostly determined the genera and species, I have not at present the leisure to draw up a report on them.

4. The Rev. H. Baker, Junr., of Mundakym, Alipi, S. Malabar.

A dozen skins of the Spiny Dormouse (PLATACANTHOMYS LASIURUS, nobis, *J. A. S.* XXVIII, 289), five skins of MUS (LEGGADA) SPINULOSUS, nobis (*J. A. S.* XXIII, 734), identical with Punjáb specimens,—one of a small Mouse affined to, if not identical with, M. ALBIDIVENTRIS, nobis, of L. Bengal, but of which it is desirable to

\* Several more have since come to hand.

† *Salarias olivaceus*, XXVII, p. 271, is identical with *S. LINEATUS*, C. V.; *Gobius breviceps* is the young of *G. ALBOPUNCTATUS*, C. V.; *Apogon 5-vittatus*, p. 272, is the young of *GLYPHISODON RAHTI*, C. V.; *Serranus lanceolatus*, C. V., is the young of *S. COIODES*, (B. H.), v. *S. suillus*, C. V.; *Gerres poeta*, C. V. = *Chanda setifer*, (B. H.), ergo *G. SETIFER*, though the name better applies to *G. FILAMENTOSA*, C. V., which I have also obtained; *Polotus nitidus* = *MESOPRION GUTGUTEA*, (B. H.) C. V., though the generic name *POLOTUS* may stand; and *PANCHAX CYANOPHTALMA*, p. 288, is the unnamed species figured in *As. Res.* XIX, pl. , f. , but in the living fish the azure eye is much less noticeable. I have since long kept this species in an *aquarium*, and it is less of a surface fish in its habits than the *P. BUCHANANI*, C. V.

have more examples for comparison,—and a young *Gho-sámp* (MONITOR DRACÆNA).

5. Capt. W. H. Lowther, in command of the 1st Asám Local Battalion. Skin of a Binturong (ARCTICTIS BINTURONG), killed on the Singpho frontier of Upper Asám, where termed by the natives *Young*. Important with reference to the geographical distribution of this remarkable animal.

6. H. M. the ex-King of Oudh. A Snake (DENDROPHIS ORNATA); and since a dead Monkey (PRESEBTIS CEPHALOPTERUS).

7. Prince Mahomed Julaludin, of Baligungge. A Snake, the *Ráj-sámp* of the Bengalis (BUNGARUS FASCIATUS).

8. Babu Rajendra Mallika. Various dead animals, including a superb male Golden Pheasant in perfect plumage, which has been set up in a manner worthy of its beauty. I take this opportunity to remark, that among the objects of particular interest now living in the aviaries of our contributor, are two very distinct species of Casowary. The Bábu has also magnificent adult hybrids, of both sexes, raised from the male PAVO MUTICUS and female P. CRISTATUS, the two species being beautifully blended in colouring, form of crest, &c.; and, still more remarkable, he has a hybrid now nearly full-grown, bred between a Curassow and Guan! Numerous other living specimens of great interest adorn his collections.

One of the Cassowaries being clearly of a new and fourth species of its genus, of which quite recently only one species was known, I shall here indicate it as

CASUARIUS UNAPPENDICULATUS, nobis, *n. s.*, from its peculiarity of having but a single pendulous caruncle in front of the neck. Specimen apparently more than half grown, and much paler in the colouring of its plumage than specimens of the same age of the common C. GALEATUS, two fine examples of which are associated with it in the same paddock. In lieu of the two bright red caruncles of the latter, the new species has but a single small oblong or elongate oval *yellow* caruncle, and the bright colours of the naked portion of the neck are differently disposed. The cheeks and throat are smalt-blue, below which is a large wrinkled yellow space in front of the neck, terminating in front in the oval button-like caruncle, and its lower portion being continued round behind, while on the sides of the

neck, the yellow naked portion is continued down to its base, the bordering feathers more or less covering and concealing this lateral stripe of unfeathered skin: on the hind-part of the neck the bare yellow skin is not tumous and corrugated as in the common Cassowary, where also this part is bright red. The casque is about equally developed at this age in the two species. The legs of the new species are smaller, from which I doubt if it attains to quite so large a size as the other.

The known species of *CASUARIUS* now range as follow :

1. *C. GALEATUS*, Vieillot: *C. emeu*, Latham; *Struthio casuarinus*, L. Hab. N. Guinea. Eastern Moluccas.
2. *C. BENNETII*, Gould (figured in *P. Z. S.* 1851, pl. 7). The *Mooruk*. Hab. N. Ireland.
3. *C. AUSTRALIS*, Gould. Hab. York peninsula, N. E. Australia.
4. *C. UNAPPENDICULATUS*, nobis. Hab. ——— ?\*
9. Alex. Thomas, Esq., in medical charge of Khyook Phoo, Ramri, Arakan. A fine specimen in spirit of *PLATYDACTYLUS GECKO*, (L.)
10. Mrs. Turnbull. A fine stuffed specimen of *PETAURUS SCIURIUS*, (Shaw).
11. H. H. Atkinson, Esq. A few bird-skins procured at Singapore.
12. The Rev. J. Cave Browne, late of Subathoo. A small collection chiefly reptiles in spirit, with a few insects, procured in that neighbourhood.

\* In the *Conspectus Ineptorum et Struthionum* of the late Prince of Canino, published in the *Comptes Rendus*, tom. XLIII (1856), 840-1, only one species of *CASUARIUS* is recognised (!); but a second *DROMAIUS* or *Emeu*, as DR. ATER, Vieillot, from "l'isle Decrès," which would appear to be already extinct; while a third species, from the interior of Australia, with transversely barred plumage, has recently been brought to the notice of the Zoological Society. H. H. also indicated a second Ostrich doubtfully, as *STRUTHIO EPOASTICUS*, C. L. Bonap., which is doubtless the northern race with smooth and poreless egg-shell noticed in *J. A. S.* XXVIII, 282. The two living species of Nandou, or *RHEA*,—the three-toed American Ostrich,—are of course recognised; and at least three, if not four (!), living species of *APTERYX*; with no fewer than 38 species, more or less satisfactorily made out, of *Inepti* and *Struthiones* of various zoological epochs; but the knowledge of the greater portion of these is vague in the extreme; and the Prince's bold attempt at classification of them will simply, as such, meet with approval. At the head of the *Inepti* he places the huge *EPIORNIS* of Madagascar, a fragment of the egg-shell of which I have recently procured for the Society's museum, presented to by M. Zill. This giant bird appears to have been first indicated (to Europeans) by the missionary Ellis, though not scientifically brought to notice. The natives of Madagascar imagine that the eggs of the *EPIORNIS* are those of some huge saurian.

Of Lizards, the common *CALOTES VERSICOLOR*, a small and young *RIOPA*, and a beautiful new Gecko congeneric, with that described from the mountainous interior of the Tenasserim provinces, in *J. A. S.* XXVIII, 279.

*NAULTINUS* (?) *FASCIOLATUS*, nobis, *n. s.* Tail proportionally longer and more slender than in *N.* (?) *VARIEGATUS*, nobis, *l. c.*; but the larger of two specimens evidently not full-grown. Head very similar to that of the other; but the dark band behind the eye bending abruptly to meet its opposite on the occiput; this is followed by 23 other blackish cross-bands, continued to the end of the tail, those of the body being edged and set off posteriorly with whitish; a series of broad sub-hexagonal plates in both species beginning near the vent and continued to the end of the tail underneath. Abdominal scales proportionally smaller than in the other, and no group of conspicuously larger scales anterior to the vent. The sub-caudal scales are also much smaller than in the other. Larger specimen  $4\frac{7}{8}$  in., of which tail  $2\frac{3}{4}$  in. Both species are remarkable for the beauty of their markings.

Of Snakes, *CORONELLA RUSSELLII*, (Daud.), *COLUBER MUCOSUS*, (L.), *DIPSAS TRIGONATA*, Schlegel, *VIPERA RUSSELLII*, (Shaw), and two species which appear to be new:—

*DIPSAS MULTIFASCIATA*, nobis, *n. s.* Form typical; the muzzle shorter and rounder than in *D. TRIGONATA*: the same whitish spots along the ridge of the back as in that species, but somewhat indistinctly defined; and narrow black transverse bands on the sides, numbering as many as 72 from neck to vent, beyond which they are broken into spots: throat dull white; the abdominal surface densely speckled throughout with triangular black spots, which are more or less continued into lines. Length of specimen (evidently young)  $14\frac{1}{2}$  in., of which tail 3 in.

For the other I must constitute a genus:—

*PLATYCEPS*, *n. g.* Like *COLUBER* (*CORYTHODON*, D. B.), but with exceedingly flat head, and tail only about a sixth of the total length.

*PL. SEMIFASCIATUS*, nobis, *n. s.* Colour olive-grey above, white below; the posterior two-fifths without markings, and the nuchal region marked with broad transverse black bands, having lateral black spots alternating on either side. These gradually become

narrower and are broken into alternate bands on the second fifth of the body, being still more broken into small spots on the third fifth, beyond which they gradually disappear anterior to the vent. Eyes of moderate size. Specimen evidently young. Length about  $10\frac{1}{2}$  in., of which tail about 2 in., its extreme tip being lost in the specimen. *Scutæ* 187; *Scutellæ* — ?

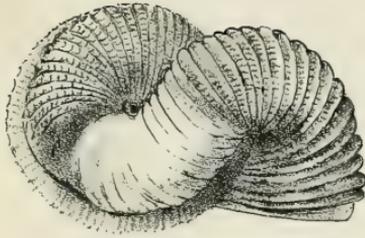
*P. S.*—It appears that a species of Deer, which has been named *CERVUS PSEUDAXIS*, has recently been received in France from the mountainous regions of the north of China and Mantcheeria. From the geographical region it cannot be a true *Axine*, and the name would imply its being an *Axis*-like (or *spotted*) species,—just possibly identical with the Formosan Deer.

E. BLYTH.

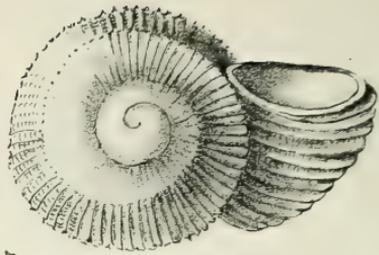
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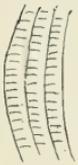


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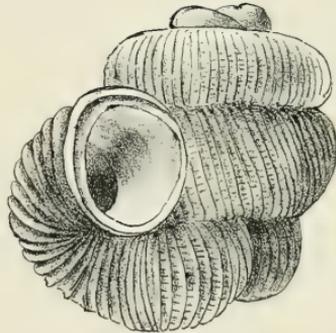


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OPISTHOSTOMA NILGIRICA

JOURNAL  
OF THE  
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No. II. 1860.

*Contributions to Indian Malacology, No. I.—By Messrs. W. T. and  
H. F. BLANFORD, of the Geological Survey of India.*

In a paper published in the Annals and Magazine of Natural History for 1857,\* Mr. W. H. Benson gave an able resumé of the distribution of the *Cyclostomaceæ* of South-western Asia and of some of the neighbouring islands. As regarded their distribution in India, both Cis and Trans-gangetic, it was proved that the evidence then available shewed a considerable generic distinction between the forms of the Indian peninsula with Ceylon on the one hand, and those occupying the Himalayas, the Khasi hills, Burmah, and the Malay countries on the other. It was also attempted to be shewn that, if two streams of distinct genera were supposed to extend from the island of Borneo, one might be imagined to pass up through the eastern, the other through the western peninsula, the valley of the Ganges and the plains of Northern India being the limit of each line.

At that time it was believed that no single species of land shell occurred at the same time upon the Himalayas, and in India south of the Ganges. A few widely disseminated species, such as *Helix vitri-  
noides*, are certainly to be found at the base of the mountains, as well as universally over the plains, but even at the foot of the Himalayas a great change takes place in the fauna generally, and when once fairly within the mountains, scarcely a species of the Indian plains recurs. But there are a few exceptions. In the Annals for April, 1859, Mr. Benson mentioned the discovery by one of ourselves of

\* Ann. and Mag. of Nat. Hist. Vol. XIX. p. 201.

*Helix castra*, Benson, on the hills of Balasore in Northern Orissa, and more recently a single specimen of a shell perfectly undistinguishable from *Helix Huttoni*, Pfeiffer, has occurred to us on the northern flank of the Nilgiri mountains in Southern India.\* Both of these species have a wide distribution; *H. castra* being known to range from Sikkim to the Tenasserim provinces, and *H. Huttoni* throughout the greater portion of the Himalayas. Indeed it is more than probable, from an examination of recently collected specimens of *H. tapeina*, Benson, that *H. Huttoni* is only a variety of that species, an identity which, if substantiated, will extend its range to the Khasi Hills and Burmah, where the variable but scarcely distinguishable *H. rotatoria*, V. d. Busch, replaces it, unless the latter also prove to be only a variety.

It is exceedingly probable that, as each region becomes more thoroughly searched, many other species will be found to have a far more extensive range than is at present supposed. The peninsula of India is, as a rule, extremely poor in land shells, and the conchologist may travel for miles over its plains without meeting with a single mollusk. The plains of Bengal, from a space as large as the British Isles, have scarcely furnished twenty species. On the contrary the Himalayas, especially their eastern portion, and the Burmese peninsula, appear to be extremely rich both in species and individuals, a circumstance doubtless intimately connected with the greater and more constant humidity of the climate. With a few exceptions, Cis-gangetic India has been fairly explored by conchologists, although it has not been thoroughly searched. Of Trans-gangetic India, nine-tenths are totally unexamined. At least half of the Himalayas have never been visited, and all that has been carefully explored consists of a considerable tract in the western Himalayas around Simla and Masúri, and the outer hills of Sikkim, from which we ourselves, but the other day, procured more than twenty undescribed forms. The Khasi Hills, a small tract of country, have been fairly examined, but the vast peninsula thence to Singapore has only been searched in the immediate neighbourhood of Molmain, whilst a few shells have been collected during hurried visits, or (the larger species

\* Mr. Benson also informs us that he has received *H. fastigiata*, Hutt. from the Nilgiris.

especially) procured by accident from Pegu, Ava, the Tenasserim provinces, Penang, Malacca, Singapore and perhaps one or two other places. The greater portion of the mountains north of the Punjab, the vast tract of Nepal, the interior valleys of Sikkim, Bhotan, Assam with the mountains both north and south of it, Arracan, and, with the few exceptions mentioned, the Malay peninsula, are totally unsearched. Despite these circumstances, the list of shells described from the Himalayas and Burmah alone probably exceeds that from all the Indian peninsula.

But even India proper may yet yield important novelties. Perhaps no part has been more carefully or more repeatedly examined than the Nilgiri hills of Southern India. They are perhaps the last place whence generic forms new to the country might be expected, yet we have been so fortunate as to meet with such, among the smaller shells as might naturally be expected, but by no means amongst those least interesting.

Amongst the genera enumerated as characterizing India north of the Ganges and east of the Bay of Bengal, none perhaps is more generally distributed or more abundant than the singular little genus *Alycæus*, Gray. Another form which, however, perhaps chiefly on account of its minute size, has not as yet been shewn to have an equal range in these countries with *Alycæus*, but which also occurs in Mr. Benson's list of genera confined to the northern and eastern regions of India, is *Diplomatina*, Benson. The discovery of species of both of these genera, in a district so well examined previously as the Nilgiri hills have been, must make us pause before we conclude that we are in possession of data sufficient to enable us to come to definite conclusions upon the distribution of Indian land shells.

The circumstance of their discovery becomes less surprising when we consider that there are several species of shells on the Nilgiris closely representative of Himalayan and Burmese forms. Thus *Helix Cycloplax*, Benson, of Sikkim and *H. Oxytes*, B., of the Khasi hills are replaced by *H. Thyreus*, B.; *Achatina tenuispira*, B. of Sikkim, Khasi, Burmah, &c. by *A. Shiplayi*, Pfr.; *Bulinus vibex*, Hutt, and *B. cælebs*, B. of the Western Himalaya by *B. Nilagiricus*, Pfr. &c.

To return to the genera of *Cyclostomaceæ*; there are to be found on the eastern side of the Bay of Bengal and in the Himalayas the

following genera which are absent on the western side of the Bay: *Megalomastoma*, *Pupina*, *Registoma*,\* *Raphaulus*, *Streptaulus*, and *Hybocystis* (all of which are closely allied genera and of one type) *Hydrocena* and *Pomatias*, the last being probably only an outlier. In Ceylon there is one peculiar genus, *Aulopoma*, but it is evident that Ceylon is a generic area by itself. Lastly there are common to both sides of the Bay of Bengal or of the Ganges valley *Cyclophorus*, *Cyclotus*, *Pterocyclos*, *Leptopoma*, *Cataulus*,† *Alycæus* and *Diplommatina*. In the Indian peninsula, properly speaking, not one generic form exists, which is wanting in Trans-gangetic countries, with the exception perhaps of the little shell which we now describe under the name of *Opisthostoma*: but even assuming this genus to be decidedly operculate, it would be premature to assert that so minute a shell has no specific representative in the Himalayan or Burmese areas ‡ *Otopoma* only occurs in Katiwar, where the climate is different from that of India proper, and where all organic nature shews an intermixture of Indian forms with those of South-western Asia and of Africa.

We can therefore only conclude that scarcely sufficient is yet known to justify a decided opinion as to the distribution of the land shells of India and the adjoining countries. So far as the most recent discoveries enable us to form a judgment, we agree with Mr. Benson in considering that a generic distinction does exist between the two areas of Cis and Trans-gangetic India, but we doubt whether it is satisfactorily shewn that Borneo is the generic centre around which all the forms of South-western Asia and the Indian Archipelago are

\* In the Nicobar Islands.

† One species in the Nicobar Islands.

‡ Since these remarks were written, Mr. Benson has described, in the Ann. and Mag. for Feb. 1860, two new genera of operculate land shells from Molmain, and has named them *Rhiostoma* and *Clostophis*. The former is allied to *Pterocyclos*, the latter is a minute form, probably allied to *Diplommatina* and *Opisthostoma*. Like the latter it is separated from the former on account of peculiarities in the last whorl, which, in *Clostophis*, is free and descending. It is possible that other species allied to these new forms may hereafter be discovered, and the two types be found to represent and replace each other in the Indian and Burmese areas.

grouped; or that the distinctions between the Indian areas are satisfactorily explained by considering them as "streams" of generic affinity radiating from that island. So far as our present knowledge extends we are inclined to look upon the distinction as consisting mainly in the more favorable conditions for land shells generally in the moist countries of the Himalayas and of the Burmese and Malay peninsula, in the absence of shells of the *Pupina* and *Megalomastoma* type in the Indian peninsula, (a circumstance doubtless connected with the greater dryness of the country) and in the existence of a generic centre in the island of Ceylon, characterized especially among the *Cyclostomaceæ* by forms of *Aulopoma* and *Cataulus*.

The shells described in the following pages were obtained in collections made by Mr. H. F. Blanford in 1857, and by Mr. W. T. Blanford during a short visit in 1859. A few other forms procured at the same time are also believed to be undescribed, but as they are of less interest, they must await further leisure.

#### OPISTHOSTOMA, gen. nov.

Testa operculata? Anfractibus apicalibus obliquiter deflectis, anfractu ultimo constricto, deinde inflato, denique sinistrorsim ascendente, anfractibus superioribus contiguo; aperturâ reversâ, rotundatâ, continuâ; peristomate duplicato.

#### 1.—O. NILGIRICA, n. s.

Testa minima, truncate pupiformis, anguste umbilicata; spirâ irregulari, apice obtusâ, obliquâ, suturâ profundâ; costulata, interspatiis minutissime decussatis, albida, translucens. Anfractus rotundati, 5, quorum duo primi obliquiter contorti; ultimus constrictus, deinde inflatus, refractus, ascendens, denique sinistrorsus, anfractum penultimum contingens. Apertura subobliqua, superne versata, orbicularis. Peristoma continuum, incrassatum, duplicatum.

Diam. maj., . . . . . 1.3 m. m.

Alt., . . . . . 1.1 m. m.

Habitat apud Pykara ad summos montes "Nilgiri" inter folia caduca humida sylvarum.

Of this remarkable little shell the first and only known specimens were found by one of us rather more than two years since in the dead leaves of one of the little thickets termed "sholas" near Pykara on

the Nilgiris. As all the specimens found were dead shells and it seemed most desirable to obtain living specimens in order to determine satisfactorily the nature of the species from an inspection of the animal, we have hitherto abstained from publishing a description which must of necessity be imperfect, in the hope, either that one of ourselves might revisit the hills and procure a supply of living specimens, or that some of our friends conchologically inclined, might aid us in the matter. We have, we regret to say, been disappointed in these expectations, and we therefore publish the description and figure of the shell, hoping that publicity may lead others to the search, and we leave the question of the nature of the animal and the existence of an operculum to be settled at some future period.

To the kind aid of Capt. Mitchell of Madras we are indebted for the accompanying figures, drawn with the aid of the camera lucida, and magnified about 30 diameters. The specimen from which the drawings are taken is in excellent preservation and shews very clearly not only the costulation, which bears a great resemblance to that of *Diplommatina* and *Alycæus*, but also a regular scalariform decussation of the interstitial spaces which is represented on an enlarged scale in figure 5. This costulation and more especially the *Alycæus*-like strangulation and inflation of the last whorl point to the probability of the present being an operculate genus, and the round whorls and continuous and duplicate peristome lead to the same conclusion. No trace of a tube is perceptible on any part of the shell.

From these characters we should infer that *Opisthostoma* holds an intermediate place between *Alycæus* and *Diplommatina*, resembling the former in the strangulation and distortion of the last whorl, the latter in the pupiform shape and in the rise of the last whorl upon the penultimate, and both in the duplication of the peristome, and in the regular costulate ornamentation: but the peculiar distortion of the apical whorls and the hyperstomoid flexure of the last whorl are characters not hitherto found in any operculate genus, and having their analogues in *Streptaxis* and *Boysia* among inoperculate shells. Seeing, however, the great variation of spiral form that obtains in the different Cyclostomaceous genera, no great weight can, we think, be attached to spiral peculiarities when opposed to the evidence of the characters above enumerated which connect *Opisthos-*

*toma* with operculate forms, and until further evidence shall shew such a view to be untenable, we may regard the present as one more of the peculiar Cyclophoroid genera which seem specially to characterize the Indian and Bornean provinces.

2.—*ALYCEUS EXPATRIATUS*, *n. s.*

Testa mediocriter umbilicata, depressa, ad anfractos internos obsolete, ad ultimum fortius, ad spatium inflatum valde, crebre costulata, corneo-albida, apice diaphane rubella; spira vix elevata, apice obtusa; sutura impressa; anfr.  $3\frac{1}{2}$  convexi, ultimus ad latus mediocriter inflatus, deinde constrictus; constrictione longa, medio tumida, glabra; tubulum suturale pone constrictionem oriens, mediocriter longum, plerumque  $\frac{1}{5}$  peripheriæ subæquans, sed nonnullis exemplis brevius; apertura circularis, obliqua, juxta anfr. penultimum retro curvatum; perist. duplex; internum breviter porrectum, continuum, externum expansum, interruptum, columellari margine strictum. Operculum corneum, distincte multispirum, anfr. 7-8 planulatis, externe perconcauum, nucleo centrali interno prominente papillari.

|                      |                       |
|----------------------|-----------------------|
| Diam. maj. . . . .   | $4\frac{1}{2}$ m. m.  |
| Ditto min. . . . .   | $3\frac{3}{4}$ ditto. |
| Alt. . . . .         | $2\frac{1}{2}$ ditto. |
| Apert. diam. . . . . | $1\frac{3}{4}$ ditto. |

Hab. Haud raro ad Neddoowuttom ghat, ad latus septentrionale montium "Nilgiri" Indiæ australis et circa 3000—4000 ped. alt.

This species appears to be more depressed in the spire than any other of the genus, except perhaps the Bornean *A. spiracellum*, A. Ad. and Reeve. Its nearest Indian ally is *A. strangulatus*, Hutton, and in size it is intermediate between that species and *A. stylifer*, Bens. It belongs to the section *Charax* of Benson, having a wide strangulation behind the peristome, crossed by a swollen ridge, which, however, in *A. expatriatus* never presents the sharpness so remarkable in *A. stylifer* and *hebes*, but is rather a broad tumid space separating two narrow constrictions. The sutural tube is variable in length, sometimes being nearly as short as in *A. strangulatus*, in other specimens as long as in *A. stylifer*; the latter being the usual case, the former the exception, but both occur in perfectly fresh and full grown specimens.

From *A. strangulatus*, the species is distinguished by its greater size, more depressed form, more oblique aperture, by the recurvation of the peristome at its junction with the penultimate whorl, the longer sutural tube, the greater distance of the ridge crossing the constriction from the mouth, and the closer sculpture. From *prosectus* and *stylifer*, the characters of the peristome, which is simple in *stylifer* and expanded at the columellar margin in *prosectus*, besides the smaller size of *A. expatriatus*; from *hebes* and *gemmula* the slightly prominent ridge not recurved and the depressed form afford abundant grounds for distinction. *A. spiracellum* of Borneo is probably closely allied, but we are only acquainted with that shell by its description. Judging therefrom *A. expatriatus* should be distinguished by its smaller size, more narrow umbilicus, greater bluntness of the ridge in the constriction, and in general by the greater length of the sutural tube, a character which, however, is evidently, from its variability in this species, of less value than has hitherto been supposed.

The species occurred near the base of Neddoowuttom ghat, and a little above the village of Goodaloor. The animal is small and colourless; the body very short; the sole undivided; tail short and rather pointed; tentacles short, yellowish; muzzle blunt, not elongated.

### 3.—DIPLOMMATINA NILGIRICA, n. s.

Testa dextrorsa, imperforata, subovata, *glabra*, tenuis, nitida, cornea; spira conoidea, apice obtusa; anfr. 6 convexi, superne leniter crescentes, ultimus parum augustior, antice ascendens, carinâ costiformi circa umbilicum munitus; apertura subverticalis, circularis; perist. haud dentatum, duplex; externum breviter expansum, interruptum; internum mediocriter porrectum, continuum. Operc. corneum, subcirculare, ad suturam angulatum, planum, haud spiratum.

|                               |                        |
|-------------------------------|------------------------|
| Long. . . . .                 | 3 m. m.                |
| Diam. max., . . . . .         | 1 $\frac{1}{4}$ ditto. |
| Apert. diam., . . . . .       | $\frac{3}{4}$ ditto.   |
| Anfr. ultimi long., . . . . . | 1 ditto.               |

Habitat in sylvis prope Pykara versus apices montium "Nilgiri" (ad alt. circa 7000 ped).

This species is distinguished from all others of the genus yet described by the ridge around the umbilicus, which is an exact coun-

terpart of that in the Sikkim shell, *Megalomastoma funiculatum*, B. The perfect smoothness of Dip. Nilgirica, and the continuity of the internal peristome, give it a sub-generic character, yet seem insufficient alone to authorize its separation from *Diplommatina*.

The animal could not be well observed for the want of a sufficiently powerful magnifier at hand. It was small, short, and colourless, with two small black tentacles.

#### 4.—CYCLOTUS MALABARICUS, n. s.

Testa subaperte umbilicata, depresso-conica, albida, glabra, nitidula, epidermide deciduâ corneâ, ad anfr. ultimum transverse fusco-strigatâ, induta; spira conica, apice acuta; sutura profunda; anfr. 4 rotundati, celeriter crescentes, ultimus cylindraceus; apertura parum obliqua, circularis, prope umbilicum parum sinuata, superne vix angulata; perist. duplex, externum brevissime expansum, internum porrectum, acutum, continuum; umbilicus perspectivus. Operculum haud immersum, duplex, internum corneum multispirum, externum testaceum, anfractuum marginibus lamella spirali, albidâ, scabrâ ad anfr. externos prelevatâ et versus centrum incurvatâ, quasi convexâ, munitis.

|                     |                        |
|---------------------|------------------------|
| Diam. maj., .....   | 3 $\frac{1}{4}$ m. m.  |
| Ditto min., .....   | 2 $\frac{3}{4}$ ditto. |
| Alt., ....          | 2 $\frac{1}{2}$ ditto. |
| Apert. diam., ..... | 1 $\frac{1}{8}$ ditto. |

Hab. sub rupibus et saxis in terrâ humidâ ad margines sylvarum prope Pykara montium "Nilgiri," ad alt. 7000 ped.

Nearly allied to *Cyclotus filocinctus*, Benson, by the peculiarity of its operculum, this shell is distinguished by its smaller size, more depressed form, and less expanded peristome, by the absence of the marked sculpture of *C. filocinctus*, and by the epidermis being lighter in colour and marked by brown transverse streaks on the last whorl. That of *C. filocinctus* is hispid. The last named shell was first described by Mr. Benson as a *Cyclostoma*, to which genus it was assigned till lately. The construction of the operculum is very peculiar. The testaceous spiral lamina being very much more raised towards the exterior than towards the centre, and being curved inwards, the interior whorls of the operculum are almost concealed and the appearance, unless very closely examined, is that of the oper-

culum of a *Turbo* hollowed out at the centre. The lamella in *C. Malabaricus* is rather more elevated than even in *C. filocinctus*.

The animal of *C. Malabaricus* we have not had an opportunity of observing, that of *C. filocinctus* belongs to the Cyclophoroid group,\* the sole of the foot being undivided, the tentacles tapering, and the muzzle short and blunt. The foot is short, broad and rounded at the tail, the tentacles are black, rather short, and contractile, with the eyes at their base, the body is colourless, with the exception of black patches above the head and at the base of the tentacles.

*C. filocinctus* abounds on the N. side of the Nilgheris, but we have not met with it on the top of the hills. It is found chiefly in decay-ing leaves and moist earth beside rocks and stones. *C. Malabaricum* with *Dip. Nilgirica*, *Ennea Pirriei*, Pfr. and some minute *Helices*, occurred at the edges of the small patches of forest, known as "sholas," which abound in every small hollow in the hills, and are remarkable from the abruptness of their boundaries, a few feet leading from dense jungle to the open grassy hill side. Under the shrubs at the edges of sholas is generally a great resort of land shells.

##### 5.—STREPTAXIS WATSONI, n. s.

Testa subumbilicata, compressa ovata, corneo-albida, nitida, superne transverse arcuato-striata, infra obsolete striatula, interdum ad ultimum anfractum lineis albidis versus suturam cineta; spira fere plana; sutura impressa; anfr. 6 convexiusculi, 2 ultimi e axi deviantes, ultimus rotundatus; apertura obliqua, elongato-lunaris, juxta anfr. penultimum acute retro sinuata, margine basali paulo arcuata; perist. reflexum, subincrassatum, albidum, tridentatum, singulis dentibus depressionibus pone peristoma externe correspondentibus; dentes 2 lamelliformes margine dextro, 1 columellari quasi basali; marginibus peristomatis callo, duas lamellas approximatas juxta suturam gerente, junctis.

|                   |           |
|-------------------|-----------|
| Diam. maj., ..... | 6½ m. m.  |
| Ditto min. ....   | 4½ ditto. |
| Alt. ....         | 3 ditto.  |

\* In common probably with every other operculated Indian land shell except *Otopoma clausum*, Sow, and perhaps the two species of *Pomatias* described by Mr. Benson from the Himalaya and Khasi Hills.

Hab. in sylvis, præsertim prope arborum radices, ad apices montium "Nilgiri." Var. est, peristomate quinque dentato, dente uno minimo versus sinum aperturæ, tribus normalibus, uno minuto juxta umbilicum; dente ad marginem columellarem alteris latiore, quæ prope "Avalanche," ad pedem montium "Koondah" habitat.

This species appears to be more abundant than the previously described form, *Str. Perrotteti*,\* Petit, from which it differs in its much smaller size, and despite this, in the greater development of its teeth, and also in the presence of two lamellæ instead of one on the callus joining the margins of the peristome. It appears to inhabit only the more southerly portions of the hills, but our researches have not been sufficiently extensive to render this a certainty. *Str. Perrotteti* occurred at Neddiwuttom, and on the hills N. of Ootacamund; *Str. Watsoni* we found S. of Ootacamund, and the variety at the base of the Koondahs. Both were obtained at an elevation of 6000 to 7000 feet. Although the variety differs slightly in the teeth, in the presence, viz. of two teeth which are absent in the normal form, these additional projections are so very minute that they might easily become obsolete, and probably additional specimens might shew a complete gradition, while the shells are so exactly similar in every other detail of form, that we have no hesitation in pronouncing them identical.

#### *Explanation of figures.*

1.—*Opisthostoma Nilgircum*. Natural size.

2, 3, 4.—The same magnified 90 diameters (900 times).

5.—Scalariform costulation further enlarged.

\* Or is this Petit's original species and that described by Pfeiffer distinct? In that case the names may be exchanged.

*Memorandum on the great flood of the river Indus which reached Attok on the 10th August, 1858.—By Captain T. G. MONTGOMERIE, Bengal Engineers, F. R. G. S. 1st Asst. G. T. Survey, of India, &c.\**

“At 5 A. M. on the 10th August, 1858, the Indus at Attok was very low. At 7 A. M. it had risen 10 feet. By 0.30 P. M. it had risen 50 feet, and it continued to rise till it stood 90 feet higher than it did in the morning. The Cabul river continued to flow upwards for ten hours.”—*Extract from the proceedings of the Asiatic Society for September 1858, Journal Vol. XXVII. p. 366.*

The flood destroyed a large amount of property in British territory both above and below Attok; and the back water (on the Cabul river) destroyed the greater part of the private property in the cantonment of Naoshera.

After the subsidence of the water, numerous reports were current near Attok, viz.: that the river was still blocked up and that another similar flood might soon be expected. These reports were generally given out on the authority of the inhabitants far up the river, who had sent down word to say that the water was still dammed up.

Such a sudden flood or cataclysm on such a gigantic scale, at all times an important and interesting subject of enquiry, was rendered still more so to me by the above mentioned circumstances.

Being at the time of the flood in the territories of the Máharajah Rumbhir Singh. I was in a favorable position for making enquiries in the Upper Valley of the Indus as far as the Máharajah's territories and influence extended, and I consequently made all the enquiries that I could.

On applying to the Wazeer Punnoo, the governor of Kashmir, he told me that had any damage been done in the Máharajah's territories by a flood on the Indus, he would certainly have heard of it, but up to that time he had received no report on the subject. However I begged him to write to all the Máharajah's officials (on the

\* See papers by Capt. Henderson and Major Becher, Journal, Vol. XXVIII. pp. 199 and 219.

Indus and on its tributaries)\* to enquire whether any extraordinary flood had been noticed. The answers were all in the negative except that from Boonjee, (the Máharájah's most northerly fort and cantonment on the Gilgit frontier) the report was as follows, viz. :—

“That a great flood (burá sailab) was noticed by the sepoy at Boonjee on the 27th day of “Sáwan Mahina,” “derh pahar din gaiya” when it first arrived. Shortly afterwards the sepoy saw a mass of timbers floating down the stream, which they recognised as belonging to the gateway of the Númbúl fort.”

The Númbúl fort is said to have been on the Gilgit river below the point where the Naggar river joins the Gilgit river.

I understand “the 27th day of Sáwan Mahina, derh pahar din gaiya” to mean the 11th day of August about 9 or 10 in the morning. Although this is the day *after* the flood was noticed at Attok, it is in my opinion sufficiently near the date to make it highly probable that it was the same flood that was noticed at Attok.

At a frontier outpost of the Máharájah's (where no one goes that has sense enough to make interest to keep away), a mistake of two or three days in the date would be no wonderful thing considering the general indifference of natives on the subject of dates and the numerous doubts as to when their months begin.

I am therefore of opinion that the flood (sailab) noticed at Boonjee was the same that passed Attok on the 10th of August, and for reasons given hereafter I am of opinion that the sepoy's date at Boonjee should have been the 25th of Sáwan or the 9th of August about 9 or 10 A. M.

The Trigonometrical height of Skardo the capital of Little Thibet situated on the river Indus has been ascertained to be about 7700† feet above the sea and that of the G. T. Station eighteen miles above Attok has been found to be about 1050‡ feet above the sea, thus shewing a difference of height between the two places of about 6650 feet. The distance between Skardo and the above G. T. Station by the course of the river Indus is approximately about three hundred and ten miles, and consequently there is an average fall in

\* Specially mentioning the Shayok river.

† G. T. S. point near Skardo fort 7701 very little above river.

‡ G. T. S. Station on river eighteen miles above Attok and 1049 feet above sea.

130 *Memorandum on the great flood of the river Indus.* [No. 2,  
the bed of the Indus between those places of about  $21\frac{4}{10}$  feet  
per mile.

Similarly the height of Baramoola where the Jhelum river leaves the Kashmir valley is about 4930\* feet, that of the river† two miles below Jhelum is about 750 feet above the sea, shewing a difference in height between the two places of about 4180 feet. The distance by the course of the river Jhelum between those two places is about one hundred and ninety-four miles giving an average fall in the bed of the Jhelum of a little over  $21\frac{5}{10}$  feet per mile.

Consequently we may assume that the Indus and Jhelum rivers flow at (very nearly) the same average rate between the respective places mentioned.

With the assistance of Lieut. Melville‡ I measured the rate of the Jhelum river at Naoshera, one march below Baramoola, in as slow a part of the stream, as there is between Baramoola and Jhelum, and I found the rate to be nearly 690 feet per minute, or about seven miles per hour. And Lieut. Melville quite agreed with me that we had taken a place where the rate§ was far below the average. The river Jhelum between the points mentioned has in general such rugged and precipitous banks that it was with difficulty that even the above measurement was made.

The distance from Boonjee to Attok may be taken approximately as about two hundred and twenty miles, and if the flood in question was the one noticed at Boonjee it traversed the distance between those two places between 10 o'clock in the morning of some day before the 10th of August and say 6 A. M. of the 10th August, that is the flood must have taken either twenty-one hours or forty-five or sixty-nine &c. to traverse two hundred and twenty miles, that is, it must have passed Boonjee on 9th, 8th or 7th of August. Had the flood passed Boonjee on the 8th August, it would have taken forty-five hours and would have travelled at the rate of hardly five miles an hour, but it has been shewn above that the average rate of the

\* Baramoola Barometrical height 4938 feet above sea.

† G. T. S. point two miles below Jhelum 758 feet above sea.

‡ Topographical Asst. Great Trigonometrical Survey.

§ Seven miles an hour may be assumed to have been the minimum rate of the Jhelum river.

Indus must be above seven miles an hour in ordinary times, and of course much greater during a flood, so it may, I think, be fairly concluded that the flood would take only about twenty-one hours in traversing the two hundred and twenty miles, and that it passed Boonjee on the 9th August, 1858, about 10 A. M. If so it travelled at the rate of ten and half miles per hour, by no means an improbable rate\* as the Ganges when it issues from the hills opposite Hurdwar is stated by the Canal officers to flow in ordinary times at nine miles an hour, and its pace looks slow compared with that of the Jhelum below Baramoola.

As soon as I got the report from Boonjee I sent for further information but could only make out that the flood was understood to come from Naggar, an independent district which the Máharájah's people called a part of Yághistan! quite inaccessible to ordinary messengers. Nothing would induce a man to go there; and the Wazeer said that when a present was offered, the man took the money, but only went a short distance and returned after a time with a made-up-story.

Though repeated enquiries were made, nothing further was elicited.

Indeed beyond the fact that the flood had come from the Gilgit river, as reported by natives and as shewn by its carrying away the well known gateway of the Númbúl Fort, nothing positive was known as to the cause of the flood or of the exact site of the place dammed up, though the Boonjee sepoy believed that it came from the Naggar valley which is drained by an Eastern tributary of the Gilgit river.

Whether the flood in question came from Naggar or not, I feel quite certain that it did not come from above Skardo. At the time of the flood two of my assistants were working round Skardo, and another was working on the Shayok river within a month afterwards. I asked them to make particular enquiries, but they heard nothing of a large flood from any of the inhabitants of those parts.

\* A table taken from the Philosophical transactions gives 480 feet in one minute or nearly five and a half miles an hour as the velocity of absolute torrents with an inclination of only 3 feet 1.27 inches per mile. The table gives no greater inclinations.

Had the flood been generated on any of the tributaries of the Shayok I must have heard of it, as the damage done by the water on first escaping from the barrier or dam would have been very great in the Shayok valley itself.

No report was prevalent at Boonjee or elsewhere in the Máharájah's territories as to any river being still dammed up or as to the prospect of another flood.

Should the river Indus or any of its tributaries be hereafter dammed up in any part of the Máharájah's territories, there would not be much difficulty in getting information from the Máharájah's officials, if proper measures were taken for collecting the same.

If timely warning were given, I think that the water might be eased off, if the place was accessible and labour was available for the necessary blasting, mining and other operations.

If, however, an obstruction should arise on the Gilgit river or any of its tributaries, there is, in the present political state of those valleys, no chance of getting timely warning or any accurate information, and if such was forthcoming, nothing could be done as to easing off the water unless the Engineer was accompanied by troops.



*Memorandum in answer to the five following questions\* by Captain T. G. MONTGOMERIE, Bengal Engineers, F. R. G. S., 1st Asst. G. T. Survey, &c.*

1st. Whether there is any truth in a prevalent rumour that the Indus or one of its tributaries is still obstructed, and how it arose?

2nd. When the late cataclysm of 1858 (August) occurred and how it arose?

3rd. Whether such accidents are likely to be limited to one locality or may occur in several points of the Upper Indus and its feeders among the mountains?

4th. Where is the probable locality of the cataclysm of 1841, and how was it occasioned?

\* Questions proposed by Major Becher, Bengal Engrs.

5th. What means are the most available for ascertaining the occurrence of such a calamity in future?

1st. There is no report prevalent in the Máharájah's territories as to any portion of the river Indus or its tributaries being dammed up.

2nd. In my opinion the late cataclysm of August 1858 was generated in the Naggar valley on a tributary of the Gilgit river, see accompanying Memorandum on the flood of 1858.

3rd. I do not think such accidents are likely to be confined to one locality only. On the contrary, I think they may occur in a great many places both on the main Indus and on its tributaries. The main river would not, however, be likely to submit to any obstruction so long as the tributaries would.

4th. I have made enquiries about the flood or cataclysm of 1841, as far as I have heard at present I am inclined to think that it did not arise in the Shayok river. The Khapalu Rájah Mahomed Ali Khan says in a letter of July 1859, that the last great flood on the Shayok river took place about twenty-four years ago, that is in 1835, but that he was a small boy at the time and did not remember it well. His district suffered very much during the flood and had it occurred in 1841 he would have remembered all the circumstances. I have again addressed the Rájah on the subject and have asked for more precise dates.

Again I think, on examining the existing maps of the Upper Indus, that it is highly improbable that the damming up of the head of the Shayok river\* would make the Indus look smaller at Attok than it otherwise would be. Had the whole of the Shayok river been stopped, the Indus at Attok might have looked smaller than usual but not so for less than a tenth part. And this applies both to the flood of 1841 and 1858, if on the latter occasion the river really was much lower than it would have been had there been no flood—I am of opinion that if the water that falls into the Shayok above Sassar† never fell into it again, no one would ever notice the loss at Attok.

\* At a point not more than forty miles below its sources.

† The point where the cataclysm of 1841 was said by some to have been generated.

3. According to accounts of the cataclysm of 1841 the river Indus was observed to be unusually low in December 1840 and January 1841 at Attok and lower still in February and March. If that was the case it would point to the damming up of something that contributed more water than the head of the Shayok possibly could. Indeed when the channel was open but little water could descend during December and January from such a cold tract as that of the Shayok above Sassar, when snow only falls and when the melting of the glaciers must have almost ceased. Moreover the area drained by the Shayok at Sassar is comparatively speaking insignificant.

It is a question whether it was not simply a matter of gossip as to the Indus having been unusually low\* both in 1841 and in 1858. In the *latter* case the fact is very doubtful. People on the river would naturally say "we noticed that it was very low, &c."

It would require a very careful registration of the height of the river for several years in order to come to any trustworthy conclusion as to whether the Indus was at any period lower or higher than the average.

If some sort of daily register was kept at Attok light might possibly be thrown upon any future cataclysm that may occur. Observations should be made as to the height† giving the daily maximum and minimum heights and noting the time, velocity, temperature, colour, &c. of the water with general remarks on the weather.

As to getting timely warning of the damming up of the Indus or any of its tributaries, the Lieut.-Governor of the Punjab will I have no doubt be able to get the necessary information from the Máharajah's officials if it arises in the Máharajah's territories. Should it however arise in the Gilgit river or its tributaries, there is no hope of getting any, as I have explained in my memorandum on the flood. As far as the Máharajah's territories are concerned I

\* The Indus is, I believe, generally very low in December and January.

† The height to be referred to some permanent bench mark not liable to destruction.

All the rivers in the Punjab have a tide or daily maximum and minimum height in the mountains caused by the difference between the amount of snow melted during the night and during the day.

recommend that periodical reports should be obtained from the Máharajah's officials at Boonjee, Skardo and Leh, say once a month whilst the passes are open, in order to shew that their attention is directed to the subject—special reports to be made directly any reliable information is obtained as to any obstruction in the Indus or its branches. In the winter months men without loads can in fine weather often cross from the valley of the Indus to that of Kashmir, it only requires a sufficient inducement.

The officer at Boonjee should be requested to report on the river in the neighbourhood of the fort and to get all the information that he can from the Gilgit countries, viz. Naggar, Hunza, Yassin, &c.

The officer at Skardo to report on the river in his neighbourhood\* more especially on the Shayok river and its tributaries getting information from the Khapalu Rajah and the Kardar of Nubra.

The Thanadar of Ladak to report on all the rivers in his district.

The Máharajah is at present preparing for an expedition against Gilgit and may possibly succeed next year in establishing his posts in that valley, should he do so Hunza and Naggar will most probably come under his rule and Yassin may come under his influence. In that case information might be forthcoming as to the state of all the countries drained by the Gilgit river.

Under all circumstances it is very difficult to get information on such a subject, the natives take little interest in it, and barriers formed by landslips or glaciers may arise in some of the very elevated gorges which are rarely if ever visited by men from the Ladak side.

\* Khapalu and Nubra.

In Mr. Blyth's recent paper on the Animals known as wild Asses, he states that "the late Prof. H. Walker referred the Tibetan *Kyang* to *EQUUS HEMIONUS* of Pallas; and the *Ghor-khur* of this country is even more satisfactorily referable to *E. ONAGER* of Pallas, figured by Gmelin: but Prof. Walker committed the extraordinary mistake of figuring and describing an Indian *Ghor-khur* for a *Kyang*, so that the alleged distinctions which he has pointed out are valueless. However this mistake originated, there is no doubt whatever of the fact."\*

Now I am in a position to say *quite positively* that Mr. Walker was right, and that Mr. Blyth is wrong, in the *matter-of-fact*. The animal in question was bought in my presence for the late Mr. Thomason for Rs. 100, at the fair at Bágesar in Kumaon, from a Tuhári Bhotiya by whom it had been got in Tibet. The story of its attachment to the pony, to which Mr. Blyth also alludes, is odd, and I will state it in full, with the hope that I may satisfy everybody that I really do know something of the personal history of Dr. Walker's *Kyang*.

Mr. Thomason paid a visit to Almora (the capital of Kumaon) at the end of 1847. I was there at the time, and so was my brother Mr. John Strachey. We heard of the *Kyang*, and Mr. Thomason having been informed of its existence, asked my brother to buy it for him, and to send it down to Calcutta to be forwarded thence to England to the Zoological Society. The animal was bought, as I before said. But on attempting to remove it from the place where it was tied up, it most flatly refused to stir, neither coaxing nor force was of any use. We were rather puzzled what to do, when on enquiry of its old Bhotiya owner, we learned that it had always been in company with a white pony for which it had a strong affection. It then occurred to us that if we got the pony too, the *Kyang* might be induced to follow where the pony led; and so it turned out. One or two attempts were made subsequently to surprise the *Kyang* into a more independent sort of existence, but it was of no use, and so the pony and he went off to Calcutta together.

\* Journal Vol. XXVIII, p. 230.

The end of the pair was tragical. In a gale of wind off the Cape the Kyang died; and the Captain somewhat savagely threw the pony overboard alive, as his existence seemed no longer necessary after the Kyang's death.

Thus much as to the Kyang's identity. I must add, however, that although I am thus forced to show Mr. Blyth's mistake in this matter-of-fact, I in reality corroborate the force of his arguments as to the probable specific identity of the two Asses,—the Kyang and the Ghor-khur. It is obvious that Dr. Walker's description of a true Kyang, answers perfectly for a true Ghor-khur,—and as Mr. Blyth observes (though in a somewhat different sense), the alleged distinctions pointed out by Dr. Walker are probably enough valueless.

I have no pretensions to such a knowledge of Zoology or Anatomy as would make my opinion of any weight on the question of specific identity; but I may add a few words as to some of the more prominent features of the Kyang, having seen many of these animals dead and alive.

In the first place, my impression as to the voice of the Kyang is that it is a shrieking bray—not like that of the common Ass—but still a real bray and not a neigh. The differences of opinion on this point are easily reconcileable, I think, considering the inarticulate nature of the sounds.

As to the colour of the animal, it varies very greatly, and I think no dependence, as regards specific character, can be placed on mere depth of tint or brilliancy of hue. So also as to the dorsal and humeral stripes. The dorsal stripe is always plain. The humeral cross varies much, but is often as strongly marked as in the Ass bred in Kumaon, in which, however, it is not commonly very well defined.

I see nothing in the habits of the Kyang to make it improbable that it is, in fact, the same species as the Ghor-khur. The Kyang must be a very hardy animal to be able to live on the desert plateaus of Tibet; and though in winter the climate in which he exists is different enough from that of the plains of Sindh, yet in the summer the arid surface and scorching heat of the mid-day sun place the Kyang much more on a par with the Ghor-khur than might be supposed.

The Kyang, so far as external aspect is concerned, is obviously an Ass and not a Horse.

*Report on some Fishes received chiefly from the Sitang River and its Tributary Streams, Tenasserim Provinces.—By ED. BLYTH.*

A Report upon fishes which I drew up some months ago has gradually attained to such a length that it may be conveniently divided; and I shall therefore here confine attention almost entirely to fluviatile species, mostly collected by the late Major Berdmore in the Sitang river and its tributaries, with a few notices of new or little known species from the Gangetic streams and their outlets; reserving an extensive collection of marine fishes, collected principally at Port Blair, Andamán Islands, for a future occasion.

Fam. *Apogonidæ*.

AMBASSIS NOTATUS, nobis, *n. s.* Nearly similar to A. LALA, (Buchenan Hamilton), in form, but as large as A. RANGA, (B. H.), the mouth proportionally larger than in the latter and opening more distinctly upwards. Diameter of the eye nearly half that of the head. Body scales minute, but conspicuously visible to the unassisted eye; and the lateral line distinctly traceable throughout. In this genus, the first true dorsal spine is minute and fixed, pointing forwards (as in various Scomberoids), and the second or first moveable spine is generally reckoned as the first. Counting the moveable species only, the dorsal and anal rays are—

*D.* 7—1-13.—*A.* 3-14.

The first moveable spine of the anterior dorsal fin is  $\frac{1}{4}$  the length of the second, and the third is a little shorter than the second. Of the anal spines, the first is but half the length of the second, which again is a little shorter than the third. Fins colourless. A silvery band on each flank, commencing from a large dusky humeral spot. Length  $2\frac{1}{2}$  in. Sitang river.

A. LALA, (B. H.), var. A number of specimens of this fish sent by Major Berdmore are of small size, not exceeding  $1\frac{1}{2}$  in. in length, and have the anterior dorsal fin infuscated and the posterior dorsal and anal fins margined with blackish, to an extent that I have never seen in Bengal specimens; but I can detect no difference in structure. Sitang river.

BOGODA INFUSCATA, nobis, *n. s.* A minute species (if adult),  $\frac{9}{16}$  in. long by  $1\frac{1}{8}$  in. deep *minus* the fins; with the tail much less forked than in B. NAMA, (B. H.), Bleeker; and of a dusky or infuscated hue, having silvery gill-covers and a greenish-silvery stripe on each side: fins paler than the body, with a blackish tinge on the anterior half of the first dorsal.

D. 10—1-10?—A. 3-8?

One specimen only, from the Mutla. Presented by Major W. S. Sherwill.

The following are the species of *Sciænidae* which have occurred to me in Lower Bengal: this being an estuary group, of which several of the species ascend into fresh water.

SCIENOIDES, nobis, *n. g.* Certain Asiatic species are here brought together, which do not range well (as hitherto) either in SCIÆNA or OTOLITHUS, but they approach nearer to JOHNIUS, from which they indeed chiefly differ in the comparatively small size of the eye. The jaws are of equal length, with dentition as in JOHNIUS; and the anal spine is short and feeble.

1. SC. BIAURITUS; *Otolithus biauritus*, Cantor. Common about the mouths of the Ganges, and not unfrequently brought to the Calcutta bazars. I have an impression that, many years ago, I forwarded specimens of this fish to the India-house by the *M.S.* name *Sciæna elongata*.

2. SC. PAMA; *Bola pama*, B. H.: *Sciæna pama*, C. V.\* Exceedingly common, but I have never known it to exceed 2 ft. in length, and therefore believe that the examples “between four and five feet long” noticed by Buchanan Hamilton appertained to the preceding species, which is very similar in form of head, and moreover is unnoticed as a distinct species by Hamilton.

3. SC. HARDWICKII, nobis, *n. s.* A diminutive species, common at the mouths of the Gangetic rivers, which greatly resembles the

\* The so-called ‘Whiting’ of Calcutta tables. At Madras the SILLAGO ACUTA is eaten for ‘Whiting;’ and I consider the Bengal species, S. DOMINA, to resemble the flavour of true Whiting much more than does the SC. PAMA, or ‘Bola’ fish. S. ACUTA occurs at the Sandheads, but I have never seen this species in the Calcutta fish-bazars.

SCIÆNA LUCIDA, Richardson, figured in the *Zoology of the Voyage of H. M. S. 'Sulphur,'* and is therefore probably that cited as figured in one of the unpublished drawings of Gen. Hardwicke in the British Museum, No. 130; the SC. LUCIDA inhabiting the Chinese Seas. The eyes, however, are smaller than in SCIÆNOIDES LUCIDA, the teeth more developed, the medial caudal rays are prolonged into a lengthened filament (which, however, may be characteristic of youth), and the fore-part of the back is smooth and spineless. It has also many more rays to the second dorsal and fewer to the anal fins.

*D.* 9—1-43—*A.* 2-7.

Length to end of caudal filament under 2 in., in all hitherto examined. Colour bright silvery with white fins.

4. SC. (?) ASPER, nobis, *n. s.* Another small fish common at the mouths of the Gangetic rivers, with body and fins like the last, but the back less elevated, and the anal spine considerably more developed. Mouth large, opening obliquely upward; the teeth moderate or rather small. Head with many prickles or spinelets, more or less developed in different individuals. Eyes placed high, near the plane of the forehead, on which two slight ridges—one from above each eye—meet behind upon the occiput at a somewhat acute angle. Some have a mesial spinelet, pointing a little backward, on and above the moveable and protrusile portion of the upper jaw, and another directed forward a little behind it: other spinelets, again, are seen (or more readily felt) on a raised line posterior to the eye, another upon each side of the occiput, and there are spinelets likewise at the margin of the pre-opercule.

*D.* 9—1-28. *A.* 2-6.

Colour silvery, the head brilliant silvery in the recent fish, with more or less of a nigrescent wash on the dorsal and the caudal fins, and numerous very minute dark specks near the ridge of the back, which are likewise seen in SC. HARDWICKII. Length mostly under 3 in.

5. OTOLITHUS MACULATUS, Kuhl and von Hasselt (nec apud Cantor). This is clearly the species described by this name in the *Histoire des Poissons*, with numerous black spots on the caudal and

second dorsal. It is occasionally, though rarely, brought to the Calcutta fish-bazars.

6. *O. SUBMACULATUS*, nobis, *n. s.*: *O. maculatus* apud Cantor? Spots few in number and comparatively large, ranged chiefly in two subregular lines, one bordering the second dorsal and the other bordering the lateral line above, with a few spots also bordering the lateral line below,—about 24 in all on each side: no decided spots on the fins; but numerous dusky specks on the dorsals, caudal, and a few on the anal: a purple spot or patch and below it a yellow one on each gill-cover. Mouth opening more decidedly upwards than in the other, so that the large canine-like teeth of the lower jaw point directly backward when the mouth is closed.

*D.* 9—1-31.—*A.* 2-11.

Length 7 in. by  $1\frac{1}{2}$  in. in greatest depth of body. Two individuals only obtained in the bazar, within a few days of each other.

7. *O. BISPINOSUS*, Cuvier and Valenciennes. The fry common at the Sandheads, together with *SCIÆNOIDES HARDWICKII* and *SC. (?) ASPER*.

8. *JOHNIUS ANEI*, Bloch: *Bola coibor*, B. H. Common. Attains an enormous size, but the very large are seldom brought to the bazars.

9. *J. MACULATUS*, C. V.: *Sciæna maculata (?)*, Gray, Hardw. *Ill. Ind. Zool.* (represented as without spots below the lateral line!) Accords minutely with the description in the *Histoire des Poissons*; and Russell's figure (No. 123) assigned to the same must therefore be faulty, especially in the form of the head above the eye, if intended to represent the same species. Once only obtained; two specimens.

10. *J. CATALEUS (?)*, C. V. This also must be very faultily figured if Russell's pl. 116 is correctly assigned to it. It is not uncommon; and we have specimens from  $4\frac{1}{2}$  to 21 in. long. It is thoroughly distinct from No. 9 (at least the species are so to which I have assigned the names). *Kála Bola* of the natives here.

11. *J. CHAPTIS*; *Bola chaptis*, B. H. Common.

12. *J. SINA*, C. V. (Russell, No. 111). Rare.

13. *J. COITOR*; *Bola coitor*, B. H. Common.

14. *CORVINA CUJA*; *Bola cuja*, B. H. Common.

15. *LOBOTES ERATE*, C. V. Not rare. A particularly delicate fish for the table.

Of the foregoing fifteen species of *Sciænidae*, twelve have been obtained in the Calcutta fish-bazars, and only five of them are noticed by Buchanan Hamilton, though he appears to have confounded *SCIÆNOIDES BIAURITUS* with *SC. PAMA*.

A remarkable little fish obtained in the Calcutta fish-bazars may be designated —

*URANOSCOPIUS ADHÆSIPINNIS*, nobis, *n. s.*: having the ventral fins well separated apart, but each being connected along its whole inner edge to the skin of the abdomen, forming apparently an adhesive disk. Another curious character consists in a duplicature of the skin within the upper angle of the gill-cover, forming a sort of tube communicating with the gills when the opercle is closed. The anterior dorsal consists of ten almost detached spines, of which the first (which is close to the occiput) is longest. The upper part of the head is ridged, shewing angular interspaces or compartments, mostly of a squarish form: on the gill-covers are five distinct cross-ridges, and a sixth less distinct below. Above each lateral line is a series of prominent tubercles, and the lateral line is near to and runs almost parallel with the middle of the back. The ventrals reach as far back as the pectorals.

*D.* 10—14.—*A.* 11.—*P.* 15.—*V.* 5.—*C.* 11.

General colour olive-brown, paler below, and whitish about the gill-openings, with all the fins blackish and obscurely mottled. Largest specimen obtained  $2\frac{3}{4}$  in.; but the species doubtless attains a much greater size.

Fam. ————— ?

*TOXOTES MICROLEPIS*, nobis, *n. s.* Exceedingly like *T. JACULATOR*, but the scales conspicuously very much smaller, especially on the lower half of the body; the eye being also proportionally rather larger, and the body-markings much more developed, forming broken or discontinuous longitudinal bands. The fin-rays appear to be the same. From the Sitang river.

Fam. *Anabantidæ*.

*COLISA VULGARIS*, C. V. Sitang river.

Fam. *Zeidæ*.

*MICROZEUS*, nobis, *n. g.* A remarkable minute fish, which is little

else than an exceedingly diminutive ZEUS (the genus to which the British 'John Dory,' or *Jaune dorée*, is referred); and both in its uniform dark brown colouring,\* and its remarkable great humeral spine, specially approximating the Z. PANGIO, C. V., of the Mediterranean, figured in the *Histoire des Poissons* (pl. 280). From the first dorsal, however, which commences at the middle or highest portion of the back, the outline of the head and body (as viewed laterally) describes a quarter of a circle, falling vertically at the mouth. The mouth, also, is not protrusile, but the lower jaw extrudes when it is open; both jaws being apparently furnished with a single row of minute teeth. No scales or lateral line discernible (and the latter would appear to be somewhat indistinct in the ZEUS PANGIO). The general shape is nearly as high as long, compressed; the head broader, and armed with a great tumid frontal casque, adjoining which are several distinct and prominent ovoid plates variously disposed, at the junction of two of which on the gill-cover and directly behind the eye, arises the great lateral spine, which, though directed backward, stands out from the sides of the body and is therefore particularly conspicuous when the fish is viewed from above or below. There are two dorsal fins, distinct though continuous at base; the anterior having spinous rays, and greatly resembling the corresponding fin of ZEUS PANGIO, only proportionally much smaller: all the other fins are distinct and well defined, but short and compact, with no rays elongated beyond the rest; tail slightly rounded, less so than in Z. PANGIO, and the ventrals are not elongated as in that species. No proper scales are discernible, but the body is uniformly studded with rough tubercles.

M. ARMATUS, nobis, *n. s.* A minute species,  $\frac{3}{8}$  in. long *minus* the tail, by somewhat exceeding  $\frac{1}{4}$  in. high *minus* the fins. As in various other Scomberoids, &c., there is a minute and concealed forward-directed spine (readily ascertained by the sense of touch) anterior to the first dorsal, which latter consists of ten moveable spines, of which the third is longest and the rest are successively shorter, followed by a distinct though conterminous fin containing about sixteen soft rays; the anal has three short spines, followed by about fourteen flexible rays; the ventrals have one spine and five or six soft rays;

\* This, however, I since learn is only when preserved in spirit.

and the short pectorals have about fifteen rays; the caudal about seventeen.

*D.* 10-16.—*A.* 3-14.—*V.* 1-5 or 6.—*P.* 15?—*C.* 17?

From the diminutive size of the fish, it is difficult to count the fin-rays even with the help of a magnifier. The colour (in spirit) is uniform dusky-brown; but Major W. S. Sherwill, who discovered this species in the Mutla river during the month of May, swimming in shoals of about fifty each, in mid-stream during the height of the tide, assures me that about ten individuals of such a shoal were of a brilliant cobalt-blue colour, about twenty bright yellow, and the remaining twenty a rich brown,—differences no doubt of sex and of breeding condition.

Fam. *Macrogathidæ*.

MASTACEMBALUS, Gronov. Of this genus we possess—1. *M. UNICOLOR*, K. et v. H.; from the Sitang;—2. *M. PANCALUS*, (B. H.); very common in Lower Bengal;—3. *M. ZEBRINUS*, nobis, *J. A. S. XXVII*, 281, from the Sitang, which some might consider to be a strongly marked race of the last;—and 4. *M. ARMATUS*, Lacépède (apud Cuvier); very common in Lower Bengal, and here varying chiefly in the markings being more conspicuously developed in the young. It is accurately figured by Buchanan Hamilton, and incorrectly coloured (so far as the Bengal race is concerned) in the *Histoire des Poissons*. Dr. Bleeker identifies with it *M. ponticerianus* et *M. marmoratus*, C. V., and also *M. undulatus*, McClelland. The last is from China, and it agrees sufficiently with some Bengal examples of the species, except that it is stated to have three spines anterior to the anal fin; but I have seen none resembling in its variegation the *M. marmoratus*, C. V., and *M. venosus*, Val., as figured in the Zoology of Jacquemont's Voyage, nor the *M. armatus* as figured by Sykes. Dr. Jerdon recognised three species in S. India, all of which were considered by him to be different from that of Sykes—viz. his *ponticerianus*, which is doubtless true *ARMATUS* of Bengal, with 78 dorsal and 72 anal rays,—his *marmoratus* with *D.* 84 to 87 and *A.* 90 to 92,—and his *malabaricus* with 74 of each; the number of soft rays in the first and second according with those given by Cuvier and Valenciennes. A Tenasserim race now sent is a little differently marked from *ARMATUS* of Bengal, and the fins

(including the pectorals) are minutely speckled: but I considerably incline to the opinion that all will prove to be slight varieties only of *M. ARMATUS*,—excepting, of course, the *UNICOLOR*, *PANCALUS* and *ZEBRINUS*,—the last two being again very nearly affined to each other.

Fam. *Gobiidæ*.

Genus *ELEOTRIS*, Gronov. Five species are more or less commonly brought to the Calcutta fish-bazars. Of these, one—*E. MACRODON*—has minute scales; two—*E. POROCEPHALUS* and *E. INCERTA* (*n. s.*)—have small scales (and the former is less frequently obtainable than the others); and there are two with large scales—*E. BUTIS*, (*B. H.*, *v. humeralis*, Val.), and another which appears to be undescribed:—

*E. BUCCATA*, nobis, *n. s.* Affined to *E. CAPERATA*, Cantor, and at once distinguished by having a black spot at base of each pectoral fin, margined and dotted with bright gamboge-yellow. Scales larger than in *E. BUTIS*, (*B. H.*), a range of eight of them only from second dorsal to anal fins. The head very short, as high as broad, with a serrated ridge above each orbit, concave between the orbits and convex anteriorly above the mouth, with prominent scaled cheeks or præ-opercles; teeth small and uniform. In some specimens a series of dark transverse bands is distinctly traceable; one of them as broad as the first dorsal is long, the other being equal to the second dorsal: fins infuscated, more or less mottled, and the lower edged with yellow; the first ray of the second dorsal being elongated in some specimens.

*D.* 6-10.—*A.* 9.

Length 4 in. By no means a common species.\*

*E. CAVIFRONS*, nobis, *n. s.* Affined to *E. MACRODON*, Bleeker, but the scales fully twice as large, all the fins much longer, and a remarkable depression between the eyes; also the same scaleless line or groove from the eye to the insertion of the præ-opercle, conspicuously developed, as is described of *E. MADAGASCARIENSIS*. Head one-fourth

\* Though aware that Dr. Bleeker has subdivided the great genus *ELEOTRIS* (as it stands in the *Histoire des Poissons*), I have not seen his arrangement; but gather incidentally that *BUTIS* stands as the type of one group, and another distinct type of large-scaled species is exemplified by *E. CAPERATA* and *E. BUCCATA*.

of the total length: the pectorals reaching to the middle of the body. The lower jaw when closed exceeds in length and rises to the same plane as the upper; and in both jaws there is a row of larger teeth bordering the usual band of small teeth. Genital appendage rather long.

*D. 6-10.—A. 9.*

Colour greenish-albescent, much embrowned above; all the fins much speckled, the variegation shewing as numerous pale dots upon the caudal. Longest specimen  $4\frac{1}{4}$  in. Port Blair, Andamán Islands.

*E. INCERTA*, nobis, *n. s.* This is a species very similar to the last, and which is commonly brought to the Calcutta fish-bazars; but I have not known it to exceed 3 in. (or at most  $3\frac{1}{8}$  in.) in length, and the head is more than a quarter of the total length. In an example  $3\frac{1}{8}$  in. long, the head to point of gill-cover measures  $\frac{7}{8}$  in. In a few specimens—one or two thus characterized may generally be selected from two or three dozens—the curious feature occurs of a sharp reflected spine at the angle of the præ-opercle. In *E. BELOBRANCHA*, C. V., such spines occur on two of the gill-rays. The groove from the eye to the angle of the præ-opercle exists, but the naked line is more contracted than in *E. CAVIFRONS*. Dentition as in the latter, but the teeth are proportionally smaller. Fin-rays the same. Colour dull olive-brown, the pectorals whitish and minutely speckled, having a dusky spot at their base above, which does not occur in *E. CAVIFRONS*: dorsals, anal, and caudal, infuscated, the second dorsal prettily speckled with whitish and the other fins less distinctly variegated. Length mostly under 3 in.

*E. SCINTILLANS*, nobis, *n. s.* A species with only eight rays to the second dorsal and 6 (or perhaps 7) to the anal fins. General aspect very much that of an *OPHICEPHALUS*. Form short, the head nearly a third of the total length. Colour dull pale green, infuscated above and at the sides, with an appearance of two black spots above and below at base of tail; all the fins being inconspicuously speckled. As seen in spirit, many of the scales have a brilliant golden sparkle. Length of only specimen  $2\frac{1}{8}$  in. Port Blair, Andamán.

*E. FELICEPS*, nobis, *n. s.* Species remarkable for the approximation of the eyes, which are separated by an interspace only one-fourth of the diameter of the orbit. Scales, as in the preceding species,

moderately small, or of about the same proportionate size as in *E. ROBOCEPHALUS*. Mouth unusually small. Form rather short, with the head nearly a fourth of the total length. Rays of the first dorsal elongated into slight filaments. Ten rays in the second dorsal, and eight in the anal fins. Colour albescent-greenish, with numerous obscure and more or less confluent dusky spots on the sides (as best seen through a magnifier): all the fins being somewhat faintly variegated. Length of only specimen 2 in. Port Blair, Andamans.

I have introduced these Andamán species whilst treating of this genus; but the species of true *Gobius* thence received are very numerous, and, for the most part, are difficult to determine. An extraordinarily beautiful Goby of which I obtained a single specimen, some months ago, in one of the Calcutta fish bazars, appears to be the

*G. VIRIDIPUNCTATUS*, C. V. The fresh fish had a double row of brilliant greenish-cærulean large spots or patches on each side, which immediately and completely disappeared when it was put into spirit. Length  $5\frac{1}{2}$  in.

*AMBLYOPUS CIRRATUS*, nobis, *n. s.* A large and remarkable species, much shorter in proportion to its thickness than *A. HERMANNIANUS*, having the dorsal and anal fins much more elevated than in that species, and the pectorals also considerably broader; with the tail-fin quite distinct from the dorsal and anal, though connected at their extreme base only, the tail being broader and much less attenuated at tip than in the other; with eyes undiscernible in an adult preserved in spirit, but a pit in the centre of the face, and numerous flat lobes of skin around and about it; also with seven flat and pointed cirri about the symphysis of the lower jaw; and with the mouth more strongly reverted than in *A. HERMANNIANUS*, having all the teeth black at base.

*D.* 5-42.—*A.* 44.—*P.* 13.—*V.* 1-5.—*C.* 15.

Length of specimen 9 in.; and body  $1\frac{1}{2}$  in. deep posterior to the vent. A single example of this very strongly marked species was found among a lot of duplicates of *A. HERMANNIANUS*: origin unknown, but probably obtained in the Calcutta bazar.

*PERIOPHTHALMUS PAPILIO*, Bloch, Schn.: *P. fuscatus*, nobis, *J. A. S.* XXIII, 271 (the young). Agrees essentially with M. Valenciennes' figure of a species which he refers to *P. PAPILIO* from the W. coast

of Africa; but the tail is obliquely truncated underneath, as usual in the genus; and the high anterior dorsal fin is of a dusky plumbeous colour, with a conspicuous black margin which again is slightly fringed with white; there is ordinarily, however, no second white line below the black, as figured by M. Valenciennes, though I have found this in two small specimens, and the lower portion of the fin is often conspicuously speckled with white. General colour of the body fuscous above, subdued white beneath, the gill-covers more or less spotted with white, and rudimentary short transverse bands passing up from the white of the belly; neutral and anal fins white, the pectorals and caudal a little speckled. Length 5 in.; height of anterior dorsal fin  $1\frac{1}{4}$  in. in the finest examples. Common at Port Blair, Andamán islands.

P. 7—*RADIATUS*, (B. H.) Tenasserim and Calcutta specimens undistinguishable.

P. 13—*RADIATUS*, (B. H.) Ditto. The rays of the first dorsal vary from 11 to 13 in the males, and in the females this fin is either wanting altogether, or commonly so minute as to be discerned with difficulty, while in some examples five short rays are readily perceptible. Occasionally in the males the first or lengthened ray of the anterior dorsal is white to its base, and sometimes the second ray also. Mostly under  $3\frac{1}{2}$  in. in length.

*BOLEOPHTHALMUS INORNATUS*, nobis, *n. s.* A small species perhaps, with proportionally small mouth, the gape barely reaching to between the eyes; of a greenish colour, with about ten dark transverse bands, in general not very distinct; with colourless fins, excepting the two dorsal, the membranes of which are minutely speckled with black (as seen through a magnifier); the first dorsal being not more elongated than the second.

*D. 5-22.—A. 22.*

Our largest specimen measures 3 in. long, but is probably not full-grown. Tenasserim.

Fam. ————— ?

*NANDUS MARMORATUS*, C. V.: *Coius nandus*, B. H. Tenasserim. Common in Lower Bengal.

Fam. *Siluridæ*.

*BAGRUS LEUCOPHYSIS*, nobis, *n. s.* A restricted *BAGRUS*, of very

remarkable colouring; the head and fore-part of the body being bright silky-white above, studded with minute pores (as best seen under a magnifier). Maxillary cirri reaching to the end of adipose dorsal. Teeth and palatal band of them as usual in the genus. Eyes one-third of the vertical diameter of the head, and the two separated by an interspace equal to the orbit. Occipital process nearly as in *B. GULIO*, (B. H.) First dorsal spine short and triangular; the second elongated, moderately slender, and pectinated behind for its terminal third; the next two soft rays being longer than the spine. Pectoral spines very strongly pectinated behind. Adipose dorsal fin elongated longitudinally. Tail strongly forked.

*D.* 2-7.—*A.* 10.—*P.* 1-9.—*V.* 6.—*C.* 17.

Fins chiefly black, the rays of the first dorsal pale. Adipose dorsal pale and yellowish, studded with minute dusky specks, and having a slight dusky border. Base of ventrals yellowish, and an admixture of this colour on the pectorals, anal, and caudal. Body chiefly of a dark chocolate-brown, passing to silky-white anterior to the dorsal spine.\* Largest specimen  $5\frac{1}{2}$  in. long,  $1\frac{1}{4}$  in. high at the dorsal spine, and length of dorsal spine  $1\frac{1}{8}$  in. From the Sitang and other Burmese rivers.

*B. TENGARA*, (B. H.), *var.* Merely differs from *B. TENGARA* of Bengal by having constantly a strongly marked black spot near the tail, similar to the pectoral spot in both races. Tenasserim.

*B. CAVASIUS*, (B. H.), *var.* Differs only from the Bengal race by having a very distinct black mark at base of the dorsal spine, and in some individuals a distinct black spot also on the operculum,—markings which are only indicated in Gangetic specimens. Tenasserim.

*BATASIO*, nobis, *n. g.* A *Bagroid* form well worthy of distinction; comprising a number of small species with round and prominent muzzle, and the contracted mouth opening from below: with eight, or sometimes (?) six, cirri, which are very short, the maxillary cirri scarcely passing the eye in some. Palatal band of teeth continuous with the mass of maxillary teeth, or separated only by a slight groove. Rest as in *BAGEUS* (*verus*).

\* This white recalls to mind that of the male of *HEPIALUS HUMULI*, an insect commonly known in England as the 'Ghost-moth.'—In the recent fish, the colour of the lower parts should be green, according to a communication just received from Major Tickell.

Type. B. BUCHANANI, nobis ; *Pimelodus batasio*, B. H.

B. AFFINIS, nobis, n. s. Exceedingly like B. BUCHANANI, as described by Buchanan Hamilton and as figured in one of his unpublished coloured drawings ; whereas his published figure (*F. G.* pl. XXIII. f. 60,) refers to his *Pimelodus carcio*, which is a true BAGRUS with moderately long maxillary cirri:—but having 12 instead of 16 anal rays, no distinct longitudinal black stripe on each side of the body, but a tendency to shew three or four broad cross-bands, more or less distinct, besides a round black spot near the gill-covers, as in the other. The first dark band proceeds obliquely downward from the fore-part of the first dorsal, to some distance below the lateral line ; and posterior to this first band are obscure traces of three or four others, the last at base of tail. On the membrane of the dorsal fin is a large blackish spot, consisting of minute dark specks. Maxillary cirri scarcely passing the eye ; the two inferior pairs of cirri minute. Length  $3\frac{1}{4}$  in. by  $\frac{3}{4}$  in. high, of dorsal spine  $\frac{1}{16}$  in., and of maxillary cirri under  $\frac{3}{8}$  in. Tenasserim.

To the same type, but with shorter adipose dorsal, appertain the TENGANA, CHANDAMARA, and RAMA of Buchanan Hamilton. B. CHANDAMARA is referred to SILUNDIA by M. Valenciennes, and is described by Hamilton to have only two cirri ; but his unpublished figure represents six cirri distinctly, and in all this group the minute cirri are discernible with difficulty and are extremely liable to be overlooked. The BAGRUS CAPENSIS of Sir A. Smith's 'Illustrations of S. African Zoology' would appear also to be referrible to this particular division.

Of the well marked type exemplified by BAGRUS SONDAICUS and B. DOROIDES of Valenciennes, Dr. Bleeker constitutes his genus HEXANEMATICHTHYS. The latter species, however, I consider to be—

H. SAGUR ; *Pimelodus sagur*, B. H. : *Bagrus doroides*, Val. For a few days, in the month of March, 1859, several specimens were brought to the Calcutta bazar ; and the largest obtained by me was  $22\frac{1}{2}$  in. long, with dorsal spine  $2\frac{3}{4}$  in., and pectoral spines  $3\frac{3}{8}$  in. ; the membrane prolonged into a short filament beyond the spines : the latter are granulose, striated, with a regular series of tubercles in front, which are round on the pectoral spines and *omega*-shaped on the dorsal. Maxillary cirri reaching back to beyond the posterior

base of the pectorals, as far as the tip of the triangular granulose bone above the pectorals and behind the gill-cover. Osseous plate broad, and uniformly granulose almost to the ventrals; the second plate, anterior to the base of dorsal, large and bilobate or *saddle-shaped*. A series of granulose ossicles continued along the lateral line, nearly as far as the posterior base of the dorsal fin. Colour uniform livid plumbeous above, spotless pearly-white below: a series of transverse dull silvery bands, each with a row of pores along its anterior margin,\* above the lateral line: no dark spot on adipose dorsal; the membrane of anterior dorsal pale, and of the other fins purple-black. Eyes moderate, with yellow irides.

Another type is rightly discriminated by Dr. Bleeker by the name CEPHALOCASSIS, comprising species both from the Old World and the New. Among them are —

C. SONA; *Pimelodus sona*, B. H.: *P. auratus*, B. H., MS.: *Bagrus arioides*, Val.

C. GAGORIDES; *Bagrus gagorides*, C. V.; *Pimelodus gagora*, B. H. (in part), vide *J. A. S.* XXVII, 285.

C. TRACHYPOMUS; *B. trachypomus*, C. V.; which I am now satisfied is distinct from GAGORIDES, though I have not obtained it. Indeed, the *habitat* of this fish is not stated.

ARIUS is restricted by Dr. Bleeker to the type exemplified by *P. arius* and *P. gagora*, B. H., with two groups of blunt teeth on the palate. The following also belongs to it.

A. JATIUS; *Pimelodus jatius*, B. H. Stated to have no palatal teeth; and certainly they are not always discernible in the recent fish.† But in most fresh specimens, and always soon after death, or in the dry skin, two oblique oval masses of round tubercle-like teeth are seen, very far back on the palate, and a few similar teeth detached from the others by a long interval are placed in two small lateral masses nearer to the card-like maxillary teeth. General aspect of A. GAGORA, but with the face anterior to the eyes considerably longer: maxillary cirri reaching only to the white spot on centre of

\* These are difficult to discern in the dry skin.

† In a description which I took from the first specimen obtained, I underlined the statement that it had no palatal teeth.

forehead. Dorsal and pectoral spines resembling those of *A. GAGORA*, being of the same proportional length and thickness but less distinctly pectinated behind. Cephalic plate much less uniformly tuberculated than in *A. GAGORA*, and considerably more grooved or lineated and having fewer tubercles anteriorly: small bony crescent anterior to the dorsal spine prolonged on either side to a point, and tuberculated only in the middle. Colour lurid, passing to silvery on the sides below the lateral line, and white underneath; the fins also white, and a black spot on the adipose dorsal: irides pearly-white: mouth small and of a yellow colour. The largest specimen obtained is 29 in. long, with dorsal spine  $4\frac{1}{8}$  in. This species is but occasionally brought to the Calcutta fish-bazars, and generally more or less stale and unfit for preservation, as if not taken in the immediate neighbourhood.\*

*GAGATA*, Bleeker. This, as it now stands, is a heterogeneous assemblage of species, and I know of none that can properly range with the type of it, which is *Pimelodus gagata*, B. H.: a species with the maxillary cirri bony towards the base, as in *BAGARIUS* to a much greater extent. The *MENODA* dubiously referred to this type by Dr. Bleeker is identical with *Bagrus corsula*, Val., which therefore must stand as *B. MENODA*, (B. H.); the *MANGOIS* appertaining to my genus *AMBLYCEPS*; and another type may be here indicated as—

*HARA*, nobis, *n. g.* With broad maxillary cirri, soft throughout, and annulated with two colours: the pectoral spines short, flat, and pectinated on both edges; the dorsal spine less stout, serrated on both edges or behind only: mouth small, terminal, but opening below: head flattish, with small eyes placed high: a band of card-like palatal teeth. Colouring dark and minutely mottled.

Type. *H. BUCHANANI*, nobis; *Pimelodus hara*, B. H.

*H. FILAMENTOSA*, nobis, *n. s.* Very like *H. BUCHANANI*; but having a long filament continued from the upper segment of the caudal fin. The markings are difficult to describe, from their intricacy; but two

\* To the list of *Siluridiæ* obtained in the Calcutta bazars, published in Vol. XXVII, p. 283 *et seq.*, have accordingly to be added—

*HEXANEMATICTHYS SAGUR*, (B. H.)

*ARIUS JATIUS*, (B. H.): as also

*CHACA LOPHIODES*, Val.: *Platystaca chaca*, B. H.

irregular speckled-whitish transverse bands are constant, preceded each by a blackish band, the first white band being anterior and the second posterior to the adipose dorsal; a row of whitish spots on the membrane of the dorsal; two dark bands, one of them basal, on the ventrals; and a black band at base of anal fin. Length 3 in.; of caudal filament 1 in. more. Tenasserim.

To this genus must also be referred the (*Pimelodus*) *CONTA*, B. H., with a deeply furcate tail, the upper lobe of which is longer and more attenuated; as also the (*P.*) *CARNATACA*, Jerdon, and the (*P.*) *ASPERA*, McClelland, *C. J. N. H.*, IV, 404, and pl. XXIV, f. 2.

Another distinct type occurs in the (*P.*) *CENIA* and (*P.*) *VIRIDESCENS*, B. H. These are referred doubtfully by Dr. Bleeker to his *HEMIPIMELODUS*; as also (*P.*) *JATIUS*, B. H., which is a true *ARIUS*, as already shewn. If the *Nallah Jellah* of Russell (pl. CLXX) be a proper *HEMIPIMELODUS* as assigned by Dr. Bleeker, then the *CENIA* group is quite distinct; and the (*P.*) *TELCHITTA*, B. H., again, represents a special type with additional species in S. India.

*AMBLYCEPS*, nobis, *J. A. S.* XXVII, 281. Type *AMB. CÆCUTIENS*, nobis, *ibid.* ('*Cobitis*-like Siluroid,' XXIV, 712). To this genus should be referred the (*Pimelodus*) *MANGOIS*, B. H., figured among his unpublished drawings; but the form is rather less elongated, the tail more sharply forked, the eyes (to judge from the drawing) more distinct, and the adipose dorsal better defined and less distant from the first dorsal, than in *A. CÆCUTIENS*.

*A. TENUISPINIS*, nobis, *n. s.* A third species, distinguished by the slenderness of its short dorsal and pectoral spines, and also by the fineness of its eight cirri: eyes minute and difficult to be distinguished: adipose dorsal indistinct and pointed posteriorly: six soft rays to the dorsal and nine to the anal, the first of the latter being short and the next two successively longer. Colour uniform dark greenish olive-brown. The lateral line wanting in all the species. Length 2 in. A single specimen procured at Gházipur by Dr. Jerdon, and presented by him to the museum.

*GLYPTOSTERNON*, McClelland. It appears that as many as four very distinct generic types have been brought together under this name by Mr. McClelland, in the five species which he has described

in the second volume of the *Calcutta Journal of Natural History*, pp. 584-8.

The species first described by him is his *GL. RETICULATUS*, from Afghánistán. It is stated to be "without spines; the first ray of the pectoral and ventral fins soft and pinnate, giving off soft pointed cartilaginous rays along the anterior margin, which are enveloped in the membrane of the fin. *The under surface of the head and of the anterior portion of the body forms a flat corrugated surface.*" Gill-covers — ? Cirri — ? This form will remain as typical *GLYP-TOSTERNON*.

A second type (*PSEUDECHENEIS*, nobis, *n. g.*) is figured and very unsatisfactorily described as *GL. SULCATUS*. All that is stated is— "An oval disk on the breast between the pectorals, composed of *transverse plates* as in the *Remora* (*ECHENEIS*), and a series of similar plates on the broad lower surface of the first rays of the ventrals." No mention of spinous rays: and from the figure published it is doubtful if the gill-coverings are visible from below. Adipose dorsal distinct and well developed. Mouth figured as small, subterminal; with tolerably developed maxillary cirri; the six other cirri small.

"D. 8.—A. 9.—P. 13.—V. 7.—C. 16."

The third type is that of his *GL. STRIATUS* and apparently his *GL. PECTINOPTERUS*, respectively from the Khásya hills and the vicinity of Simla. We have what appears to be the former from Dorjiling; also another species from the same locality, but in too imperfect condition to permit of a description being taken of it. A fine third species likewise from the Tenasserim provinces. This type may be denominated

*GLYPTOTHORAX*, nobis, *n. g.* Mouth subterminal, large, with a band of card-like maxillary teeth above and below: gill-openings large, and nearly meeting below; and behind them a pectoral adhesive disk grooved longitudinally. Maxillary cirri rather large, with a concealed spinelet at their base; the six other cirri moderate. Adipose dorsal distinct and well defined; the anal fin moderate or somewhat large. Dorsal spine well developed, smooth, feebly pectinated behind towards its tip; the pectoral spines broad and flat, and strongly pectinated behind: a distinct spinous base also to the first ventral ray.

*GL. TRILINEATUS*, nobis, *n. s.* Typical in structure, and of a

blackish colour, with three longitudinal yellow lines, one along the entire ridge of the back from occiput to base of tail, the others along each lateral line. Dorsal spine two-thirds of the length of the first soft ray. Lobes of the furcate tail subequal, the lower rather the larger and longer.

*D.* 1-7.—*A.* 12.—*P.* 11.—*V.* 6.—*C.* 15.

The chief structural difference from *GL. STRIATUS* consists in its having three more rays to the anal fin. Length  $5\frac{1}{2}$  in. Tenasserim.

The fourth type is very distinct in the form of the mouth, and has remarkably small gill-openings which are visible only from above. I term it

*EXOSTOMA*, nobis, *n. g.* Otherwise generally similar to *GLYPTOTHORAX*, but with no pectoral disk, the dorsal spine exceedingly slender (if always present?), and the eyes somewhat larger. "Lips reflected and spread continuously round the mouth, so as to form a broad flat sucker." Two distinct lateral lobes of minute card-like teeth, both above and below, reflected much apart, and having an obviously suctorial centre. Only one pair of lower cirri, situate at the posterior corners of the reflected lower or hinder lip: the entire lower-parts smooth and flat. Anal fin small; the adipose dorsal lengthened but very slight and low, extending nearly to the caudal.

*EX. BERDMOREI*, nobis, *n. s.* Maxillary cirri reaching beyond the base of the pectoral spines, and no distinct spinelet at the base of the latter; but a spinous base to the first ray of the ventrals: lower caudal lobe much broader and longer than the upper.

*D.* 7.—*A.* 6.—*P.* 1-10.—*V.* 1-5.—*C.* 14.

Colour dingy olive-brown, with obscure broad dark bands, presenting more or less of a clouded appearance; the fins mostly darker: below pale. Largest specimen 4 in. Tenasserim.

*EX LABIATUM*; *Glyptosternon labiatum*, McClelland. Dorsal described to be "perfectly soft and free from spines and bristling points; cirri very short." No notice of the colouring. From the Mishmi hills, E. Asám.

Dr. Bleeker refers the (*Pimelodus*) *NANGRA*, B. H., to *GLYPTOSTERNON*; but this I cannot understand. *Vide* Hamilton's published figures. He also gives a *GL. PLATYPOGON*, (K. et v. H.), from Java

and Hindustan, and a *GL. PLATYPOGONOIDES*, Blkr, from Sumatra; both of which appear to fall under *GLYPTOTHORAX*, nobis, *ut supra*.

*EUTROPIUS MACROPTHALMOS*, nobis, *n. s.* Of the usual form of this genus, but with remarkably large eyes, that occupy more than half of the height of the head. Longer maxillary cirri reaching to the vent, the four inferior cirri to base of pectorals: spines slender, the pectoral less so, and all minutely pectinated behind; the dorsal also jagged in front for its basal half.

*D.* 1-7.—*A.* 47 to 54.

Colour bright silvery, infuscated along the back, with a golden lustre on the gill-covers. Soft rays of the dorsal and pectorals infuscated except at base; also the medial portion of the deeply forked caudal, while several outer rays of the caudal above and below are white throughout. Ventrals and anal white: the slender adipose fin having minute dusky spots. Longest specimen  $6\frac{1}{2}$  in. Tenasserim.

*SILURICHTHYS BERDMOREI*, nobis, *n. s.* Maxillary cirri reaching to base of ventrals, the inferior to base of pectorals. The upper jaw slightly longer than the lower. Eyes small. Dorsal fin slight and slender, but seeming to consist of three or four rays. Pectoral spine short, only half of the length of the fin.

*D.* 3 or 4.—*A.* about 65. *P.* 1-13.—*V.* 11.—*C.* 17.

Anal continuous with the caudal, but distinctly defined. General colour dull olive-brown, paler below. Length of specimen  $4\frac{3}{4}$  in., by  $\frac{3}{4}$  in. deep at dorsal. Head  $\frac{3}{4}$  in. Tenasserim.

*PSEUDOSILURUS MACROPTHALMOS*, nobis, *n. s.* General form of *Ps. FABDA*, (B. H., *microcephalus*, Blkr), but proportionally less deep and more elongated, with eye of twice the diameter, and the lower jaw closing evenly with the upper, or very nearly so, though protruding when the mouth is open; maxillary cirri much longer, reaching far beyond the more developed pectorals; the anterior bands of teeth above and below much less broad, and the palatal teeth reduced to two straight and well detached transverse patches.

*D.* 4.—*A.* 75.—*P.* 1-13.—*V.* 7.—*C.* 19 or 20.

Colour dull silvery, much embrowned, especially above, with a greenish tinge, probably more decided in the recent fish. Length of specimen  $9\frac{1}{4}$  in., by  $1\frac{3}{8}$  in. in a vertical line from dorsal to ventral; head  $1\frac{1}{2}$  in.; pectorals  $1\frac{3}{8}$  in.; maxillary cirri  $3\frac{1}{2}$  in., becoming

extremely fine towards the end. A large round dark spot on each side, situate on the lateral line, a little anterior to the dorsal fin. Tenasserim.

Fam. *Cyprinidæ*.

*BARBUS CAUDIMARGINATUS*, nobis. *n. s.* One of those *SYSTEMI* (for such they essentially are) which, having four barbules or tentacles, are currently assigned to the great and comprehensive genus *BARBUS*: such are the *B. GORDONIDES* and *B. CHRYSOPOMA* figured by Valenciennes, and the *B. SARANA*, (*B. H.*), Val., which is *S. immaculatus* as described by McClelland.\* In the present species the barbules are well developed, the form less deep than usual in the particular group, the principal dorsal spine robust and passing into a soft ray for its terminal fourth, being finely pectinated behind, and preceded by three distinct spines, the first very minute. About 32 scales on the lateral line, and ten longitudinal series of scales.

*D.* 4-8.—*A.* 7 (the last divided).

Colour silvery, above darker and greenish; with an irregular vertical black mark behind the gills, and broad black upper and lower margins to the caudal fin; the rest of the caudal, with the ventrals and anal, bright crimson (which soon disappears in spirit). Length 4 in., by  $1\frac{1}{2}$  in. from dorsal to ventrals. Vertical diameter of the eye fully half that of the head. Irides pale golden. Tenasserim provinces.†

*CAPOETA MACROLEPIDOTA* (?), K. et v. H. Specimen 2 in. long. No serrature discernible on the dorsal spine, and I distinguish seven anal rays. The late Dr. Cantor gives this species as inhabiting the Tenasserim provinces; and it and *LEUCISCUS BASBORA* are the only

\* His figure (*As. Res.* XIX, II, Pl. XL, f. 5), I take, from the colouring, to represent a common species of *SYSTEMI* with one pair of very minute tentacula, otherwise resembling *S. SOPHORE* except in the absence of markings. For this the name *IMMACULATUS* might be retained. It grows to about double the size of *S. SOPHORE*.

† 'Black and red-tailed *Systemus*' of the Rev. F. Mason's 'Natural Productions of Burma.' Several species are indicated in this work, as *ROHITA VULGARIS*, *R. CALBASU*, and *R. NANDINA*; also a large Barbel affined to *B. TOR*, (*B. H.*), which he terms *B. MORTONIUS*; and a mountain Barbel with minute scales, of the *OREINUS* group, which requires examination.

*Cyprinidæ* which are included in his Catalogue of Malayan fishes. Tenasserim.

Genus *OSTEOBRAMA*, Heckel. Comprising certain Bream-shaped Carps with minute scales, as exemplified by the (*Rohtee*) *VIGORSII* and (*R.*) *OGILBII* of Sykes, and the (*Leuciscus*) *ALFREDIANUS* of Valenciennes.\* Dr. Bleeker includes them in *SYSTEMUS*.

*O. MICROLEPIS*; *Systomus microlepis*, nobis, *J. A. S.* XXVII, 289. ('Tenasserim Bream' of Mason.) A specimen obtained by Mr. Atkinson at Maulmein; and I am now certain that the example formerly described is also from Maulmein, having been sent many years ago by the Rev. F. Mason. Colour silvery-ash above the lateral line, white below it, and a semi-obsolete large blackish spot near base of tail: fins white, a little tinged with yellow; and the irides apparently pale golden. From analogy with kindred species, it is probable that this fish attains a weight of 3 or 4 lbs.

*O. COTIS*; *Cyprinus cotis*, B. H.; *Abramis cotis* apud McClelland; *Leuciscus alfredianus* (?), Val. A Tenasserim specimen 3 in. long accords with the description, excepting in having but 32 instead of 36 rays to the anal fin.† The second dorsal ray is spinous, but very slender, and is conspicuously serrated on the hind-edge. In lieu of the row of four dots close under the lateral line and immediately behind the gill-cover, figured by Buchanan Hamilton, are four scales of the lateral line having remarkably large tubes; and most of the soft rays of the dorsal are marked anteriorly with black, and the rays of the anal are spotted with the same anteriorly, as seen with the help of a magnifier. The merest trace of a slight dark spot in front of the dorsal fin.

\* Figured in the *Histoire des Poissons* by this name; but described as *L. Duvaucelii* (by which appellation a species of *SYSTEMUS* is also described and figured),—having "le premier rayon de la dorsale forte et un peu dentelé." From Nipal. It appears that three divisions of these spined Bream-carps are recognised by Heckel, bearing the names *ACANTROBRAMA*, *OSTEOBRAMA*, and *GLOSODON*. I am unacquainted with the distinctions; but find that *ROHTEE* *OGILBII*, Sykes, is assigned to *OSTEOBRAMA*, as is likewise the (*Cyprinus*) *COTIS*, B. H. *Vide* Hugel's *Fauna von Kaschmir*, p. 392.

† McClelland also counts 32 rays. (*As. Res.* XIX, II, 588). But Valenciennes counts 36 in his *ALFREDIANUS*.

*SYSTEMUS* (?) *MACULARIUS*, nobis, *n. s.* Affined to the preceding in shape of head: the muzzle unusually prolonged anterior to the nostrils, where shewing a considerable concavity above. Body less deep than usual; its lower outline continued straight to the base of the anal fin. Principal dorsal spine unusually large in every way, and strongly pectinated behind: anterior to it are distinctly three others, the first very minute: large anal and first ventral spines passing gradually into soft rays towards their tips. Series of 35 or 36 scales along the lateral line, and of 12 obliquely downward from base of dorsal spine.

*D.* 4-8.—*A.* 3-6.—*P.* 17.—*V.* 1-8.—*C.* 21.

Colour pale olivaceous, deeper on the back; each scale having a distinct shining blackish spot at tip, less conspicuous on the browner scales of the back; fins pale; the tail well forked. Length 6 in., by  $1\frac{1}{2}$  in. high in the body; of principal dorsal spine *plus*  $1\frac{1}{4}$  in. Tenasserim.

*S. DUVAUCELII*; *Leuciscus Duvaucelii*, Val., *H. P.* pl. 491. Tenasserim.

*S. PHUTONIO*, (? B. H.) Five specimens, averaging  $1\frac{3}{4}$  in. long, a trifle more or less.

*D.* 2-8.—*A.* 1-6.

Fins spotless. A transverse black bar on the medial third of the body, above the middle of the pectorals, and a broader black transverse bar towards the tail, appearing generally as a round spot that had *run* more or less above and below. From Maulmein. What appears to be the same fish in Lower Bengal, I have never obtained more than  $1\frac{1}{2}$  in. long, and the anterior transverse streak is invariably longer and better defined, occupying the medial two-fifths of the depth of the body above the middle of the pectoral fins. The fins of the Tenasserim fish seem also to be proportionally larger.

*S.* (?) *UNIMACULATUS*, nobis, *n. s.* Species much resembling in outline the *LEUCISCUS COSUATIS*, (B. H., as figured by McClelland by the name *Systemus maculatus*, *As. Res.* XIX, II, pl. XLIV, f. 9), but the scales are proportionally smaller, and there are three distinct spines to the dorsal fin, the principal one being very slender, smooth or unserrated, and those of the anal barely recognisable as such. Colour pale silvery-brown, with one great black spot on the dorsal

fin towards its base. Lateral line very indistinct from below the commencement of the dorsal.

*D.* 3-8.—*A.* 2-5?

About 24 scales longitudinally, and 8 or 9 obliquely downward from the dorsal. Largest specimen but  $1\frac{3}{8}$  in. Tenasserim.

Genus PLATYCARA, McClelland (as originally founded on his PL. NASUTA, which is a large-scaled Cyprin altogether distinct from BALITORA of Gray, which Mr. McClelland most unaccountably unites with his PLATYCARA):\* *Bangana*, Gray (*nec* B. Hamilton); comprising *Discognathus*, Heckel; and the more typical Indian species doubtfully referred to LOBOCHEILOS by Dr. Bleeker. A genus of Gudgeons inhabiting mountain rapids, the more characteristic species having a great transverse cleft on the face studded with large tubular pores, and also an adhesive disk to the lower lip,—which group Mr. McClelland referred to RICNORHYNCHUS (as adopted by him), without perceiving that his PLATYCARA NASUTA and also his PL. LISSORHYNCHA strictly belonged to it, equally with other species which he has figured in *As. Res.* XIX, pl. LIII, in some of which the face is smooth and not cleft and the labial disk is greatly reduced, as illustrated also by the *Discognathus fusiformis*, Heckel, of Baron Hugel's *Fauna von Kaschmir* (p. 378). As examples of the more typical form may be cited the *Cyprinus (Bangana) falcata* and *C. gotyla*, B. H., of Hardwicke's *Illustrations of Indian Zoology*: but all shew a strong tendency to the BALITORA form of pectorals; all that I have seen having likewise large ventrals, and the backward position of the mouth which opens downwards, and fimbriated anterior lip, seem to be of constant occurrence. The cleft and tubercular face occurs in another type, exemplified by the GOBIO RICNORHYNCHUS of McClelland, which (so far as I know at present) stands quite alone, as a particular type worthy of a special designation.† The

\* *J. A. S.* VII, 947, and pl. LV, fs. 2, *a* and *b*; copied into *As. Res.* XIX, pl. LVII, *f.* 2, with *a* and *b*. The mistake of uniting these two incongruous genera is repeated in *Calc. Journ. N. H.*, Vol. II, p. 587, and pl. XVI; where a species of the mountain type of Gudgeon is described and figured as PLATYCARA LISSORHYNCHA, and a true BALITORA as PL. ANISURUS!

† Perhaps true LOBOCHEILOS? It approximates the TYLOBHYNCHUS, Heckel, but the duplication of the lips and great chin-pore are peculiar. To TYLOG-

extremes of the present genus are connected by intermediate gradations, of which the *PL. NASUTA* of McClelland presents a good illustration.\*

A highly typical species, with every character developed in the utmost degree, may be designated—

*PL. NOTATA*, nobis, *n. s.* Easily recognized by having five conspicuous black spots on the base of its dorsal fin. Four labial cirri, the hindmost liable to be overlooked. Scales on lateral line 33, and 8 from dorsal to ventral: the dorsal rather high and falcate anteriorly. Ventrals as large as the pectorals, and somewhat falcate; the anal more decidedly so.

*D.* 10.—*A.* 7.—*P.* 15.—*V.* 9.—*C.* 20.

Colour dusky olive-green above and on the sides, beneath buffy-albescent. Base of the dorsal fin whitish, setting off a series of black spots, larger anteriorly and the hindmost generally obsolete; rest of the fin a little nigrescent. One or more spots also at base of the anal fin. Pectorals somewhat yellowish at base, then blackish: a dusky line along each longitudinal row of scales becoming gradually visible towards the tail. Length 6 to 6½ in. Tenasserim.

The next has a smooth muzzle and almost rudimentary disk.

*PL. LATIUS*; *Cyprinus latius*, B. H.: *Gonorhynchus macrosomus*, McClelland. Tenasserim.

*LABEO CURCHIUS*; *Cyprinus curchius*, B. H. What I take to be this species accords with the fin-ray formula assigned by McClelland (*As. Res.* XIX, II, 328); but I count only about 64 (instead of 78) rows of scales along the lateral line, and but 17 or 18 (instead of 30) rows from dorsal to ventrals. No proper “stripe along the middle

*NATHUS*, Dr. Heckel refers the *Varicorhinus diplostomus* of the *Fische aus Caschmir*, by the new specific name of *Valenciennesii*; and the *Barbus diplocheilus* of the same work is now his *T. BARBATULUS*. A third species, from the Bombay Presidency, is also described by him as *T. PORCELLUS*. (Vide *Fauna von Kaschmir*, pp. 376, 378, and 385). The true *VARICORHINUS* of Rüppell has spines to the dorsal fin; wherefore *V. bobree* of Sykes also cannot properly be retained in it.

\* I think, however, that the so-called ‘Mountain Trout’ of Kumâon, figured by Mr. McClelland in *J. A. S.* IV, 40, with its minute scales and other striking distinctions, is erroneously placed by him in this particular group in *As. Res.* XIX, II, 281, 367.

of the anal fin," as described by B. Hamilton; but all the fins are more or less minutely dotted, the dots tending to form a slight stripe along the lower half of several of the rays of the dorsal, anal, and ventral fins, the ventral and lower half of the caudal being more decidedly suffused with blackish.

*D.* 17.—*A.* 8.—*P.* 15.—*V.* 9.—*C.* 19.

The first rays of the dorsal and anal being minute, and the first three rays of each of these fins joined as usual. Tenasserim provinces.

*DANGILA BERDMOREI*, nobis, *n. s.* Readily distinguished by having a black spot at the tip of every scale. Head  $4\frac{1}{2}$  times in the total length. Height about the same. Tentacles small and fine. Eye larger than in *D. CUVIERI* (figured by Valenciennes), and the back rising evenly from the muzzle to the base of the dorsal fin. About 40 scales on the lateral line, and 12 or 13 longitudinal rows.

*D.* 28.—*A.* 9.

Colour silvery, paler below, and each scale marked as described: the membrane of the dorsal fin minutely dotted, and all the fins slightly tinged with yellow. Length of only specimen  $4\frac{1}{8}$  in.; the dorsal nearly  $\frac{3}{4}$  in. high in front. Tenasserim provinces.

*LEUCISCUS ANJANA*, (B. H.): *L. lateralis*, McClelland. Tenasserim.

*NURIA*, Valenciennes. The members of this genus are *LEUCISCI*, with the dorsal fin placed far backward as in *PERILAMPUS*, but the anal is short as in *LEUCISCUS* proper, and there are four slender and rigid maxillary filaments, the upper sometimes of great length. To this genus belong *N. SUTIHA*, (B. H.), *JOJIA*, (ibid.), and (*Leuciscus*) *BARBATUS*, Jerdon.

*N. ALTA*, nobis, *n. s.* Of comparatively large size and deeper in the body than any previously described; but evidently nearly affined to *N. BARBATA*, (Jerdon), and like it with 32 scales along the body in 7 rows; each scale having three or four distinct diverging ridges. Upper filaments of great length, more than reaching to the anal fin; the other pair minute. Pectorals reaching to the ventrals.

*D.* 8.—*A.* 7.

Colour ruddy, with a broad yellow lateral band surmounted by a nearly obsolete black streak: gill-covers silvery; and a black spot above the base of the pectorals: fins pale and yellowish, more or less

tinged with dusky in the young. Length 4 in., by rather more than 1 in. in depth. Tenasserim.

*N. ALBOLINEATA*, nobis, *n. s.* Both broader and deeper in the body than *N. DANRICA*, (B. H.), with the muzzle scarcely upturned, and a longer anal fin—more immediately approximating the species to *PERILAMPUS* (as restricted). Upper filaments reaching to the tips of the pectorals, which latter do not reach to the base of the ventrals; the base of the dorsal is scarcely anterior to that of the anal; ventrals somewhat short.

*D. 9.—A. 10.*

Colour olive-green on the upper half, buffy-white below, with a broadish white stripe along the hind-half of the body chiefly, narrowing anteriorly, and more or less distinctly bordered by a blackish stripe above and another below, the lower more developed and becoming conspicuous towards the tail. A fuscous tinge on the pectoral fins; the other fins colourless, or perhaps yellowish. Length 2 in. or less. Tenasserim.

*PERILAMPUS FULVESCENS*, nobis, *n. s.* A species without cirri, and deep in the body, much resembling in form the *P. LOYOKULA*, (B. H., v. *P. psilopterus*, McClelland), but having longer and more pointed pectorals reaching nearly to the anal.

*D. 10.—A. 22.*

Colour (in spirit) dull fulvous, with a just perceptible narrow dark lateral streak, a little more decided towards the tail: infra-orbital plates and gill-covers bright silvery: irides yellow. Fins white, with a faint nigrescent wash, especially on the tail; the first ray of the ventrals much lengthened, as in certain affined species. Length  $2\frac{1}{2}$  in. Tenasserim.

*P. AFFINIS*, nobis, *n. s.* Greatly resembles *P. LINEOLATUS*, nobis (*J. A. S. XXVII*, 289); but is a degree more typical, with the head distinctly upturned, and the anterior base of the dorsal is less forward, being more nearly parallel with that of the ventrals. It has also 13 dorsal and 16 anal rays, instead of 12 and 14. Markings obsolete on the anterior third of body, but the medial streak to base of tail very dark, bordered by a narrow pale streak above and by another below, and the dark one above this, again, broader than in *P. LINEOLATUS*. Length  $2\frac{3}{4}$  in. Tenasserim.

## PELECUS BACAILA, (B. H.) Tenasserim.

MOLA, nobis, *n. g.* A well marked group, which Dr. Jerdon referred to RHODEUS of Agassiz, founded on the *Cyprinus amarus*, auct. It is a form of LEUCISCUS, having very small scales; the mouth terminal and opening upward, with the lower jaw longer; no cirri; the eyes large, placed laterally near the muzzle. Form compressed, rather deep, the back considerably arched, with the dorsal medial or nearly so, and no osseous ray; dorsal and anal fins with few rays. The lateral line commences high, proceeding downward and then backward, and terminating abruptly about the middle of the body. No spots or other markings, beyond a broad silvery streak along the sides.

Type M. BUCHANANI, nobis; *Cyprinus mola*, B. H.

M. ATKINSONII, nobis, *n. s.* Very similar to M. BUCHANANI, but attains a larger size, and the scales are conspicuously larger in proportion, the lateral silvery streak being also much broader and less defined; no tinge of blackish on the fins. Scales about 56 by 20 (but difficult to count).

D. 8.—A. 7.—P. 15.—V. 9.—C. 19.

Length  $4\frac{1}{2}$  in. by  $1\frac{3}{8}$  in. deep. Tenasserim.

N. B.—The (*Rhodeus*) INDICUS and (*Rh.*) MACROCEPHALUS, Jerdon (*Madr. Journ. Lit. Sc.* XV, 324), appertain to this particular type; and the *Leuciscus microlepis*, Blkr. is probably identical with M. MACROCEPHALUS, (Jerdon). The (*Leuciscus*) HARENGULA and (*L.*) METELLINA of Valenciennes should also range in the same division, even if the lateral line be continuous, as represented in the figures of those species.

Fam. *Cobitidæ*. The Loches. As suggested to me by Dr. Jerdon, the species of the old genus COBITIS constitute an extensive natural family, equivalent to *Cyprinidæ*, *Salmonidæ*, *Siluridæ*, &c., and need to be distributed into various genera.\* In the *Histoire des Poissons*,

\* Mr. Swainson recognises *Cobitidæ* as a distinct family; but then he regards the Carps, the Salmon, the Herrings, the Pikes and the Flying fishes, as 'subfamilies' only of *Salmonidæ*! Though why he distinguished *Esocinæ* from *Exocatinæ* does not appear, unless to complete his magic 'circle' of five; for he describes *ESOX* under *Exocatinæ*! In like manner, he tried (of course) to form a 'circle of five' of his *Cobitidæ*, but most unsatisfactorily, and with

M. Valenciennes recognises COBITIS only, with the addition of BALITORA, Gray, to which he refers the HOMALOPTERA of Kuhl and von Hasselt; but a Tenasserim species conforms in type to the H. ERYTHROPTERA, K. et v. H., and differs considerably from true BALITORA, as the latter differs entirely from the PLATYCARA of McClelland (as originally constituted upon his PL. NASUTA, which, as we have seen, is a large-scaled Cyprin). The ordinary Loches have been commonly arranged according to the presence or absence of a moveable forked spine under or before the eye; but Mr. McClelland divides them according to the shape of the tail into *Cobitis* and *Schistura*, each comprising both spined and spineless species. The series now to classify necessitates the adoption of further subdivisions and the admission of some entirely new forms.

I.—BOTIA, Gray; founded on B. GRANDIS, Gray, figured in Hardwicke's 'Illustrations of Indian Zoology;' to which have been rightly added the (*Cobitis*) GETA and (C.) DARIO of B. Hamilton. These have more the form of ordinary Cyprins, and a strongly forked tail: the air-vessel as usual in the Carp family. We have now five species in the museum, comprising two hitherto undescribed which nearly approximate B. GRANDIS, but have the muzzle less prolonged—so that the distance from the eye to the muzzle is a fourth less. All have a stout forked spine under each eye, of which the second or posterior prong is much longer than the anterior; and their colours are bright black and yellow, with barred markings on the fins.

1. B. GRANDIS, Gray (*nec apud* McClelland, *C. J. N. H.* II, 586). Of this we possess a blanched specimen from Almoreh, presented by the late Major R. Wroughton.

2. B. NEBULOSA, nobis, *n. s.* Like B. GRANDIS, but with the face shorter (as described), and eight cirri not quite so strongly

unnecessary coinage of new names. Thus BOTIA of Gray he terms *Diacantha*, retaining two of B. Hamilton's species which he refers to, *viz.* DARIO and GETA. His *Diacantha* is moreover erroneously stated to have "the body destitute of scales;" which again is erroneously asserted of his *Canthophrys*, to which he refers the C. GUNTEA, B. H., by the new name *vittatus*. I doubt if any Loche is scaleless. The 'circle of five' completed, of course a redistribution is necessary as often as any well-marked new form is brought to notice, and especially such very strongly characterised generic forms as will be here described.

developed. Body imperfectly banded, shewing about seven irregular transverse bands, which are double or dark only on their borders and more or less broken and confluent. Three distinct lines of spots on the dorsal, besides its dusky tip: three also on the forked caudal, besides the base and tip: five in all on the pectorals; two on the ventrals; and two (indistinct) on the anal. Colours black and gold in the recent specimen, as in the various affined species; the markings tending to assume the spotted appearance proper to *B. GRANDIS*. The fin-rays are alike in both.

*D.* 10.—*A.* 6.—*P.* 13 or 14.—*V.* 8.—*C.* 19.

Length of specimen  $5\frac{1}{2}$  in. Height of body 1 in.; at base of tail nearly  $\frac{5}{8}$  in. From Dorjiling: presented by the late Dr. Wallich.

3. *B. HISTRIONICA*, nobis, *n. s.* A species of very remarkable beauty, similar to the last in form but having the eight cirri still less developed. Only five black bands on the body, the first of which encloses the gill-covers and the third descends from base of dorsal: another crosses the forehead and eyes: another, again, passes from before each eye to the cleft of the mouth; and the medial portion of the face is also black to the muzzle. The bands of the body are broad and subregular in shape, each containing a pale round spot at the lateral line and another on the ridge of the back. Dorsal fin with one broad interrupted black band, and some black also at base. Pectorals, ventrals, and anal, each with two black bands; and the caudal also with two broad bands and a black tip to each lobe. Fin-rays as in the two preceding species; and the markings exhibit a sort of link between those of *B. NEBULOSA* and of *B. GETA* and *B. DARIO*. Length  $4\frac{1}{2}$  in. Tenasserim.

II.—*SYNCROSSUS*, nobis, *n. g.* Like *BOTIA*, but more compressed, with similar forked tail; the head much compressed, small, elongated, and tapering to the muzzle, which terminates in one flat filament that ramifies into four; two cirri only on the lower jaw: eyes placed high, but laterally; and nostrils midway between the eyes and muzzle. A forked spine anterior to the eye, of which the second prong is more developed.

1. *S. BERDMOREI*, nobis, *n. s.* (Probably *Schistura grandis* apud McClelland, from the Khásya mountains, *C. J. N. H.* II, 586.) Length  $5\frac{1}{2}$  in., by  $1\frac{1}{8}$  in. deep at dorsal fin. Eight distinct lateral

black bands, the second of which proceeds from the anterior base of the dorsal fin; as seen from above, there are three more anterior bands, and an imperfect fourth at the occiput; these on the sides are broken into numerous spots, seen also on the gill-covers, and more or less on the sides of the face. Two longitudinal dark bands on the occiput unite into one towards the muzzle. Dorsal fin with three series of black spots, more or less well defined as distinct rows, and sometimes one large black spot towards the end of the first three rays. Tail with four or five transverse rows of distinct spots, continuous as a series of bands in some specimens. Pectoral, ventral, and anal fins spotless. A dark streak from eye to muzzle.

*D.* 11.—*A.* 6.—*P.* 13.—*V.* 8.—*C.* 17.

Length  $5\frac{1}{2}$  in., of which head to gill-cover is  $1\frac{5}{8}$  in. Tenasserim provinces.

*N. B.*—The *Schistura grandis* apud McClelland, from the Khásya hills, belongs clearly to this genus, though perhaps to a second species. "The head is long, much compressed, with two strong prickles beneath each eye; mouth narrow; four short cirri suspended from a single pedicle on the snout; and two from a single pedicle at the apex of the lower jaw, and one at each corner of the mouth.

*D.* 10.—*A.* 1-7 [?].—*P.* 14.—*V.* 9.—*C.* 19.

"Body and fins covered with irregular green spots and streaks  
Habitat Káshyá mountains."

III.—PROSTHEACANTHUS, nobis, *n. g.* Form greatly elongate, subcylindrical; the head much lengthened, compressed, tapering, with the eyes small, placed very high and near together, but laterally directed; moveable forked spine situate midway between the eye and muzzle, its posterior prong longer. Two minute cirri above, and below a broad lappet which tends to divide into four rudimentary cirri. Dorsal fin equidistant from the muzzle and tail-tip, its base anterior to that of the ventrals. Tail moderately furcate.

PE. SPECTABILIS, nobis, *n. s.* From twelve to fifteen transverse black bands on the back, and as many large black spots along the lateral line; between them an irregular longitudinal series of small spots: a row of four or five spots along the profile, and a row of smaller spots on the cheeks. One row of small spots on the rays of the dorsal fin, a large black spot towards the end of its first ray, and a terminal

series more or less distinct. Tail with one large spot towards the end of each lobe, and two or three more intermediate; also an irregular row of spots towards its base. Pectoral, ventral, and anal fins, colourless or nearly so.

*D.* 10.—*A.* 6.—*P.* 11.—*V.* 6.—*C.* 17.

A very prettily marked fish. Length 5 in., of which head to gill-cover 1 in.; and height at dorsal  $\frac{1}{2}$  in. Tenasserim provinces.

IV.—*ACANTHOPIA*, Agassiz. The ordinary spined Loches with compressed head, of which the European *A. TENIA* is typical.

Of these, some are of more elongate shape, with the dorsal fin placed somewhat backward and distinctly posterior to the ventrals; tail rounded more or less; and the head not so much compressed as in the others, with the eyes placed high, but not approximated as in *PROSTHEACANTHUS*. Such are *AC. TENIA*, (L.), and the Indian *AC. GONGOTA* and *AC. CURCURA*, (B. H.) Also

*AC. BERDMOREI*, nobis, *n. s.* Of a pale reddish clay-colour, thickly freckled over with blackish except on the abdominal region; about a dozen larger black spots along the lateral line, more or less distinct; the dorsal aspect uniformly dark or nearly so: head minutely speckled: bifurcate spine small, with subequal prongs: well developed cirri: dorsal and caudal minutely speckled throughout; the anal less so; and pectorals and ventrals dark-centred.

*D.* 8.—*A.* 6.—*P.* 8.—*V.* 6.—*C.* 17.

Length  $3\frac{1}{2}$  in., of which head  $\frac{5}{8}$  in.: depth of body  $\frac{1}{2}$  in. Tenasserim provinces.

Others have a shorter body, with the dorsal in the middle of the entire length and opposite to the ventrals; the head small and much compressed. To this division appertains *AC. GUNTEA*, (B. H.), which is the only species of Loche common about Calcutta.

*AC. MICROPOGON*, nobis, *n. s.* Head and body very much compressed, the tail furcate, and cirri minute: posterior prong of the bifurcate spine conspicuously longer and stronger. Body pale, blotched and mottled with light ashy-brown, and showing a more or less obscure series of ten transversely oval ashy spots along the lateral line, and a black one at base of tail: each tail-lobe marked with four oblique dark cross-bands, the last of them terminal: four transverse

dusky striæ on the dorsal, not well defined; the lower fins with one or more obscure dark striæ, or merely a little powdered with dusky.

*D.* 8.—*A.* 6.—*P.* 7.—*V.* 7.—*C.* 16.

Length  $2\frac{1}{2}$  in., by  $\frac{3}{8}$  in. deep at base of dorsal, and  $\frac{1}{8}$  in. across base of ventrals, the back much narrower. Tenasserim provinces.

Other forms of spined Loches will have to be discriminated; amongst which, one very distinct may be termed—

V.—PANGIO, nobis, *n. g.* Of uniform thickness, elongated, slender, with the dorsal fin placed very far backward, much nearer to the tail than to the head; the head short, much compressed between the eyes, and each nostril furnished with a short filament, additional to the six labial cirri. Anterior prong of the infra-ocular spine distinctly longer.

P. CINNAMOMEA: *Cobitis pangio*, B. H.; *C. cinnamomea*, McClelland. This has small fins and a round tail; but certain Indonesian species affined to it have a forked tail. The ventrals are well developed.

VI.—APUA, nobis, *n. g.* Much like the last, but the dorsal placed still further backward, and the ventrals *wanting altogether*. The head, and the fins, smaller than in PANGIO; the former still more compressed, and the same infra-ocular forked spine, and eight cirri (two of which are given off from the nareal apertures), but the cirri are more minute. The spines are exceedingly liable to be overlooked. Dorsal placed at the commencement of the last fourth of the entire length; the anal near the tail: all the fins being small and narrow.

A. FUSCA, nobis, *n. s.* Of three specimens of this curious fish, the largest measures  $2\frac{1}{2}$  in. long, by  $\frac{1}{4}$  in. deep, and  $\frac{1}{8}$  in. broad; head  $\frac{5}{16}$  in.: from muzzle to base of dorsal  $1\frac{3}{4}$  in. The rays of the dorsal, anal, and pectoral fins are difficult to distinguish, but appear to be

*D.* 7 or 8.—*A.* 6.—*P.* 9.—*C.* 17.

On a cursory view, the dorsal, anal, and pectoral fins might be supposed each to contain two or three rays only, these fins being remarkably narrow. Colour uniform dull brown, paler below. Tenasserim.

Had it not been for the total absence of the ventral fins, this form

might have been included in PANGIO; and very closely akin to it, again, must be the COBITIS MICROPUS, Val., from China, in which the ventral fins are minute,\*—but this would appear to have no infra-ocular spine. M. Valenciennes, however, remarks of it—“La caudale, arrondie, a deux carènes charnues sur le dos ou sur la base de la queue, qui semble augmenter la longueur de la nageoire ou simuler une sorte d’adipose.” This exactly describes what is seen in our largest specimen of APUA FUSCA; but in the others the ridge is continuous. C. MICROPUS should constitute another generic *coup*; and another again occurs in the MISGURNA, Lacépède, founded on the European (C.) FOSSILIS.† This last is akin to the first division of ACANTHOPIS, but is still more elongated, subcylindrical, or only a little compressed laterally, and it has no infra-orbital spine, but an indication of the facial slit that conceals the spine in all the preceding. It has therefore been held to conduct to the spineless Loches, to which, for the present, I restrict—

VII.—COBITIS, L. Type C. BARBATULA of Europe. These never have the head so much compressed as in the majority of Spined Loches, and in some it is even broader than the body: the latter also tends in many of them to be subcylindrical rather than compressed. Some, however, are moderately compressed, approaching to the form of BOTIA, but more elongated; having also a large dorsal fin of many rays: such is—

C. RUBIDIPINNIS, nobis, *n. s.* A fine species,  $4\frac{3}{4}$  in. long, by  $\frac{7}{8}$  in. deep, and  $\frac{1}{2}$  in. broad; fully  $\frac{1}{4}$  in. between the eyes; from eye to muzzle  $\frac{3}{8}$  in.; and head from gill-cover  $\frac{7}{8}$  in.; the dorsal fin nearly 1 in. along its base. Six well developed cirri; and a peculiar character consists in a short broad obtuse spine-like process projecting from the middle of the upper lip: tail somewhat rounded. General colour olive-brown with a ruddy wash, paler below; the fins tinged with red; dorsal and caudal fins transversely rayed with dusky, the other fins without markings. On the dorsal are four or five rows of dark

\* He terms it “la Loche aux petites ventrales.”

† Another, again, perhaps, in certain rather elongated Loches of China, which have ten cirri; as the C. BIFURCATA and C. PECTORALIS, McClelland, and C. ANGUILLICAUDATA, Cantor, figured by Sir J. Richardson in the *Zoology of the Voyage of the Sulphur*.

spots, on the caudal ten or more transverse lines. Pectoral fins much larger than the ventrals. The rays are—

*D.* 15.—*A.* 6.—*P.* 10.—*V.* 7.—*C.* 17.

Tenasserim provinces.

Others have the body proportionally less deep; as the *C. BILTARIA*, *B. H.*;\* nearly affined to which ranks—

*C. SEMIZONATA*, nobis, *n. s.* Four well developed cirri above and two below: a minute spinelet above the muzzle (as in *C. MONOCERA*, McClelland):† tail slightly bilobate: pectorals larger than the ventrals: the dorsal consisting of sixteen rays and the anal of six. A series of twelve to fourteen dark transverse dorsal bands, occasionally forked or confluent, attenuating and curving backward as they descend till they reach the lateral line, below which is a longitudinal row of about twelve irregular blackish spots: head spotted with blackish, the spots sometimes uniting to form transverse bands on the occiput: a black spot surrounded with white at base of tail above: lower parts pale and spotless. Dorsal fin with four or five irregular rows of dark spots: caudal with seven or eight dark transverse lines. Length  $3\frac{1}{2}$  in., by more than  $\frac{1}{2}$  in. deep at base of dorsal, and above  $\frac{1}{4}$  in. broad. Tenasserim provinces.

The great mass of small spineless Loches have the head shorter anterior to the eyes, the dorsal fin with fewer rays (commonly nine or ten, or not so many), and the tail slightly furcate. The pectorals

\* To *C. BILTARIA* I refer a specimen from Másuri, having 12 rays only to the dorsal and 7 to the anal fins; the black spots on the dorsal and black transverse lines to the caudal being well defined. Length  $2\frac{3}{8}$  in. It agrees with a specimen from the Brahmaputra, excepting that the tail-markings are finer and more distinct.

Another species from Másuri, which agrees in all else with Mr. McClelland's description of *C. MONTANA*, is in every respect a typical *COBITIS*, but has *not* "a single sub-orbital spine on each side." The zones or bands on the body vary in number and breadth and in arrangement in different specimens, and the dorsal and caudal fins are more or less speckled, in some much more so than in McClelland's figure. Largest specimen  $3\frac{1}{2}$  in.

These Másuri specimens are in the private collection of Major R. C. Tytler.

† This little nasal process re-appears in *HOMOLOPTERA BILINEATA*, nobis, described in the sequel.

and ventrals are mostly nearly equal in size. This form is exemplified by those figured by Mr. McClelland in *As. Res.* XIX, II, pl. 53, figs. 1, 3, 4, 5, and 6, and also by the two Kashmirian species figured by Heckel. To it appertain—

*C. ZONALTERNANS*, nobis, *n. s.* Largest specimen  $1\frac{5}{8}$  in. long, with ten dorsal and six anal rays. It has a dark lateral streak, crossed by twelve short transverse bands, which alternate with about the same number of dorsal dark cross-bands. The dorsal fin is marked with three and the caudal with four rows of black spots: the other fins being spotless. Tenasserim provinces.

*C. CINCTICAUDA*, nobis, *n. s.* Very like *C. SCATURIGINEA*, B. H., but with fewer rays to the dorsal and anal (*viz.* seven and six respectively), and the body more regularly banded; shewing about ten dorsal transverse bands which are broader than the alternating yellowish bands, and a strongly marked black transverse bar at base of tail,—also a dark bar between the eyes and mouth, crossing the muzzle. Two black spots on base of dorsal, and above them a black speck on each ray; the other fins without markings. Length 2 in. Tenasserim Provinces.

VIII.—*HOMOLOPTEBA*, Kuhl and von H. asselt. A form intermediate to the ordinary spineless *Loches* and *BALITORA* of Gray.

*H. BILINEATA*, nobis, *n. s.* Affined to *H. ERYTHORRHINA*, (figured as *Balitora erythrorrhina* by M. Valenciennes,) but with the *BALITORA* tendencies less decided. A minute blunt knob on the muzzle, as in certain species of restricted *COBITIS*. Nine dorsal and six anal rays; the tail acutely furcate. A narrow dark line from muzzle to eye, continued behind the eye as a broad, irregular, and somewhat zigzag band, set off laterally with whitish, and joining its opposite behind the dorsal fin: a corresponding but obscure band below the lateral line, little seen on the hind-half of the body. Dorsal with a large blotch of black and one small posterior spot. Caudal fin also black, with the sides of its base and the forking tips white (or yellow?), but the extreme tips black. Pectorals, ventrals, and anal, blotched with black: sides of body somewhat nigrescent. Largest specimen  $2\frac{3}{4}$  in. long. Tenasserim provinces.

Fam. *Clupeadæ*.

CHATLESSUS MANMINA; *Clupanodon manmina*, B. H. Tenasserim provinces.

Fam. *Anguillidæ*.

ANGUILLA ARRACANA, McClelland. Young, 7 in. long. Tenasserim.

Fam. *Symbranchidæ*.

AMPHIPNOUS CUCHIA, (B. H.). Tenasserim. Mr. Theobald.

Fam. *Hippocampidæ*.

HIPPOCAMPUS MANNULUS, Cantor. Tenasserim, Mr. O'Reilly. Also Port Blair.

Fam. *Tetrodontidæ*.

LEIOSOMUS CUTCUTIA; *Tetraodon cutcutia*, B. H.: *L. marmoratus*, Swainson. Procured at Maulmein by Mr. Theobald, *J. A. S.* XXIV, 712. Type of *Monotreton*, Bibron.

GASTROPHYSUS LUNARIS; *T. lunaris*, Cuv.: *T. tepa*, B. H.; *T. leiopleura*, Gray, et *T. spadiceus*, Richardson, apud Bleeker. Tenasserim.

AROTHRON SIMULANS, Cantor: *T. fluviatilis* apud nos, *J. A. S.* XXIV, 712. Procured at Maulmein by Mr. Theobald.

CHONERHINOS NARITUS (?); *T. naritus* (?), Richardson. Some small specimens, procured at Amherst by E. O'Reilly, Esq., accord with Dr. Cantor's description (*J. A. S.* XVIII, 1365), except in having no dark markings on the dorsal, anal and caudal fins. Perhaps, therefore, an affined species rather than the same.

Five species of this family are commonly procurable in the Calcutta fish-bazars; but I have never been able to obtain the *T. FLUVIATILIS*, B. H., which is a *GASTROPHYSUS* of J. Müller.\* One approximating it in appearance, like the *A. SIMULANS*, may be designated.

*AROTHRON DORSOVITTATUS*, nobis, *n. s.* Attains to 8 in. long. The spines much larger and more sparsely inserted than usual; a series of about twelve only occurring on the dorsal region, from one pectoral fin to the other. Caudal region, from some distance anterior to the dorsal and anal fins, quite free from spines. Head exceeding one-fourth of the total length. Lateral line indistinct.

\* Type of *Dichotomycteris*, Bibron, *Rev. et Mag. de Zool.* 1855, p. 279, which I have not now to refer to.

*D. 15.—A. 13.—P. 21.—C. 12.*

Colour dusky yellowish-green, with usually three distinct pale bands crossing the dorsal aspect, anterior to the dorsal fin; the first passes from eye to eye, terminating near the hind-part of the orbits; the second passes in a curve from before the pectorals, and is sometimes double; and the third occasionally reaches back as far as the dorsal fin, but is generally a little in advance of it; the interspaces of those pale bands being infuscated and undivided, but posterior to the third of them the alternating dusky bands are broken into roundish spots of various sizes, much as in *GASTROPHYSUS FLUVIATILIS* (as figured by Buchanan Hamilton), only the spots run generally smaller; but there are no bars on the caudal fin, though occasionally it is much infuscated, together with the entire lower-parts. A common species.

*GASTROPHYSUS MICROPHALMOS*, nobis, *n. s.* Still commoner than the last, but hitherto overlooked from its general resemblance to *G. PATOCA*, (B. H.) It has, however, a conspicuously smaller eye, a considerable development of spinelets both anterior and posterior to the pectorals (whereas *G. PATOCA* has generally the sides quite smooth, or at most and rarely a very few spinelets at that part), and the nareal apertures have no distinct appendage (whereas in *G. PATOCA* they have a considerable membranous appendage both before and behind, approximating this particular species to *ABOTHRON*). Again, the pale spots of the upper-parts are generally smaller and more numerous, also more angular, and they mostly form a series of transverse stripes on the sides. Head exceeding two-fifths of the total length: the fimbriation of the lips internally much developed. Dorsal and anal fins rather falcate; the caudal square.

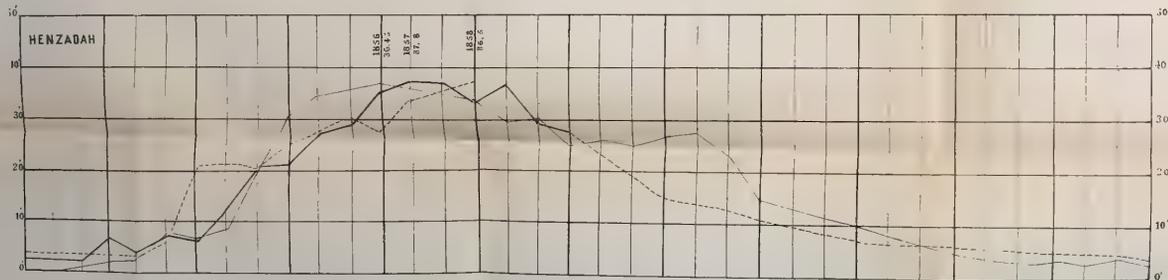
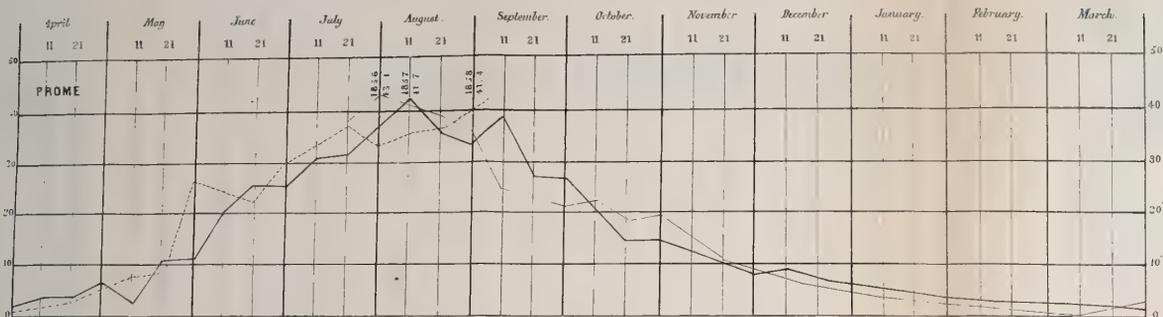
*D. 13.—A. 11 or 12.—P. 16.—C. 12.*

Colour dark olive-green on the upper-parts, studded with numerous greenish-silvery spots and transverse stripes, the latter prevailing on the sides: medial third of body spotless golden; the belly white; and the fins more or less tinged with bright yellow. Irides orange. Equally common with *G. PATOCA*, and attains to as large a size, or to about 18 in. in length.

Our three other species, obtainable in the Calcutta fish-bazars, are *LEIOSOMUS CUTCUTIA*, *GASTROPHYSUS LUNARIS*, and *G. PATOCA*, (B. H.)



DIAGRAMS showing the RISE and FALL of the IRAWADI RIVER at PROME and HENZADAH.  
during the Years 1856, 1857, 1858.



W. FRASER, P.L.S. & CO. MONTH ENVELOPE SHARPS, LITH. BY W. SMITH, LONDON. GENERAL OFFICE CALCUTTA JUNE 1860

*S. A. Cunningham Lt. Col.*  
*Chief Engineer*  
*Bengal & Tenasserim.*

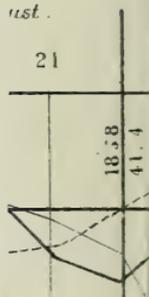


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*Memorandum on the Irawadi River, with a monthly Register of its Rise and Fall from 1856 to 1858, and a measurement of its minimum discharge.*—By Lieut.-Col. A. CUNNINGHAM.

Under instructions from Major Phayre, Commissioner of Pegu, a daily register of the rise and fall of the river Irawadi has been kept at Thayetmyo, Prome and Henzadah, from the highest flood in 1856 to the maximum rise in 1858. The results of these observations at Prome and Henzadah are embodied in the accompanying diagrams, which show the actual height of the river at each place on every tenth *day* throughout the period of observation. The Thayetmyo register has been omitted, because the first twelve months' observations are palpably erroneous, and cannot now be corrected, whilst the last twelve month's observations correspond so closely with those taken at Prome, that I did not think it worth while to draw up another diagram for a single year.

2. The Irawadi generally attains its lowest level about the end of March, when a slight rise takes place for a week or ten days until the middle of April, after which time for about a month, the river becomes stationary, occasionally rising and falling until the first week of May. This is the usual period for the setting in of the monsoon, and the river continues steadily to rise, with but few checks until August, when it attains its maximum. The actual period at which the river has gained its greatest height during the last three years has ranged from the end of July to the beginning of September. The following are the dates of maximum at the three places of observation :

| +    | THAYETMYO.     | PROME.         | HENZADAH.      |
|------|----------------|----------------|----------------|
| 1856 | 29th July.     | 30th July.     | 30th July.     |
| 1857 | 10th August.   | 10th August.   | 11th August.   |
| 1858 | 4th September. | 5th September. | 1st September. |

3. The following are the dates of minimum, or lowest level :

| —    | THAYETMYO.  | PROME.      | HENZADAH.   |
|------|-------------|-------------|-------------|
| 1856 | —           | —           | 14th April. |
| 1857 | 7th April.  | 10th March. | 8th March.  |
| 1858 | 20th March. | 31st March. | 3rd May.    |

4. I have no means of comparing the monthly rise of the river with the monthly fall of rain, as the only rain registers which I have been able to procure are those of Rangoon. The diagrams, however, show that an early setting in of the monsoon is accompanied by an early rising of the river. For instance, there was no rain in April 1857, when the first great rise of the river was delayed until the 20th June. During the present year, however, there was a fall of more than six inches of rain during April, and accordingly the Irawadi attained its first great rise on the 1st of June or just three weeks earlier than in the previous year.

5. The diagrams also show, by the exact correspondence in time, as well as by the relative correspondence in quantity, of the alternate risings and fallings both at Prome and at Henzadah, that the annual swell of the river is mainly due to the rain-fall in its upper course. Thus, the pulsations of the river at Henzadah generally take place just one day later than at Prome. This coincidence in the times and quantities of the swell and fall of the river above the Delta might have been inferred from the narrowness of the strip of land drained by the lower Irawadi compared with the greater breadth drained in its upper course.

6. These diagrams further show the very small amount of rise that is due to melted snow, and consequently the limited extent of the snowy mountain range drained by the Irawadi. As this is a point of some interest with reference to the still disputed question of the connection of the Irawadi with the Tsân-pû River of Tibet, I now give the details of the rise and fall of the Irawadi for every ten days between the date of lowest level, and that of the first great rise due to the setting in of the Monsoon.

## PROME.

| 1857.       |        | TOTAL. | 1856.       |       | TOTAL. |
|-------------|--------|--------|-------------|-------|--------|
| 10th March, | — 0·0  | — 0·00 |             |       |        |
| 21st „      | + 1·6  | + 1·60 |             |       |        |
| 1st April,  | — 1·4  | + 0·20 | 31st March. | — 0·0 |        |
| 11th „      | + 0·75 | + 0·95 | 11th April. | + 0·7 | + 0·7  |
| 21st „      | — 0·55 | + 0·40 | 21st „      | + 0·6 | + 1·3  |
| 1st May,    | + 4·10 | + 4·50 | 1st May.    | + 3·1 | + 4·4  |
| 11th „      | — 4·20 | + 0·30 | 11th „      | + 1·8 | + 6·2  |
| 21st „      | + 8·65 | + 9·95 | 21st „      | + 0·9 | + 7·1  |

## HENZADAH.

| 1857.       |        | TOTAL. | 1858. |  |  |
|-------------|--------|--------|-------|--|--|
| 11th March, | — 0·00 | 0·00   |       |  |  |
| 21st „      | + 1·65 | + 1·65 |       |  |  |
| 1st April,  | — 0·65 | + 1·00 |       |  |  |
| 11th „      | — 0·20 | + 0·80 |       |  |  |
| 21st „      | — 0·10 | + 0·70 |       |  |  |
| 1st May,    | + 4·10 | + 4·80 |       |  |  |
| 11th „      | — 2·60 | + 2·20 |       |  |  |
| 21st „      | + 4·90 | + 7·10 |       |  |  |
| 1st June,   | — 0·10 | + 7·00 |       |  |  |

7. In all these registers, it will be observed that there is a sudden rise of about four feet during the last ten days of April. As this rise is succeeded by a sudden decrease, I would attribute the swell of the river solely to the fall of these heavy bursts of rain which usually precede the steady falls of the Monsoon rain. The small amount of rise that takes place before the setting in of the Monsoon is further proved by the state of the Panlang Creek, which, with a minimum depth of 2 feet of water, is never open for steamers drawing four feet until the monsoon has fairly set in.

8. The abstract of the registers kept at Prome and Henzadah is given in the following tables :

*Monthly Rise and Fall of the Irawadi River, during the years 1856, 1857 and 1858, in Feet and Decimals.*

|               | PROME. |   |       |      |       |      | HENZADAH. |      |       |      |       |      |
|---------------|--------|---|-------|------|-------|------|-----------|------|-------|------|-------|------|
|               | 1856.  |   | 1857. |      | 1858. |      | 1856.     |      | 1857. |      | 1858. |      |
|               | -      | + | -     | +    | -     | +    | -         | +    | -     | +    | -     | +    |
| January ...   |        |   | 2.3   |      | 2.2   |      |           |      | 5.0   |      | 1.0   |      |
| February ...  |        |   | 1.4   |      | 0.8   |      |           |      | 1.9   |      | 1.0   |      |
| March ...     |        |   | 0.6   | 0.2  |       |      |           |      | 0.9   | 1.0  | 1.0   |      |
| April ...     |        |   |       | 4.3  |       | 4.4  |           | 2.3  |       | 3.8  | 1.0   |      |
| May ...       |        |   |       | 4.8  |       | 21.0 |           | 4.1  |       | 2.2  | 0.3   | 18.3 |
| June ...      |        |   |       | 14.0 |       | 3.1  |           | 24.7 |       | 11.9 |       | 3.7  |
| July ...      | 0.5    |   |       | 13.5 |       | 3.5  |           | 5.3  |       | 14.6 |       | 3.5  |
| August ...    | 7.1    |   | 8.4   | 4.9  |       | 8.0  | 3.7       |      | 3.8   | 2.1  |       | 3.4  |
| September ... | 14.7   |   | 6.5   |      |       | 0.2  | 8.2       |      | 6.6   |      |       |      |
| October ...   | 1.5    |   | 12.2  |      |       |      |           | 1.5  | 12.0  |      |       |      |
| November ...  | 11.2   |   | 6.9   |      |       |      | 11.9      |      | 4.0   |      |       |      |
| December ...  | 3.8    |   | 2.5   |      |       |      | 0.9       |      | 4.0   |      |       |      |

*Annual Rise above the lowest known level.*

|              | THYETMYO. | PROME. | HENZADAH. |
|--------------|-----------|--------|-----------|
| 1856         | —         | 43.1   | 36.4      |
| 1857         | 45.6      | 41.7   | 37.8      |
| 1858         | 45.5      | 41.4   | 36.5      |
| Average rise | 45.55     | 42.06  | 36.90     |

9. The volume of water discharged by the Irawadi in the dry season is another subject of considerable importance towards clearing up the still disputed question of the sources of the river. The great French geographer D'Anville first broached the opinion that the upper course of the Irawadi was the Tsânpû River of Tibet, but the great English geographer Major Rinnell of the Bengal Engineers identified the Tsânpû with the upper course of the Brahmaputra River. The former opinion was adopted by Klapproth, Dalrymple, and Griffith. The latter opinion by Wilcox, whose adventurous journey across the Khamti mountains to the upper valley of the Irawadi has all but finally established that the sources of the Irawadi could not be far to the north of latitude 27° 26', the point where he

struck the river. The fact that the Irawadi was then only 8·0 yards broad and fordable, is absolutely conclusive regarding the small volume of its water, and should I think be equally so regarding the near vicinity of its source.

10. The minimum discharge of the Irawadi is differently stated by the only two observers who have yet published their measurements. On 25th April, 1853, Dr. McClelland found the breadth of the river at Prome to be 3,630 feet with a mean depth of 12·7083 feet, giving a sectional area of 46,131·129 square feet. The velocity of the current was  $1\frac{2}{2}$  miles per hour, or 2·8666 feet per second. Dr. McClelland calls this the "mean speed." This measurement refers to the surface velocity and not to the average velocity of the mass, to obtain which he multiplies the above mean speed by 0·8, and makes the discharge 105,794 cubic feet per second. But the formula for obtaining the average velocity of the mass which is given by Cape, and by Jackson, the Secretary of the Royal Geographical Society, as determined from the experiments of Du Buat, yields a very different result. By this formula the velocity of the mass, 
$$M = \frac{(\sqrt{S}-1)^2 + S}{2} = S - \sqrt{S} + \cdot 5,$$
 where  $S$  = the surface velocity of the stream. By using this formula, the mean velocity of the mass of water is reduced to 1·67352 foot per second, which yields a discharge of 77,201·151 feet per second. But as the river fell fifteen inches after the date of Dr. McClelland's measurement, this amount has to be brought still lower by deducting 1·25 foot from the mean depth of 12·7083 feet. This will cause a reduction of 7592·760 cubic feet, and thus make the minimum discharge of the Irawadi in 1853 at Prome 69,608·391 cubic feet.

11. The other measurement of the Irawadi was taken by Mr. T. Login, at the head of the Delta, just above the point where the Bassein river branches off. The measurements were made I believe in 1855, but the details have not been published. The result alone is given, which makes the minimum discharge at the head of the Delta at 75,000 cubic feet.

12. On the 30th March, 1857, a third measurement of the Irawadi was made at Meaday at my request, by Lieut. G. de P. Falconnet of the Madras Engineers. This measurement was conducted with

great care; the mean depth of the stream having been determined in thirteen different places, and the whole operations repeated five distinct times. The breadth of the stream was 2,057 feet. The mean depth was 21.2423 feet, and the extreme depth 29 feet, with a surface velocity of 3 feet per second, or 2.04545 miles per hour. From these data the sectional area was 43,695.411 square feet, and the mean velocity of the mass of water, calculated by the formula before quoted, was 1.7679 cubic feet per second. The discharge on the 30th March, 1857, was therefore 77,249.097 cubic feet. But as the river, according to the flood register kept at Thayetmyo, fell exactly 1 foot after this date, a corresponding decrease must be made by deducting 1 foot from the mean depth. This will cause a reduction of 3,636.570 cubic feet and thus make the minimum discharge of the Irawadi in 1857 at Meaday 73,612.437 cubic feet.

13. The results of these measurements, although made by three different persons, at three different places, and in three different years, correspond so well together, that I think we may place considerable reliance upon their accuracy. I repeat them for comparison.

|                                           |            |             |
|-------------------------------------------|------------|-------------|
| Minimum discharge at Meaday in 1857 ..... | 73,612.437 | cubic feet. |
| „ at Prome in 1853 .....                  | 69,608.391 | „           |
| „ at Head of Delta in 1855                | 75,000.000 |             |

The difference between the extremes is only 5,400 cubic feet, an amount which is within the limits of variation of the low water level of the river, between a very dry season, and an average one. The mean of the two observations at Meaday and Prome is 71,610 cubic feet, which I think may be taken as a very close approximation of the usual minimum discharge of the Irawadi river at those places. The discharge at the head of the Delta above Henzadah, as determined by Mr. Login at 75,000 cubic feet, corresponds so closely with these observations, that I have every confidence in its accuracy.

14. To bring these measurements of the discharge of the lower Irawadi to bear upon the question of its sources, we must compare the volume of water discharged at certain points with its area of derivation, or extent of surface drained. This question has been ably discussed by Captain Yule in his note on the sources of the Irawadi, published in his narrative of Major Phayre's mission to Ava. In this note all available information on the subject is detailed and

compared, and Captain Yule gives his decision in favour of the lower estimate of Mr. Login. The following statements of "the areas drained by the Irawadi in different parts of its course, assuming its sources in the Khamti mountains" are taken from Captain Yule's note:

|                           |                 |                 |
|---------------------------|-----------------|-----------------|
| Below Magoung River ..... | $5\frac{3}{4}$  | square degrees. |
| At Amarapura .....        | $13\frac{1}{2}$ | „               |
| At Prome .....            | 31              | „               |
| Head of Delta .....       | $32\frac{1}{2}$ | „               |

To these I may add Moong Khamti in lat.  $27^{\circ} 26'$  where Wilcox found the Irawadi only 80 yards broad and fordable. Assuming the sources in the Khamti mountains as before, the area of drainage will be only three quarters of a degree, or certainly less than one degree.

15. Now taking the discharge at the head of the Delta at 75,000 cubic feet, and the area of derivation at  $32\frac{1}{2}$  degrees, the volume of water will be 2,300 cubic feet per square degree of country drained. The discharge at each of the above points will therefore be as follows:

|                           |        |             |
|---------------------------|--------|-------------|
| Moongkhamti .....         | 1,733  | cubic feet. |
| Below Magoung River ..... | 13,175 | „           |
| At Amarapura .....        | 31,050 | „           |
| At Prome .....            | 71,300 | „           |

As the *calculated* discharge at Prome is within two hundred cubic feet of the mean discharge obtained by the actual measurements of Dr. McClelland and Lieut. Falconnet, the calculated amounts of discharge at the other points may be assumed as fair approximations to the truth.

16. The calculated discharge of the Irawadi at Moong Khamti must now be compared with the state of the river as described by Wilcox. He found the river 240 feet broad and fordable: that is, the greatest depth was not more than 3 feet, and the mean depth about 2 feet. The sectional area would therefore be 480 feet, which, compared with the above calculated discharge of 1,733 cubic feet, would give the mean velocity of the mass of water at 3.61 feet per second; which is equivalent to a surface velocity of 6.125 feet per second, or somewhat more than 4 miles per hour.

17. If the area of derivation be taken at one whole degree, the discharge at Moong Khamti will be 2,300 cubic feet, or one-third

more, and the surface velocity will be increased to upwards of  $5\frac{1}{2}$  miles per hour. Even admitting that the mean depth may have been three feet, the discharge would still be under 3,000 cubic feet. But as a stream with a mean depth of three feet, and a current of  $5\frac{1}{2}$  miles per hour, would be almost, if not quite, unfordable, a volume of 3,000 cubic feet may be considered as the extreme discharge of the Irawadi at Moong Khanti, consistent with Wilcox's observations.

18. If this determination is correct, and I do not see how its accuracy can be disputed, what has become of the Tsânpû, the great river of Tibet? The following measurements of the Brahmaputra and its tributaries will probably assist in determining this point :

|                       | <i>On 26th December, 1825.</i> | <i>On 29th March, 1826.</i> |
|-----------------------|--------------------------------|-----------------------------|
| Dihong (Bedford)..... | 56,564 cubic feet.             |                             |
| Dibong „ .....        | 13,100 „                       |                             |
|                       | <hr/>                          |                             |
| Joint stream ...      | 69,664                         | 86,211                      |
| Brahmaputra (Wilcox)  |                                |                             |
| at Saduja .....       | 19,058                         | 33,965                      |
|                       | <hr/>                          | <hr/>                       |
| Total discharge ...   | 88,722                         | 120,176                     |
|                       | <hr/>                          | <hr/>                       |

On comparing the discharge of the Dihong with that of the Dibong and Brahmaputra, the only natural way of accounting for its immensely superior volume is by supposing that it must be fed by some large stream from beyond the Himalaya. No accounts of Cis-Himalayan drainage calculated from the data supplied by the measurements of the Brahmaputra and Dibong would give a greater discharge than 20,000 or at most 25,000 cubic feet. The question then arises whence comes the other large volume of 30,000 cubic feet of water, to which the *only* obvious reply is “from the Tsânpû River of Tibet beyond the chain of the Himalaya.” The lower course of the Tsânpû, where it breaks through the mountains, is unknown ; but from all the evidence collected by Wilcox, compared with the small discharge of the Irawadi, and with the large volume of the Dihong, the connection of the Tsânpû and Dihong Rivers seem to me to be as clearly and satisfactorily established as any deduction can possibly be without absolute ocular demonstration.

19. The last link of corroborative evidence in favour of the Trans-Himalayan source of the Dihong is the greater coldness of its waters compared with those of the Ganges and other rivers, for the knowledge of which fact I am indebted to Colonel Phayre. I conclude that the greater frigidity of the Dihong is due to the large volume of melted snow supplied by the Tsânpû, which imparts some portion of its original coldness to the waters of the Dihong.

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*Attempts of Asiatic Sovereigns to establish a Paper Currency.—By*  
E. B. COWELL, M. A.

The old motto "*Ex Oriente lux*" holds true in many departments of science; Europe is no doubt indebted to Asia for many an invention and idea; but if there be one science above others, which is all her own and where the Western mind is utterly unindebted to the East, it is that peculiar discovery of modern times, Political Economy. In fact it is not under despotisms like those which have prevailed from time immemorial in the great nations of Asia, that such a science could even take root, much less bear fruit. And yet it is singular, here and there, in the moral and philosophical treatises of Eastern authors, to come upon imperfect attempts to develop some of its principles; and in the same way, amid the bloody annals of Eastern kings, to trace an occasional abortive effort to anticipate the financial measures of modern times. Their very failures, in fact, are deeply interesting. They tell us that mere physical might is powerless in the moral world; that that magic influence of national credit, which is the firmest pillar of an empire's stability, is beyond the tyrant's control, in spite of his armies.

It may not be uninteresting at the present time to trace a series of these attempts in one particular direction,—I refer to the endeavours of the kings of China, Persia and India to establish something like a paper currency in their respective dominions. These attempts were made during the thirteenth and fourteenth centuries; they all failed after a longer or shorter period, and probably from the same causes.

We first meet with the idea in China. It is said that the plan was originally started by a native Chinese monarch of the Song dynasty, two centuries before the Moghul conquest; and we certainly find it

in full force under the early successors of Chenghiz Khán. After the expulsion of the Moghuls in 1366, the founder of the native or Ming dynasty tried to revive it, but the attempt appears to have failed.

We have the accounts of two travellers, who visited China during this period, to confirm this account. The first is Marco Polo who resided in the court of the Emperor Kublai Khan from about 1274 to 1291. Kublai Khan, one of the most enlightened of the Moghul monarchs, had been crowned Great Khan (or more properly Ká-án) of Northern China in 1260; in 1280 he overthrew the Song dynasty in the South, and he reigned over all China (founding the Yuen dynasty,) until his death in 1294.

The second is the Arabian traveller Ibn Batúta, who visited China as ambassador from the Sultan of Delhi, Muhammad Toghluk, in 1345, and seems to have spent about a year there. He left during the troubles which followed the accession of the last of the Yuen or Moghul dynasty.

Marco Polo's narrative is as follows.\*

“With regard to the money of Kambalu,† the great Khan may be called a perfect alchemist, for he makes it himself. He orders people to collect the bark of a certain tree, whose leaves are eaten by the worms that spin silk. The thin rind between the bark and the interior wood is taken, and from it cards are formed, like those of paper, all black. He then causes them to be cut into pieces, and each is declared worth respectively half a livre, a whole one, a silver grosso of Venice, and so on to the value of ten bezants. All these cards are stamped with his seal, and so many are fabricated that they would buy all the treasuries in the world. He makes all his payments with them, and circulates them through the kingdoms and provinces, over which he holds dominion; and none dares to refuse them under pain of death. All the nations under his sway receive and pay this money for their merchandise, gold, silver, precious stones, and whatever they transport, buy or sell. The merchant often brings to him goods worth 400,000 bezants, and he pays them all in these cards, which they willingly accept, because they can make purchases with them throughout the whole empire. He frequently commands

\* Murray's transl. p. 137. (ch. 26.) which I follow as more recent than Marsden's.

† Khán-bálik or Pekin.

those who have gold, silver, cloths of silk and gold, or other precious commodities, to bring them to him. Then he calls twelve men skilful in these matters and commands them to look at the articles and fix their price. Whatever they name is paid in these cards, which the merchant cordially receives. In this manner the great sire possesses all the gold, silver, pearls and precious stones in his dominions. When any of the cards are torn or spoiled, the owner carries them to the place whence they were issued, and receives fresh ones, with a reduction of 3 per cent. If any man wishes gold or silver to make plates, girdles or other ornaments, he goes to the office, carrying a sufficient quantity of cards, and gives them in payment for the quantity he requires. This is the reason why the Khan has more treasure than any other lord in the world; nay, all the princes in the world together have not an equal amount."

It has been sometimes said that Marco Polo saw *only* the court and the servile obsequiousness of the courtiers; but this is by no means the case. He continually mentions in the course of his travels the fact of the paper currency in the provinces. Thus in Chap. 56, (ch. 49 in Marsden) in his account of Cyn-gui (Chintigui in Marsden,) he says, "they have no money except paper," and in that of Ca-cian-fu (Pazafu in Marsden,) more than two months' journey distant from Cyn-gui, "they are subjects of the Grand Khan, and his paper money is current among them." Again in Chap. 60 (ch. 50 and 51, Marsden,) we have the same remark made about the cities of Sin-gui and Cin-gui, which are described as "full of merchandise and arts and paying a large revenue to the sovereign." Again in Chap. 64 in describing the province of Pau-chym, we have, "the people are artificers and merchants, and have abundance of silk; through all that country the Khan's paper money is circulated." Beside these, there are at least a dozen similar allusions in his travels through various parts of the empire.

There doubtless may be some exaggeration in his narrative; but the very fact of the system's continuance seems to prove that it was by no means the oppressive system which it appeared to foreigners, and in which character indeed it possessed such attractions to the grasping despots of Persia and India.

The substance of Marco Polo's account is amply confirmed by the very similar narrative of Ibn Batúta, who visited the same court

nearly fifty years afterwards and found the same system still pursued under the later princes of the dynasty. The dynasty was then verging to its fall—it had indeed rapidly followed the law of all Asiatic dynasties—what Gibbon calls “the unceasing round of valour, greatness, discord, degeneracy and decay.” Marco Polo had found the Moghul power in all the youthful vigour of conquest; Ibn Batúta finds it a decrepit stock, “*primo nutans casura sub Euro.*”

The following is the Muhammadan traveller’s account, as we read it in the edition lately published at Paris by MM. Defremery and Sanguinetti (Vol. IV. p. 259.)

“The inhabitants of China do not use pieces of gold or silver in their commercial transactions, and all coins that come into the country are melted into ingots. They buy and sell by means of pieces of paper, each of which is as large as the palm of the hand, and bears the Sultan’s mark or seal. Twenty-five of these notes are called a *bálish*,\* which means the same as our *dínár*. When any body finds that his notes are worn out or torn, he carries them to the office which is just like the mint with us, and there he has new ones given him in place of the old. He has nothing to pay for this, for the officers who have the charge of supplying these notes are paid by the King. The management of the office is entrusted to one of the principal Amirs of China. If a person comes to the market with a piece of silver money (*dirrhem*) or even of gold (*dínár*), in order to purchase any thing, no one will take it or pay him any regard, until he has changed it for notes, and then he can buy what he pleases.”†

The chief difference between these two narratives is the absence, in the latter, of the heavy seignorage of 3 per cent. which had been levied in Marco Polo’s time. Dr. Lee in his translation adds a sentence to explain it, “This is done without interest,—the profit arising from their circulation accruing to the King;” but these words have not been kept in the late critical recension of the text.

\* Dr. Lee in his translation wrongly gives the name as *Shat*, reading *b’il-shat* instead of *bálish*.

† In the curious account of Ibn Batúta’s interview with the shekh (iv. p. 275), we have an instance of the currency of these notes, when one of the saint’s companions gave him some paper-money ( *بوالشت من الكاغد* ) and said, “Take these for your hospitable entertainment and depart.”

The Jesuit, Du Halde, in his "Description de l'empire de la Chine," states that a few of the notes which were issued under these early Chinese kings, are still in existence,\* and they are regarded with superstitious reverence. They are greatly prized as talismans to protect houses from evil, and it is held as an omen of the greatest good fortune, if, in building a new house, they can get one to hang to the main beam. He gives a picture of one of these notes, on which we find the word *tschao* as the current name.† The following is Du Halde's translation of the Chinese inscription, "La cour des trésoriers ayant présenté cette requeste, il est ordonné que la monnoye du papier ainsi marquée du sceau imperial des Ming, aye cours et soit employée, de même que la monnoye de cuivre. Ceux qui en feront de fausse, auront la teste coupée. Celui qui les aura accusés et amenés, sera recompensé de deux cent cinquante Taels. De plus on lui donnera les biens meubles et immeubles du coupable. Fait à telle année, tel mois, tel jour du regne de Hong vou."

We now turn to Persia, where we shall find a similar but less successful attempt to have been made.

In the dissolution of the empire which followed Chenghiz Khán's death in 1226, and its division among his sons, his grandson Hulákú Khán turned his arms to Persia, and after completing its conquest by the taking of Baghdad and the overthrow of the Abbaside dynasty of Caliphs, established himself on the vacant throne, founding the Il-khání dynasty. He died in 1264 and was succeeded by his son Abáká Khán, who governed wisely and consolidated his father's conquests. But after his death, in 1283, a scene of discord and confusion ensued, until Ky Khátú succeeded to the throne in 1291. He found the finances in great disorder, but instead of attempting to restore them by economy, he plunged into all kinds of excess, and left everything to a Wazír who was himself as extravagant as his master. At length in 1294 affairs appear to have reached a crisis, and the minister, at his wits' end to provide for the current expences of the

\* There is an interesting communication in the Royal Asiatic Society's Journ. Vol. XIII. on the private paper currency now in use in some parts of China.

† *Tschao* is found in De Guignes' Chinese Dict., where it is explained, "papyrus sigillata quâ olim sinenses loco argenti utebantur."

state, proposed to introduce into Persia the scheme of an inconvertible paper currency, which the branch of Chenghiz Khán's family that reigned in China, was then carrying out with some success. The eastern historians tell us that the minister consulted the Chinese ambassador, and obtained from him the details of the measure; but Sir John Malcolm plausibly suggests that Marco Polo may very probably have had something to do with it. He arrived in Persia about this very time, having accompanied the train of a princess, whom Kublai Káán had consented to give in marriage to Arghún Khán. On their arrival in 1292 or 1293 they had found that monarch dead and his successor Ky Khátú on the throne. Marco Polo remained in Persia nine months, residing at the capital; and he reached Venice in 1295.

Whether, however, the keen Venetian traveller was consulted or not on the scheme, it was resolved by the king and his minister that the attempt should be made. It proved, as we shall see, a miserable failure, but the record of it remains, forming in fact the one circumstance of interest in Ky Khátú's imbecile reign.

I subjoin the following account of the measure from Mirchond's history.\* I regret that I cannot present the contemporary account of Rashíd-ud-dín, who wrote his history, the *Jámi'-ut-Tuwárikh*, under Gházán Khán (Ky Khátú's successor) and his son Uljái-tú Khán; but unfortunately the only MS. of that rare and interesting work which is in the Society's library, is incomplete, and this part of the history (which occupies the first volume and is often called the *Tárikhi Gházáuí*) is missing.

Mirchond relates how the Sultan's Chancellor of the Exchequer, ( *صاحب دیوان* ) Sadri Jehán, used every means in vain to meet the increasing financial difficulties of the empire. He tried loans, but these only increased his embarrassments; and what with the Sultan's extravagance and his own, the treasury became empty, and he had no money for the current expenses of the government. In the midst of these perplexities, an officer of the Revenue department, named

\* M. de Langlés published a similar extract from the *Habíb-us-siyar* (written by Mirchond's son, Khondemír) in the *Memoires de l'Institut (Literature, &c.)* vol. IV. p. 129. Mirchond wrote his history towards the close of the 15th century.

'Izz-ud-dín Muzaffar, gave him an account of the paper currency of China, called chau, and recommended that a similar expedient should be adopted in Persia. " 'In this way,' he said, 'the doors of business will again be opened, and the wealth of the country will return to the treasury without loss or distress accruing to any individual.'" The remainder of the narrative shall be given in Mírchond's words.\*

"In these perplexing circumstances, the Chancellor of the Exchequer went with Pulád Changsánik, the ambassador at that time from the emperor of China, and laid before the Sultan Izz-ud-dín's proposal. Now the external aspect of the plan promised an ample field of gain, and a diminution of the burdens of traders, and a soothing of the hearts of the poor,—and Ky Khátú Khán, with all promptitude, issued a decree that throughout his empire no buying or selling should be conducted by means of the current coin, that men should draw the line of oblivion over the weaving of gold-embroidered cloth except for the especial use of the king and his nobles, and that they should abstain from the manufacture of every article which involved the consumption of gold or silver; and that the working in gold or the smelting of silver be left henceforth to the yellow cheeks of lovers and their running tears. In fine, by the seductive instigation of this monster in human shape, Izz-ud-dín Muzaffar, who caused his beneficent master to be thus implicated in such an evil design,—the emperor of sea and land appointed certain of his nobles to carry out this perilous measure, and sent them into the provinces of Iráki-Ajam and 'Arab, Diyárbakr, Rabí'ah, Mayyáfárikín, Ázarbáján, Khurásán, Karmán and Shíráz. In every city they built a chau-khánah; and exchangers, writers, and other treasury officers were appointed, and every where a certain sum of money was expended in the materials for the issue.† At the publication of this order, the different nations were filled with astonishment and confusion.

"Now the form of the chau was an oblong piece of paper, and certain words in the language of Cathay were written on it, and on both sides was the formula of belief, "There is no God but God, and Muhammad is his prophet," and beneath this the words Yiranjín Túrjí, which were the titles which the Káans of China had conferred

\* See the Bombay lithographed edition.

† This is the reading of the Society's MS.

on the kings of Persia. In the middle of the paper was drawn a circle, and starting from the centre was written the value of the note, which varied from half a dirrhem to ten dirrhems. Certain lines were also written on it, the substance of which was as follows,—that the emperor in the year 693 (A. H.) had issued these auspicious chaus; that all who altered or forged them should be summarily punished with their wives and children, and their property confiscated to the treasury; and that when these auspicious notes were once in general circulation, poverty and distress would vanish from the people, vegetables would become cheap, and rich and poor would be equal. Certain poets and able authors of the time published their productions in praise of the scheme, to flatter the king and the minister; this single couplet is given as a specimen.

If the chau ( چاو ) becomes current in the world,  
The glory of the empire will be eternal ( جاودان ).

“Since it was part of the edict that all who melted silver or gold in their trades, should cease to work any longer therein, and these men had accordingly forsaken their businesses, it was provided, as a means of their subsistence, that each of them should receive a certain fixed amount from the chaukhánah. It was also ordered that whenever the chaus became obliterated by use, they should be brought to the chaukhánah and new given in exchange. The Persian merchants by sea, who traded with foreign countries,\* were to bring, on the eve of the voyage, their chaus to the mint and there receive gold in exchange. In fine, in the month Zú'l ka'dah, in the year 693, chaus were first issued in Tabríz; and in consequence of the stringent orders given, for two or three days people used them in buying and selling. For an order had been issued that every one should lose his head who refused to accept the new currency. Many of the inhabitants of Tabríz left the place and carried away their goods and provisions from the bazar, so that this city, which is called the little Misr, became as empty of people as a lover's heart of patience. The cries of young and old rose to heaven, and the common people in the Friday's assembly began to exclaim loudly against the tyrannous

\* I have corrected the obscure reading of the Bombay edition to از بلاد یانگی آمدشده می نمایند, the reading of the Society's MS.

measure and implore heaven to send them aid; and loud were their curses against Izz-ud-dín and those who were his partners in the scheme.

“At last with common consent they attacked him, and, having killed him with his followers, broke out into rebellion. All the movements of the caravans were stopped in that district; and robbers and lawless men lay in wait in the streets and gardens, and if any poor wretch by dint of a hundred stratagems had managed to get a little corn or a bag of fruit, they took it away from him, and if he attempted to resist, they said to him “take these ‘auspicious chaus’ then in exchange.” At length when the matter became really serious and the knife, as it were, touched the bone, all the doors of business were closed and the imperial revenue seemed abolished. The nobles and amírs with the Chancellor of the Exchequer then went to the king, and represented to him that the institution of chaus had produced ruin to the subject and emptiness to the imperial treasury, and if this state of things continued many days longer, the glory of the empire would pass away, and no subjects be left in the realm. The Sultan, having heard the words of these faithful counsellors, issued orders for cancelling the chaus, and, the inhabitants consequently returning to their homes, in a short time the city and bazar of Tabríz resumed their original appearance.”

Short lived, however, as this measure appears to have been, its consequences were not so transitory; for it brought speedy ruin on the unfortunate monarch, who had been thus duped by his minister’s golden promises. A few months afterwards, a rebellion is raised by the nobles, and Ky Khátú, after a brief struggle, is dethroned and put to death.

But ill-fated as the measure had proved in Persia, the scheme of transferring all the gold and silver of the kingdom into the imperial coffers without the loss being felt by the subjects, was too tempting to the ignorant mind of an oriental despot, to be at once abandoned. We never hear of it again in Persia, but in the next century we find it attempted in India by that strange mixture of the grandest and the basest of Imperial qualities, the Sultán Muhammad Toghluk of Dehli (1325—1351). Although in this case copper, not paper, was adopted, still as Ferishta expressly tells us that it was done in imita-

tion of the Chinese system of *chaus*, we may allow it to stand in the same series of attempts with the foregoing.

The great authority for these later pre-moghul dynasties is the *Tārīkhi Fīrozshāhī* of *Zīā Barnī*,—an edition of which is now in the press, to appear in the *Bibliotheca Indica* under the auspices of our Society. Of Muhammad Toghluq's reign he writes as a contemporary, and the following is his account of this remarkable measure.

اندیشه سوم سلطان محمد که واسطه خرابی ملک و وسیله جوت و قوت شوکت متمدان هندوستان و سرتابان بزرگ و با ثروت و نعمت شدن سایر هندو گشت معامله بیع و شرو و اظهار مهر مس بوده است و از جهت آن که سلطان محمد را از باعثه همت عالیه در خاطر افتاد که ربع مسکون را می باید گرفت و در تحت امر خود می باید آورد و برای این مهم لایمکن حشم بی اندازه و بی حد در بایست شد و حشم بسیار بی مالهای حاضر دست نمی داد و در خزاین از کثرت اعطاء و ایثار خرقی بزرگ افتاده بود سلطان محمد مهر مس پیدا آورد و فرمان داد که مهر مس را در خرید و فروخت چنانچه مهر زرو نقره جاری است همچنان جاری گردانند و از اعمال اندیشه مذکور هر خانه از خانهای هندوان دار الضربی پیدا آمد و هندوان بلاد ممالک کوروها و لکها از مهر مس ضرب کزانیند و هم ازان خراج می دادند و هم ازان اسپ و اسلحه و نفایس گوناگون می خریدند و رانگان و مقدمان و خطوطان از مهر مس با قوت و شوکت شدند و خرقی در ملک پیدا آمد چند گهی نگذشت که دورستان تنکه مس را بدل می ستند و اینجا که از حکم سلطان خوف می کردند تنکه زربعد تنکه مس رسیده و هر زرگری در خانه خود مهر مس می زد و از مهر مس خزانه پر می شد و مهر مس چنان خوار و زار شد که حکم سنگریزه و سفال گرفت و قیمت مهر قدیم از نهایت عزت یکی بچهار و یکی بپنج رسید و چون در چهار طرف در خرید و فروخت خرقها افتادان گرفت و تنکه مس از کلوخ خوار تر شد و بهیچ باز آمد سلطان محمد حکم خود را در باب سکه مس فسخ کرد و با صد غضب باطن فرمان داد تا بر هر که سکه مس موجود باشد در خزانه رساند و عوضی آن مهر زر قدیم از خزانه ببرد و چندین هزار آدمی از طوایف مختلف که از سکه مس هزارها در خانه موجود داشتند و دل ازان برداشته بودند و بچای آورد مس در گوشه انداخته تنکه مس را در خزانه رسانیدند و بدل آن مهر تنکه زرو نقره و ششگانی و دوگانی در خانه بردند و چندان تنکه مس در خزانه در آمد که تودها از تنکه مس مثل کوهها در تغلقاباد بر آمده است و بدل سکه مس

\* So in MS. but query *حواطان*, agents, sircars?

گنجها از خزانه بیرون رفت و یک خرق بزرگ که در خزانه افندار بواسطه  
تذکة مس بود و از جهت آن که فرمان سلطان محمد در باب سکه مس  
نفاذ نیافت بلکه از واسطه تذکة مس مبلغی مال از خزانه ضایع شد خاطر  
سلطان محمد از رعایاء بلاد ممالک متغیر گشت

“Another project of the Sultán’s, which brought ruin upon the empire, was his interference with buying and selling, and issuing copper money. Since Sultán Muhammad in his lofty ambition had conceived the idea of subduing the inhabited part of the world, and for this impracticable design were required countless followers and attendants, and these could not be procured without ready money, and the treasury laboured under emptiness in consequence of the royal munificence,—the Sultán for all these reasons invented his copper money; and he issued a decree that in all purchases and sales these copper coins should be current as those of gold and silver had been. In consequence of this measure every Hindu’s house became a private mint, and the Hindus of the various cities of the empire had lakhs and crores of these copper pieces coined. With these they paid their tribute, and with these they bought horses and arms and costly goods of every description; and the ranas, district officers and sircars gained immense fortunes, but with serious detriment to the empire. Nor was it long ere the distant provinces refused to take these copper coins in exchange; and even there, where the king’s edict was feared, a tanka of gold rose to the value of a hundred copper pieces. Every goldsmith coined copper pieces in his own house, and the treasury became filled with the coins. At last the copper money became so depreciated that it was reckoned only like shingle or potsherds, and the value of the old coins from the excessive estimation in which they were held, was increased four or even five fold. When such ruin everywhere fell upon commerce, and the copper tokens became viler than bricks, and were of no use whatever, Sultán Muhammad repealed his edict, and issued a new order, though with the fiercest wrath within his heart,—that every one who had the copper coin, might bring it to the treasury and exchange it for the old gold money. Forthwith thousands of men from different quarters, who had thousands of these tokens in their houses, and utterly sick of them had tossed them into holes and corners with the pots and pans, brought them to the treasury and received gold

and silver money in exchange.\* In such quantities was the copper carried to the treasury that there were heaps of it in Toghkakábád like mountains, while immense sums passed out from the treasury in exchange for it, and this was one great evil which fell upon the state from this measure. And again since the Sultán's edict had failed in bringing the scheme to pass, and the copper tokens had only absorbed a large portion of the revenue, the heart of the Sultán became more and more alienated from his subjects."

Ferishta's account is based upon that of Zíá Barní, but as he supplements it from other authorities, it may not be uninteresting to subjoin it. I may remark that neither of the historians gives us any date for this measure; it probably took place in the middle of Muhammad's reign, but it is rather singular that Ibn Batúta, who spent some years in his court and has given copious anecdotes of his generosity and tyranny, should have omitted all mention of the project.

"The history of the issuing the copper gold† is as follows:—

"When the king desired, like Sekander, to conquer the seven regions, and his pomp and treasury would not suffice to meet all his demands, in order to attain his object, he invented a copper currency, and issued orders that just as in China a paper gold is current, so too in Hindustan they should coin copper gold in the mint, and make it pass current instead of silver or gold money, and employ it in all buying and selling. Now the Jau ( جاو ) of China is a piece of paper on which is written the name and title of the king, and the people there use it commonly instead of silver and gold. But this measure did not succeed in Hindustan. The Hindus in the empire brought immense quantities of copper to the mint and obtained‡ in this way lakhs and crores of stamped coins, and having purchased goods and arms, sent them to foreign countries and sold them there for silver and gold. The goldsmiths also forged the royal stamp and

\* I cannot explain the words which follow this وششگانی و دوگانی. They would seem to mean "by sixes and twos,"—can this refer to the rate of exchange? More probably, however, they are the names of gold or silver coins.

† I have given a literal version of the printed edition, as General Briggs' translation, generally so excellent, is here unusually wide of the original.

‡ General Briggs adds "by a bribe to the officers."

coined money in their own houses. In this manner after a time it came to pass that the distant provinces refused to take the copper money and opposition began to break out on every side. At last the discontent gradually spread until the copper tokens lost their estimation even in the capital and its neighbourhood. The king seeing this state of things began to repent of his order, and as there was no help for it, he issued an order that every one who brought the copper coins to the treasury, might receive gold and silver in exchange. His hope was that by this means perhaps the copper tokens would again rise in general estimation and maintain their currency in commercial transactions. But the people, who in despair had flung their copper tokens like stones and bricks in their houses, all rushed to the treasury and exchanged them for gold and silver. In this way the treasury soon became empty, but the copper coins had as little circulation as ever, and a very grievous blow was given to the state.”\*

I have thus endeavoured to give a sketch of all that is known respecting these three attempts to introduce a total change into the commercial and financial ideas of the semi-civilized nations of Asia. Oriental historians alas! have only eyes for battles and court-shows, —the condition of the people and the progress of ideas lie entirely out of the range of their observation; and hence all that we learn from them respecting these schemes is disappointing and barren. In two of the instances mentioned, Persia and India, the experiment immediately failed; for the circumstances under which it was tried were eminently unpropitious to its success. The reigning monarchs were, the one an impotent, the other a furious, tyrant; the state was suffering all the evils of conquest and despotism; and the only aim of the monarchs in introducing the scheme at all, was to rob their subjects the more easily. It was welcomed as a new engine to wring their gains into the treasury,—that the Sultan’s round of extrava-

\* Though not strictly bearing upon the question, I cannot refrain from alluding to the history of the water-carrier who saved Humáyún’s life at Chonsa. He was rewarded by sitting on the imperial throne for half a day. He employed his brief reign in providing for his family and friends; and to commemorate it, he had his beestie’s skin cut up into leather rupees which were gilt and stamped with his name and the date of his reign as sovereign prince!

gance and profligacy might continue unbroken. It was begun only to gratify a tyrant's selfishness, and of course it miserably failed. But as far as we can tell from our meagre accounts, it was much more successful in China; it was once extensively used by the native sovereigns; and Marco Polo in his various travels abundantly proves that the royal notes of the Moghuls had a wide circulation through the different provinces. As long as the Moghul dynasty governed well, the experiment seems to have succeeded; and it certainly lasted under them for nearly a century. We cannot tell the exact causes of its final failure; but it is not improbable that, as the Moghul dynasty grew debased, the effeminate puppets who succeeded to such great Kings as Kublai Káán, under the guidance of designing ministers, kept increasing the issues, in the vain idea that it was an inexhaustible source of revenue, until it ended in a revolution. A change of dynasty would introduce new feelings—the old paper currency would naturally become associated with the remembrance of the later evils, and the earlier benefits be forgotten; and national hatred would link it with the detested name of the expelled Moghul dynasty. Under these circumstances we need not be surprised at the failure of the attempt which the Chinese successors to the Moghuls made to revive it.

I need not add to the length of this paper, by subjoining any detailed remarks on the wide difference between the circumstances of the present time and any of these three previous periods,—more especially the Indian period under Mohammad Toghluks. India *now* and India *then* in every respect present a perfect contrast. With regard to China, the partial success of the plan there seems highly encouraging; and every circumstance which in that case tended to impair public confidence, will be absent in the present time. With all those drawbacks, we know that the “tschaos” did circulate far and wide; and in Marco Polo's time they were apparently received with good will; and if this effect followed under a semi-barbarous despotism in China, why should it not follow to a far wider extent under a paternal and civilised government in India?

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*On recent Russian Researches.—By Rev. J. LONG.*

After searching in vain among Europeans in Calcutta for copies of the Transactions of the Imperial Academy of St. Petersburg, I procured them at last in the Library of a *native* friend. It is to be deeply regretted there is so little literary and scientific intercourse between St. Petersburg and Calcutta, for the Russians have long laboured with great research in the investigation of the literature and antiquities of Asia and particularly of Central Asia; and with the extension of Russian power and influence to the frontiers of India, we may expect that much light will be thrown on the mental and social state of the people of Tibet, Bokhara, Khorasan, Kirghistan and Ariana. Russia from the prominence she assigns to linguistic qualifications among her functionaries, and from her position as a Semi-Asiatic power, seems preeminently marked out as a pioneer in Asiatic Science and Ethnology; the works she has already published and the liberal patronage of the Czar afford bright hopes for the future.

The Imperial Academy of St. Petersburg was highly favored by Alexander the 1st of Russia, and the late Emperor shortly after his accession attended with his family its anniversary and patronised it in various ways by appointing its members to oriental and scientific missions and making grants of money for special oriental objects. The Academy has, on various occasions, encouraged and aided scientific voyages such as those of Pallas, Gmelin; though it has of late years rather helped with its counsel while the Imperial Government have defrayed the expenses, as in the cases of—M. Baer who spent three years 1853-57 investigating the fisheries of the Caspian.—M. Helmersen on geological researches in Olonez.—M. Schrenck, zoological and ethnological enquiries in the countries bordering on the Amour.—Middendorffs and Borstch's zoological and botanical researches on the coasts of the sea of Aral.—M. Abich on the geology of the Caucasus.—M. Struve, trigonometrical surveys between the Atlantic and Caspian.

In 1856, an annual prize of 3000 roubles was founded by Count Ouevarof to be adjudicated by the Academy for encouraging works on Russian history and the drama. Previous to that eight annual

prizes were instituted in 1821 called the Demidoff Prizes. In 1855, the works for the prize amounted to twenty-five, of these eight were on History, three on Statistics, two on Jurisprudence, one on Geography, two Mathematical, one Natural Science, two Rural Economy, one Medicine, four Philology. All were in the *Russian* language, indicating a revulsion from the old practice of writing in French and German. Prizes were in 1857 assigned for the following works—the Flora of Lake Baikal—Fossil fish of the Silurian system near the Baltic—History of Russian legislation to the time of Peter the Great—Hoffman's tour to the Northern Uralian mountains—The Shipwrecks and Burnings in the Russian navy—The inferior algæ and infusoria—History of the Moscow Academy—Systematic logic. One subject of the prize for 1858 was an historical exposition of and statistical researches on the emancipation of the peasantry in the different states of Europe.

In the department of Oriental Literature in 1857, we find Monsieur Dorn actively pursuing his researches on the Muhammadan sources serving to a history of the *people on the South Coast of the Caspian*; he has published two volumes of Persian texts on the subject. Monsieur Khanikoff has presented a memoir of the *Caucasus* and a notice of the journals of the *Persian traveller Zeinel Abidin*: valuable contributions of *Sassanian coins* with dissertations on their dates have been made. Several members of the Russian Academy are investigating the idiom, history and literature of the *Afghans*.\* Others are engaged on *Kurd history*: Monsieur Lerch, a Kurdish scholar, was sent by the Academy to live among a number of Kurdish prisoners brought into the Government of Smolensk for the purpose of learning the Kurdish colloquially; the Russian Consuls and Functionaries have given warm co-operation in these investigations into Kurdish literature so important to a knowledge of the Iranian race. Monsieur Schiefner is labouring on the Buriat, one of the purest offshoots of the Mongolian language as also on a Mongolian translation of the *Vetál panchabinstati*, which, like the Hitopadesh, has been translated into many languages.

M. Kunik has written a memoir on *Russian Expeditions to the*

\* On a recent occasion while the English Government subscribed for five copies of a Pushto Dictionary, the Russian authorities subscribed for two hundred.

*Caspian coasts* in the 9th century. M. Brosset has published a Dissertation on *political relations between Russia and Georgia* since 1586, and also a *History of Georgia*, the work of eighteen years' hard labour. Great interest is taken in pointing out the connection between the Zend and Slavonic languages. Wasselief of Kazan is engaged in a series of researches into Buddhism and also into the Tibetan language—while Schiefner in 1854 read an interesting paper on the Ceylon, Nepal and *Asam* coins in the Academy of St. Petersburg.

During the year 1857 Memoirs were read on the following subjects :

*The nebosity of Orion*, by M. Otto Struve.

*The Secular perturbations of the great planets*, by M. Pervostchikof.

*Researches on the elasticity of metals*, by M. Kupffer.

*The quickness of rotation on the current produced by magneto-electric machines*, by M. Leng.

*On simplifying and expressing popularly the forces of electricity*, by M. Jacobi.

*On isothermal lines in Russian Maps*, by Vesseloosky.

*Crystallised combinations of Hydrocarbures neutores*, by M. Fritzsich.

*Action of azotic acid &c. &c.* by Ditto.

*Contributions to a Geology of Russia*, by M. Kokcharof.

*On salt genuine and its geological site in Armenian Russia*, by M. Ebich.

*On certain fauna and flora near Lake Aral*, by Ditto.

*The Geological Map of the Caucasus*, by Ditto.

*An inflammable gas in the Crater of Vesuvius and its periodical changes*, by Ditto.

*The vegetation of the Amour*, by M. Ruprecht.

*The flora of Russia, Umbelliferæ of Kamskatkha*, by Ditto.

*On Embryos formed without fecundation*, by Ditto.

*The changes produced in the soil of Novogorod by drainage*, by M. Jezelnof.

*On the Hareng fish of the Caspian*, by M. Baer.

*The Mammiferæ insectivores of Russia.*

## Literary Intelligence.

Mr. F. E. Hall writes from America, in a letter dated Dec. 24th.

“ You may not be aware that a translation of the *Sūrya-siddhānta* is coming out in the Journal of the American Oriental Society. Part has appeared ; and the rest is ready for the press and will probably be published by next April.” The translation is made by the Rev. — Burgess, assisted by Professor Whitney. Mr. Hall elsewhere remarks, “ if I had Pundit Bápú Deva at my side, I think I could considerably improve it.” Our learned coadjutor will be glad to learn that the translation by his fellow editor, is in the press, and will soon be issued in the Bibliotheca.

Professor Müller writes from Oxford, in a letter dated April 1st.

“ The *Sūrya-siddhānta*, as you probably have heard before now, has been edited and translated (revised by Whitney) in the Journal of the American Oriental Society ; it seems very carefully done with diagrams and notes. Biot has lately published some articles in the Journal des Savans on Indian Astronomy, reiterating his opinion that the Hindus borrowed from the Chinese. Whitney believes it ; I shall never believe it ; as little should I believe that the Greeks borrowed their Astronomy from the Goths. You ask me to mention some works which are wanted for the Bibliotheca Indica. Would it be possible to prepare a complete edition of Kumārila ? He is a most instructive writer, and there are no complete MSS. of his Tantra-vártika in any library in Europe. Is the Mahábháshya ever to be continued ? The plan to publish the Vais’eshika Sūtras with commentary is a very good one. What could be done for the Puráṇas ? Could you get an edition of the Váyu Puráṇa ? This seems to be one of the most original. However, the text of the Vishṇu Puráṇa too would be acceptable. If you think it possible to publish a collection of the Ūpanishads, excluding only the most modern compilations, that would be equally useful... . The Library of the East India House is to be removed to the Board of Control ; happily it has been saved from being swallowed up by the British Museum. I hoped for a time we might have got all the MSS. for the Bodleian, but this was not to be... . Aufrecht is going on with the Catalogue of our Sanskrit MSS., part of which is out, but I do not know whether it is in

the trade. His edition of the Unádi Sūtras is very useful and carefully edited. There is not much doing in Sanskrit on the Continent. ... I received the separate copies of the Essay on Writing which was inserted in the Journal. Böhlingk has written an Essay in answer to my hypothesis, but it contains no new facts, and does not seem to me to remove any of the difficulties which I stated."

We have received during the present year two new parts of Messrs. Böhlingk and Roth's Sanskrit Dictionary, which carry the work down to तावत्. It is seldom that we can detect any omissions in this excellent work; but we may venture to notice an oversight in the latter part. Under the word डम्बर we have only a quotation from the Mahābh., where it is a proper name, followed by the remark, "Welche Bed. hat aber das Wort, Mālatī-Mādhava 148-8?" The learned editors appear to have overlooked the fact that this obscure word is a favourite with Bhavabhūti. It occurs in the Māl-Mādh., p. 33 in the phrase डम्बरनामानः where the scholiast explains it by प्रसिद्ध (Prof. Wilson translates it "possessing names of note."). In the prologue to the Mahāvīrach. we have उडुम्बराः\* in a similar sense. The use of this word in Māl. M., p. 148, 8,

ऋम्भाजर्जरडिम्बडम्बरघनश्रीसत्कदम्बद्रुमाः

is by no means so infrequent as the editors' remark would lead us to suppose. The same meaning (as applied to the blossoms of the Kadamba) occurs in an earlier part of this very play (p. 48, last line) in the lines

प्रथमप्रियावचनसंश्रवस्फुरत्पुलकेन संप्रति मया विडम्ब्यते ।

घनराजिनूतनपयस्समुत्तणवद्वकुलकदम्बडम्बरः ।

where the scholiast explains it by प्रपञ्च; and a parallel is also to be found in the Mahāvīracharita (Trithen's ed. p. 99, 17) where it is applied to the masses of clouds,

यदि संयताः कुन्तलाः

किमम्बुवहडम्बरैर्यदि तनूरियं किं श्रिया ।

C.

\* So the Calcutta edition, explained by Pundit Tārānāth Tarkabāhaspati डम्बरमुत्कर्षसन्धिगताः The London edition reads faultily उडुम्बराः.

PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR APRIL, 1860.

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The Monthly General Meeting of the Asiatic Society, was held on the 4th instant.

A. Grote, Esq., President, in the Chair.

The proceedings of the last Meeting were read and confirmed.

Presentations were received—

1. From Rajah Kundurpeshwar Sinha, through the Collector of Burdwan, four silver coins.
2. From the Royal Academy of Sciences at Stockholm, a copy of *Eugenies Resa, Heft 6*.
3. From Henri de Saussure, of Geneva, Parts 8 and 9 of *Monographie des Guêpes Sociales*.
4. From Major H. L. Thuillier, a map of the China coast.
5. From Captain Jethro Fairweather, commanding the ship *Forfarshire*, a skull of *Delphinus eurynome*, from the Bay of Bengal; a very beautiful and perfect specimen.
6. Mrs. Edwards, two fishes from Port Blair, one of them a *Serranus* new to the Museum.
7. Received by Banghy Dâk, the skin of a *Lagomys*.
8. From the Curator, a fine stuffed specimen of *Rupicola sanguinolenta*, Gould.

The following gentlemen, duly proposed at the last Meeting, were balloted for, and elected ordinary Members.

J. E. T. Aitchison, Esq., M. D.; A. K. Dyer, Esq.; H. Braddon, Esq.; and Alonzo Money, Esq., B. C. S.

Dr. M. Haug, of Poonah, was also balloted for, and elected a corresponding member.

The following gentlemen were named for ballot as ordinary members at the next meeting.

The Right Hon'ble J. Wilson, proposed by the President, and seconded by Sir Bartle Frere.

R. Temple, Esq., B. C. S., proposed by the President, and seconded by Col. Strachey.

Charles Hobhouse, Esq., B. C. S., proposed by the President, and seconded by Dr. Kay.

Dr. H. Halleur, Professor of Natural Philosophy, Presidency College, proposed by Major H. L. Thuillier, seconded by Mr. Atkinson.

Captain Stanton, Bengal Engineers, proposed by Col. Baird Smith, seconded by Mr. Atkinson.

Captain Adrian D. Vanrenen, late 71st B. N. I., Revenue Surveyor, Jhansie, proposed by Major Thuillier, seconded by Major Sherwill.

Babu Jogindra Narain Roy, proposed by Babu Rajendralall Mittra seconded by the President.

Communications were received—

1. From R. B. Chapman, Esq., Under-Secretary to the Government of India, a copy of a letter from the Superintendent of Port Blair, reporting particulars of friendly interviews held with the aborigines of the Andaman Islands.

2. From Babu Radhanath Sikdar, an abstract of the Meteorological Observations taken at the Surveyor General's Office, in October last.

The Secretary submitted the following statement, shewing the amount of the Society's Income derivable from the payments of members for the last 5 years.

|                  | No. of Members. | Amount of subns. at Rs. 64. | Amount of entrance fees at Rs. 32. | Total Income. |
|------------------|-----------------|-----------------------------|------------------------------------|---------------|
| Jan. 1, 1856, .. | 128             | 8192                        | 416                                | 8608          |
| Do. 1857, ..     | 131             | 8384                        | 608                                | 8992          |
| Do. 1858, ..     | 116             | 7424                        | 192                                | 7616          |
| Do. 1859, ..     | 96              | 6144                        | 64                                 | 6208          |

|                  | Number of Members. |               |        | Amount of Subscriptions. |       |        | Entrance fees at 32 | Total Income |
|------------------|--------------------|---------------|--------|--------------------------|-------|--------|---------------------|--------------|
|                  | Resident.          | Non-Resident. | Total. | at 48                    | at 24 | Total. |                     |              |
| Jan. 1, 1860, .. | 78                 | 58            | 136    | 3744                     | 1392  | 5136   | 1376                | 6512         |
| April 4, ,, ..   | 98                 | 70            | 168    | 4704                     | 1680  | 6384   | 928*                | 7312         |

A paper was read "On the great Flood of the Indus in August, 1858," by Captain Montgomerie, Bengal Engineers.

On the motion of Major Thuillier, the special thanks of the meeting were voted to Captain Montgomerie for his interesting paper.

The Officiating Librarian submitted the usual monthly report.

The Library has received the following accessions since the meeting in March last.

*Presented.*

Monthly Notices of the Royal Astronomical Society, Vols. 14, 16 and 17.—**BY THE SOCIETY.**

Proceedings of the Royal Irish Academy, Parts 1 to 8 of Vol. 7.—**BY THE ACADEMY.**

Monographie des Guëpes Sociales, Cahier 8, 9. Par Henri de Saussure.—**BY THE AUTHOR.**

Selections from the Records of Government, N. W. P., 2 copies of Part 33.—**BY THE GOVERNMENT.**

A Classified Catalogue of the Raw Produce of the Madras Exhibition of 1859, 2 copies.—**BY THE GOVERNMENT OF INDIA, HOME DEPARTMENT.**

Report of the British Indian Association for 1859.—**BY THE ASSOCIATION.**

The Oriental Christian Spectator for February, 1860.—**BY THE EDITOR.**

Selections from the Records of the Bombay Government, No. 52.—**BY THE GOVERNMENT.**

Memoirs of the Royal Astronomical Society, Vols. 23, 25 and 26.—**BY THE SOCIETY.**

\* For the three months.

Astronomical Observations made at the Observatory of Cambridge, By the Rev. James Challis, M. A., F. R. S.—BY THE OBSERVATORY.

Magnetical and Meteorological Observations made at Toronto in Canada, Vol. 3.

Report of the British Association, held in August, 1856.—BY THE ASSOCIATION.

The Athenæum for December, 1859.—BY THE EDITOR.

Transactions of the Royal Irish Academy, Vol. 23, Part 2.—BY THE ACADEMY.

The Philosophical Magazine, No. 124, for January, 1860.—BY THE EDITORS.

Voyage round the World of the Royal Frigate Eugene, Part 6.—BY THE ROYAL ACADEMY OF STOCKHOLM.

Map of the China Coast.—BY MAJOR THUILLIER.

*Purchased.*

Annales des Sciences Naturelles, No. 5 of Tome 11, 4 series.

Conchologia Iconica, Parts 188, 189.

Sanskrit Wörterbuch, Part 3.

Revue De Zoologie, No. 11, 1859.

The Annals and Magazine of Natural History, Vol. 5, No. 25.

Deutsches Wörterbuch, Vol. 3.

Comptes Rendus, Tome 50, No. 1.

Journal Des Savants for November, 1859.

Die Lieder Des Hafis, Vol. 2, Part 4.

The Literary Gazette, Nos. 77 to 81.

Revue des Deux Mondes for 15th December, 1859 and 1st January, 1860.  
2 Nos.

The Westminster Review, No. 33, for January, 1860.

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FOR MAY, 1860.

The Monthly General Meeting of the Asiatic Society was held on the 2nd Instant.

A. Grote, Esq., President, in the chair.

The proceedings of the last meeting were read and confirmed.

Presentations were received—

1. From Major H. L. Thuillier, a few sheets of the engraved Indian Atlas.

2. From the Rev. J. Long, a copy of his work entitled "The Indigenous Plants of Bengal."

3. From Baboo Kaliprusunno Singh a copy of Purana Sangraha, part I. (containing a translation in Bengali of the first Book of the Mahabharata.)

4. From Captain Layard, through Lieutenant-Colonel Young, five base silver coins.

The following is Captain Layard's account of them:—

*"Berhampore, 3rd April, 1860.*

"MY DEAR YOUNG,—The accompanying five coins were found by Assistant Overseer Bheemser Singh in digging the foundations of the Post Office buildings at Rajmehal. You will perceive that they bear the date, A. H. 1155, and as I read, are of the reign of Mahomed Shah, and were struck at Moorshedabad. They are of a very base coinage, seemingly half copper and lead.

"Will you kindly present these coins to the Asiatic Society.

Yours sincerely,

(Signed) F. P. LAYARD."

5. From J. H. Gurney, Esq., M. P., of Catton Hall, Norwich, the following skeletons in beautiful condition, and ready mounted:—

VULPES VULGARIS, European Fox.

MUSTELA PUTORIUS, Pole-cat.

MELES TAXUS, Badger.

PHOCA VITULINA, Seal.

ERINACEUS VULGARIS, Hedgehog.

ARVICOLA AMPHIBIA, Water Vole.

LAGUS MARINUS, Great Black-backed Gull.

MERGUS MERGANSER, Goosander.

COLYMBUS ARCTICUS, Black-throated Loon.

FRATERCULA ARCTICA, Puffin.

Also British skins of Quails, Snipes, and little Grebes, to compare with their Indian representatives.

The special thanks of the meeting were voted to Mr. Gurney for this valuable addition to the Society's osteological collection.

6. From Major G. G. Pearse, Commandant, 3rd Sikh Irregular Cavalry, a skin of HÆMATOENIS CHEELA.

Read the following letters from Government in reply to the appli-

cation of the Society that their Curator, Mr. Blyth, might be deputed as naturalist to accompany the China force.

FROM R. B. CHAPMAN, ESQ.,

TO W. S. ATKINSON, ESQ.,

*Secy. to the Asiatic Society.*

*Council Chamber, the 7th April, 1860.*

SIR,—Your letter, No. 88, dated the 27th February last, containing the proposal of the Society to send Mr. Blyth to China, in connection with the Military Expedition now in course of being despatched to that country, having been referred for the orders of His Excellency the Governor-General, I am now directed to transmit a copy of a letter, No. 78, dated the 19th ultimo from the Secretary with His Lordship on the proposal.

I have the honor to be, Sir,

Your most obedt. servant,

(Signed,) R. B. CHAPMAN,

*Under-Secy. to the Govt. of India.*

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FROM C. BEADON, ESQ.,

*Secy. to the Govt. of India with the Govr.-Genl.*

TO W. GREY, ESQ.,

*Secy. to the Govt of India, Home Dept. Calcutta,*

*Camp Deenanugger, the 19th March, 1860.*

SIR,—I have the honor to acknowledge the receipt of your letter, No. 463, dated 3rd Inst., submitting copy of a communication from Mr. W. S. Atkinson, Secretary to the Asiatic Society, containing a proposal to send Mr. Blyth to China, in connection with the Military Expedition now in course of being despatched to that country.

2. In reply I am directed to state that the Governor-General much regrets that it is not in his power to view favorably the proposal contained in Mr. Atkinson's letter.

3. The Government of India is aware that Her Majesty's Government desires to keep the Staff Establishment of the Army in China down to the lowest number.

4. The Government of India knows too that space on ship-board will be very valuable.

5. It is impossible to say whether any base of operations on the

Northern coast will be taken up, or whether the fleet will serve as the base; in the latter case Mr. Blyth's operations would be carried on only at a great disadvantage, if at all.

6. Mr. Blyth's readiness to run all risks in the pursuit of science is creditable to him; but if the Government of India send him to China the Commander of the Force will be responsible for his protection and that of his Assistants.

7. The Governor-General is strongly against attaching non-combatants to Sir Hope Grant's Force in the present aspect of affairs. It may be different if we take a footing on the coast; and should this happen, it may be a reason for reconsidering the proposal of the Asiatic Society. But until we see our way more clearly as to the nature of the operations in China, His Excellency thinks it is the duty of the Government of India to add as little as possible to Sir Hope Grant's responsibilities and to keep his Force as compact as possible.

8. The Governor-General has no knowledge of the intention of Her Majesty's Government to send any naturalist. If any person is so employed it will most probably be the Medical Officer of one of Her Majesty's ships, as has been done on some other occasions.

9. The Governor-General has before him a nominal list of the Staff of the French Expedition. His Excellency cannot say whether it is complete, but there is no scientific functionary in it.

I have the honor to be, &c.,

(Signed) C. U. AITCHESON.

Read a letter from Major R. C. Tytler expressing his desire to withdraw from the Society.

The following gentlemen, duly proposed at the last meeting, were balloted for and elected ordinary members.

The Right Hon'ble J. Wilson.

R. Temple, Esq. B. C. S.

Charles Hobhouse, Esq. B. C. S.

Dr. H. Halleur.

Capt. F. S. Stanton, Bengal Engineers.

Capt. Adrian D. Vanrenen.

Baboo Jogindra Narain Roy.

The following gentlemen were named for ballot as ordinary members at the next meeting.

W. Ritchie, Esq., M. A., Advocate General, proposed by Mr. Atkinson, seconded by the President.

J. G. Thomson, Esq., proposed by Mr. F. Fisk Williams, seconded by Mr. Atkinson.

The Rev. W. Ayerst, Rector of St. Paul's school, proposed by Mr. Cowell, seconded by Mr. Atkinson.

C. J. Campbell, Esq., C. E., Delhi, proposed by Lieut.-Col. H. Yule, seconded by Capt C. H. Dickens.

*Report of the Council.*

The Council beg to submit the following report of the Philological Committee for the approval of the Society.

REPORT.

The Philological Committee beg to recommend to the Council that the Persian Historical work entitled *Tarikhi Másáúdí* be published in the new series of the *Bibliotheca Indica*. Mr. Morley has offered to send his transcript of the original, prepared from several MSS. for the Oriental Text Society, but which he is willing to hand over to the Asiatic Society, to publish in their *Bibliotheca Indica*. The work would occupy about four *fasciculi*, and as it is the composition of Sultan Másáúdí's Secretary, Abúl Fuzl Báiháki, it offers a contemporary picture of the period. For the importance of the time itself, it will be sufficient to quote the following from Elphinstone's History.

“ Másáúdí's period must have been one of the most deserving of notice in the whole course of the career of the Muhammadans in India. It must have been then that permanent residence in India, and habitual intercourse with the natives, introduced a change into the manners and ways of the invaders, that the rudiments of a new language were formed and a foundation laid for the present national character of the Muhammadan Indians.”

The Committee also beg to recommend the publication of the Sanscrit text of the Aphorisms of Sandilya, which Dr. Ballantyne has offered to edit, with a native commentary and an English translation. The text and commentary will only fill about one *fasciculus*, and the work itself appears to be one on every account well deserving of being included in the *Bibliotheca Indica*.

The report was adopted.

A paper was read by E. B. Cowell, Esq., M. A., on the Kirán-us-Sadain, a Persian historical poem, by Amir Khusrau.

The thanks of the meeting were voted to Mr. Cowell for his valuable paper.

The Officiating Librarian submitted the usual monthly report.

The Library has received the following accessions since the meeting in April last.

*Presented.*

Quarterly Journal of the Geological Society, Nos. 60 and 61.—BY THE SOCIETY.

Transactions of the Zoological Society of London, Vol. IV. Parts 4, 5 and 6.—BY THE SOCIETY.

Proceedings of the Zoological Society for 1856, 57, and 58, and also parts 1, 2, and 3 of 1859.—BY THE SOCIETY.

General Report of British India, Vols. 1, 2 and 3.—BY THE BENGAL GOVERNMENT.

Maps and Plans to accompany Government Record, No. 53.—BY THE SAME.

Annual Progress Reports of the Executive Engineers, No. 53.—BY THE SAME.

The Indigenous Plants of Bengal.—BY THE AUTHOR.

Purana Sangraha (being a translation in Bengali of Mahabharata), Part I.—BY THE EDITOR.

The Oriental Christian Spectator for March, 1860.—BY THE EDITOR.

The Annals of Indian Administration, Vol. IV. Part 1.—BY THE GOVERNMENT OF INDIA.

A Classified Catalogue of the Raw Produce of the Madras Exhibition.—BY THE MADRAS GOVERNMENT.

Bibidharta Sangraha for Bhadro.—BY THE EDITOR.

Guide to the Gardens of the Zoological Society of London.—BY THE SOCIETY.

Notices of the Proceedings of the Royal Institution of Great Britain, Part IX. November, 1858 to July, 1859.—BY THE INSTITUTION.

Selections from the Records of the Bombay Government, No. 55.—BY THE GOVERNMENT.

Journal Asiaticque, Vols. 14 and 15 being Nos. 55, 56.—BY THE SOCIETY.

The Athenæum for January and February, 1860.—BY THE EDITOR.

The Philosophical Magazine, for February and March, 1860.—BY THE EDITORS.

Proceedings of the Royal Society of London, Vol. X. No. 37.—BY THE SOCIETY.

Weber's Vajrasûci Des Açvaghosha.—BY THE AUTHOR.

Journal of the Statistical Society of London, Vol. XXIII. Part I.—BY THE SOCIETY.

Jahrbuch, Vol. X. No. 3.—BY THE AUSTRIAN ACADEMY.

Juynboll's Lexicon Geographicum, Nonum Fasciculum.—BY THE AUTHOR.

A pamphlet entitled "English version of the New Taxes."—BY THE BENGAL GOVERNMENT.

A pamphlet entitled "English version of the New Indian Paper Currency."—BY THE SAME.

*Purchased.*

The Annals and Magazine of Natural History, Vol. 5, Nos. 26 and 27.

The Quarterly Review, No. 213 for January, 1860.

The Edinburgh Review, No. 225, for June, 1860.

Revue des Deux Mondes for 15th January, 1st February and 15th February, 3 Nos.

Comptes Rendus, Tome 50. Nos. 2, 3, 4, 5, 6, 7, 8, 9 and 10.

The Literary Gazette, Nos. 82 to 89.

Journal des Savants for December, 1859 and January, 1860.

The American Journal of Science and Arts for January, 1860.

The Natural History Review for January, 1860.

Revue De Zoologie, No. 12, 1859.

Macnaghten's Hindu and Muhammadan Law. Edited by Prof. H. H. Wilson.

Geschichte des Abbasidenchalifats in Egypten, Vol. I.

Elfachri, Von W. Ahlwardt.

Annales des Sciences Naturelles, Tome XI. No. 6.

Sanskrit-Wörterbuch, Vol. 3.

Conchologia Iconica, Part 193.

Jules Thonnelier's Vendidad Sadé.

Sidi Khalil's Précis de Jurisprudence Musulmane.

Les Avadânas, Vols. 1, 2 and 3.—BY M. STANISLAUS JULIEN.

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FOR JUNE, 1860.

The Monthly General Meeting of the Asiatic Society was held on the 6th instant.

A. Grote, Esq., President, in the chair.

The proceedings of the last Meeting were read and confirmed.

Presentations were received—

1. From Major Bouverie, Governor-General's Agent at Bhurtpore, a meteorite which fell at a village about fifteen miles south of Bhurtpore.

2. From the Government of India, Home Department, No. 53 of the Selections from the Records of the Bombay Government.

3. From the Bengal Government No. 32, and Parts I. and II. of No. 33, of the Selections from its Records, also a copy of Mr. Allen's report on the administration of the Cossyah and Jynteah Hill Territory.

4. From R. Swinhoe, Esq., of H. M. Consulate, Amoy, a large collection of Chinese birds and a few quadrupeds, many of the former not presented to the Society, but forwarded merely for inspection; also a small collection of birds from the Philippine Islands; and another from South Africa, comprising several species new to the Society's Museum.

5. From Major R. C. Tytler of the late 38th B. N. I., a collection of sundries, comprising a few acceptable specimens, but nothing new to the Society's Museum excepting a Chinese *Syngnathus*, evidently taken from one of the insect Boxes commonly brought from Canton.

The following gentlemen, duly proposed at the last meeting, were balloted for and elected ordinary members.

W. Ritchie, Esq., M. A., Advocate General.

The Rev. W. Ayerst.

C. J. Campbell, Esq.

J. G. Thompson, Esq.

The following gentlemen were named for ballot as ordinary members at the next meeting.

Rajah Bunsput Sinha of Allahabad, proposed by Mr. Atkinson seconded by the President.

A. B. Sampson, Esq., Assistant Secretary, Department Public Works, proposed by Col. Baird Smith, seconded by Dr. Eatwell.

W. Grey, Esq., Secretary to the Government of India, Home Department, proposed by the President, seconded by Col. Baird Smith.

J. P. Grant, Esq., Jr., proposed by the President, seconded by Mr. Atkinson.

Dr. Simpson, Civil Surgeon, proposed by the President, seconded by Mr. Atkinson.

George H. M. Batten, Esq., B. C. S., proposed by Mr. J. Strachey, seconded by Dr. T. Thomson.

E. G. Mann, Esq., Rajshaye, proposed by Mr. W. Theobald, Jr., seconded by Mr. J. G. Medlicott.

L. F. Byrne, Esq., C. E., proposed by the President and seconded by Mr. Leonard.

George Shelverton, Esq., proposed by Col. Waugh, seconded by Major Thuillier.

Syud Ahmed Khan, of Moradabad, proposed by the President, seconded by Mr. Cowell.

Communications were received—

1. From Lord H. Ulick Browne, Under-Secretary to the Government of India, a copy of a letter from the Superintendent of Port Blair, reporting an attack made by some of the aborigines on Dr. Gamack and his boat's crew.

2. From Baboo Radhanauth Sikdar, Abstract of the Meteorological Observations taken at the Surveyor General's Office for November last.

Mr. Cowell read a paper on "Attempts by Asiatic Monarchs to introduce a Paper Currency."

The thanks of the meeting were given to Mr. Cowell for his valuable and interesting communication.

The Officiating Librarian submitted the usual monthly report.

The Library has received the following accessions since the meeting in May last.

*Presented.*

Denschriften des Kaiserlichen Akademie Der Wissenschaften, Bands IX., XV. and XVI.—BY THE ACADEMY.

Det Norske Sprogs.—BY THE CRISTIANIA SOCIETY.

Kongeriget Norge, 3 parts.—BY THE SAME.

Undervisningsvæsenets Zilstand i Norge, for 1853.—BY THE SAME.

Kongeriget Norge for 1857.—BY THE SAME.

Beretning, 1851—1855.—BY THE SAME.

Piperviten og Ruselotbatten.—BY THE SAME.

Chart of the Northern Coast, Nos. 13 A, 13 B, 12 A. B., 12 B.—BY THE SAME.

Aarsberetning for 1857.—BY THE SAME.

Beretning for 1857.—BY THE SAME.

Udtog af Norges Riges histoire.—BY THE SAME.

Nyt Magazin for Naturvidenskaberne, Vol. 10, part 2.—BY THE SAME.

General Beretning for 1856 and 1857.—BY THE SAME.

Journal of the Royal Asiatic Society, Vol. 17, Part 2.—BY THE SOCIETY.

Proceedings of the Royal Geographical Society of London, Vol. IV. No. 1.—BY THE SOCIETY.

The Athenæum for March, 1860.—BY THE EDITOR.

Madras Journal of Literature and Science, April—September, 1859.—BY THE MADRAS LITERARY SOCIETY.

Jahrbuch of the Austrian Academy for January, February and March.—BY THE ACADEMY.

Journal of the Agricultural and Horticultural Society, Vol. XI. Part 2nd.—BY THE SOCIETY.

Journal Asiatique, Vol. 15, No. 57.—BY THE SOCIETY.

Les Aventures de Kamrup.—BY M. GARCIN DE TASSY.

The Oriental Christian Spectator for April, 1860.—BY THE EDITOR.

The Oriental Baptist for May and June.—BY THE EDITOR.

The Calcutta Christian Observer for May and June.—BY THE EDITORS.

J. C. Hörbye om de erratiske Phænomener.—BY THE AUTHOR.

M. Sars on Middelhavets Litoral-Fauna, Parts 1 and 2.—BY THE AUTHOR.

Archiv für Kunde Oesterreichischer Geschichts-Quellen, Vol. XX. Parts 1 and 2 and Vol. XXI. Part 1.—BY THE AUSTRIAN ACADEMY.

Notizenblatt for 1858.—BY THE SAME.

Selections from Papers on Indigo Cultivation, No. 2.—BY THE BRITISH INDIAN ASSOCIATION.

Mr. Allen's Report on the Administration of the Cossyah and Jynteah Hill Territory.—BY THE BENGAL GOVERNMENT.

Selections from the Records of the Bengal Government, Nos. 32 and 33 Parts 1 and 2.—BY THE SAME.

Middeldorpf's *Fistulis Ventriculi Externis*.—BY THE AUTHOR.

Selections from the Records of the Madras Government, Nos. 52 and 53.—BY THE MADRAS GOVERNMENT.

Physikalske Meddelelser.—BY THE CHRISTIANIA SOCIETY.

London University Calendar for 1859-60.—BY THE UNIVERSITY.

Sitzungsberichte der Akademie der Wissenschaften, Vol. 27, part 2, Vol. 30. Nos. 16 and 17; Vol. 31, Nos. 18, 19 and 20; Vol. 32, Nos. 21,

22 and 23; Vol. 33, Nos. 24, 25, 26, 27, 28 and 29; Vol. 34, Nos. 1, 2, 3, 4, 5 and 6 and Vol. 35, Nos. 7, 8, and 9.—BY THE ACADEMY.

Sitzungsberichte (Philosophisch-Historische Classe), Vol. 27, Nos. 4 and 5; Vol. 28, Nos. 6, 7 and 8; Vol. 29, Nos. 9 and 10 in one Vol. and Vol. 30, No. 1.—BY THE ACADEMY.

Magnetischen Beobachtungen.—BY THE SAME.

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*On a Passage in the tenth Book of the Sáhitya Darpaṇa.*—By  
E. B. COWELL, M. A.

The Sáhitya Darpaṇa has been called “the standard of taste among the learned Hindús.” It was compiled by Vis’wanátha Kavirája, who is said to have lived in the district of Dacca, and his date may be conjecturally placed in the 15th century. His book contains a complete system of Literary Criticism, from words and sentences to dramas and epic poems. Its prevalent fault is a proneness to minute subdivision,\* and many parts of it relate to obscure trivialities; but much of it displays an ingenuity and insight, which only require to be understood to be appreciated. The tenth book is devoted to the especial embellishments of style,—*alankára* in its more technical sense; and many keen observations are scattered through its pages, which often touch on points left unnoticed by the more ambitious writers on Rhetoric in the West. As an example, I have chosen the section on Simile, which seems to me a very favourable specimen of the delicate analysis of the Hindú Rhetoric, while, at the same time, it will afford an opportunity for making an important correction to the text as it now stands in print.

\* At once the strength and weakness of the self-developed Hindú mind! “Maximum et velut radicale discrimen ingeniorum, quoad philosophiam et scientias, illud est; quod alia ingenia sunt potiora et aptiora *ad notandas rerum differentias*; alia ad notandas rerum similitudines. Utrumque ingenium facile labitur in excessum, prensando aut gradus rerum aut umbras.” *Nov. Org.* I. lv.

Two editions of the original have appeared in Calcutta, in 1828 and 1851; but in consequence of the imperfect condition of the MSS. on which they were founded, an important sentence has, till now, remained perfectly unintelligible from an omission of three lines in the very centre of the argument.

The Hindú analysis of Simile and Metaphor appears in the form of a series of four terms, composed (if I may say so) of two *factors*, of which the one decreases while the other increases in equal proportion. The principle on which the division is founded, is the position of the *subject* of the comparison relatively to the *object*, and the extent to which it is able to maintain its own individuality or is forced to yield it up to its rival. These four gradations are called *Upamá*, *Utprekshá*, *Rúpaka* and *Atis'ayokti*.

In the first, we have a simple Simile; the object (*upamána*) is only introduced for the sake of illustration, and the subject (*upameya*) retains its own independent position. Thus in the sentence, "her face is fair as the lotus," the subject, the face, retains its individuality unimpaired, and the idea of the lotus is only an accessory, which is kept in its strictly subordinate position.

In the second, *Utprekshá*, we may observe a change in their relative position; the individuality of the subject is beginning to waver, and retreat into the back ground; while that of the object is assuming a new prominence. In the sentence "her face is, as it were,\* a lotus," the attributes of the lotus are threatening to encroach upon those of the face,—we are beginning already to lose the one in the other.

In the third, *Rúpaka*,† this change has come to pass. In the sentence "her face *is* a lotus" or "the lotus of her face," the attributes of the lotus have usurped the place of those of the face,—the one seems to have passed into the other and its own personal identity is being absorbed. But it is still to be recognised,—the metamorphosis is not wholly complete. It is like Ovid's account of the Centaur's daughter, when the curse has begun to operate,

\* The same result is produced by such phrases as "methought," &c. see Súra 691.

† I may notice in passing a subdivision of *Rúpaka*, called *Parináma*, where the usurping idea is not purely ornamental (as in *Rúpaka*) but helps on the original topic, as e. g. 'Her eyes were stars to guide the wanderer home.'

—nec verba quidem nec equæ sonus ille videtur,

Sed simulantis equam.

But when Ovid goes on to add

parvoque in tempore certos

*Edidit hinnitus,*

we have a parallel to the fourth, *Atis'ayokti*, where the metamorphosis is finally accomplished,—the subject being no longer visible, as it is wholly swallowed up in the object and identified with it. Thus when in Persian poetry we have “*narcissus*” used for “*eye*” and “*cypress*” for “*a woman's figure*,” these ideas, which in the simile would have been only subordinate, have not only advanced into prominence, but have completely overgrown and concealed the original.\*

The following may serve as English illustrations of the series.

She lived among untrodden ways—

.. .. ..

A violet by a mossy stone

That never meets the eye,

(*Rúpaka.*)

Fair as a star when only one

Is shining in the sky.

(*Upamá.*)

I saw thee weep—the big bright tear

Stood in thine eye of blue,

And then, methought, it did appear

A violet dropping dew.

(*Utprekshá.*)

To behold the wandering moon,

Riding near her highest noon,

Like one that had been led astray

Through the heaven's wide pathless way,

And oft, as if her head she bowed

Stooping through a fleecy cloud.

(*Utprekshá.*)

\* The most singular specimen of *Atis'ayokti* I have met with is the following anonymous stanza on a woman who stands weeping at her husband's door.

लतामूले लौनो हरिणपरिहोनो हिमकरः

स्फुरत्ताराकारा गलति जलधारा कुवलययात् ।

धुनोति बभ्रुकं तिलकुसुमजन्मा हि पवनो

वह्निद्वारे पुण्यं परिणमति कस्यापि छतिनः ॥

Oh what a noble mind was here o'erthrown!  
 The courtier's, scholar's, soldier's, eye, tongue, sword;  
 The expectancy and rose of the fair state,  
 The glass of fashion and the mould of form! (*Rúpaka*.)

*Atis'ayokti*, I fear, is but seldom used by our severer western taste, but we have it exemplified in the following line of W. S. Landor.

That rose through which you breathe—come bring that rose.

In Persian poetry, it is common enough, as in the following line of Háfiz :

“I am the slave of the drunken narcissus of that tall cypress.”

The following is a brief outline of the *Sáhitya Darpaṇa*'s account of these figures.

*Upamá* is defined as “the expressed resemblance [and not implied, as in *Rúpaka*] of two things in one sentence, without the mention of any dissimilar attribute.”

*Utprekshá* is “the hypothetical conceiving of the original subject under the form of something else.” Its hypothetical character must always be shown by the employment of such phrases as “methinks,” “as it were,” &c., as otherwise it would merge into *Rúpaka*; except when we are describing only a cause or result, as in the lines of the Raghuvans'á, “the arrow shot by Ráma, having pierced Rávana's heart, flew on and entered the ground as if to bear the news to the lower world.” This would still be an instance of *Utprekshá*, even if “as if” were omitted.

*Rúpaka* is “the superimposition of a conceived form over the original subject.”

For *Atis'ayokti*, I subjoin a literal translation of the chapter where this figure is described; its reach, however, as will be seen, extends much wider than the single case, for which I have used it above. Additions to the text, by way of explanation, are given in brackets.

“*Sútra* 693. *Atis'ayokti* [or hyperbole] is applied when the introsusceptive energy is actually completed [and not merely threatened as impending.]

*Adhyavasáya* [the introsusceptive energy,] is found where the idea is produced of the identity of the object and the subject, from the latter's being swallowed up in the former. In *Utprekshá* this was

only regarded as a future liability, since the object was not stated as being definitely placed for the subject, [but qualified by “as it were”]; but here the actual result produced is this very impression. (Still in *Utprekshá* to a certain degree the subject was swallowed up in the object in consequence of its being placed in the background, and in *Atis'ayokti* too we can have the same in such phrases as “her face is a second moon,”\* since they say,

“The wise hold that the subject is swallowed up in the object when the former is not named in the sentence, and even also when it is named, if it be thrown as subordinate in the background.”)

*Sútra* 69A. *Atis'ayokti* may have a five-fold division,—identity where there is difference,—disconnection where there is connection,—the opposites of these—and a violation of priority and posteriority in cause and effect.

By “the opposites of these” I mean—difference where there is identity, and connection where there is disconnection. For an example of identity where there is difference, take these lines of mine.

“How can it be! a peacock's feathers above, and under it shines a fragment of the moon eight days old, and next a pair of lotuses dancing, and then a *tila* flower, and under that a new shoot!”

Here we have the introsusceptive energy manifested by the identity [in spite of the real difference,] of the fair one's hair, &c., with the peacock's feathers, &c. [the half-moon being her forehead, the lotuses her eyes, the *tila* her nose and the new shoot her lips]: or again in the verses quoted from Ráma's speech, in a former part of the treatise :

“This is the spot where seeking thee I came to the anklet thou hadst dropped on the ground; but I saw it not, as it lay fixed in silence, as though from sorrow at its separation from thy lotus-foot.”

Here the attribute of silence in a sentient being is one thing, and that in a non-sentient is another; but the poet produces the idea of their identity in spite of their real difference. Or again, in the line,

\* When you boldly say “her face is another moon,” as there is only one moon (*scil.* in Hindú science,) you really make as much exaggeration as if you dropped the face altogether and spoke only of “her moon.”—“Her face is fair as the moon” is *Upamá*; “her face shines as if it were a moon” *Utprekshá*; “her face is a moon,” *Rúpaka*; “her face is a second moon,” or “her moon” *Atis'ayokti*. Many authorities, however, deny that the former of these is properly *Atis'ayokti* at all.

“The lover also had *rāga* in her youth as well as her leaf-like lower lip.”

Here *rāga* in the case of the lip means ‘redness,’ but in the case of the lover ‘affection’ [from the root *ranj* having these two significations]; but the two meanings are rhetorically treated as identical.

2. ‘Difference in identity’ may be seen in the following :—

“The grace of her limbs is wholly *sui generis*,—the wealth of her sweet odour is something utterly different; the freshness of her with the eye like a lotus-leaf is indeed supernatural.”

3. “Disconnection in connection;” as in these lines from the *Vikramorvasí*.

“Say, was it the moon, the giver of beauty, who was the *Prajápati* in her creation? or was it *Káma* himself, his whole soul immersed in love? or was it the month that is richest with flowers? How indeed could an ancient sage, cold with continued study of the *Vedas*, and his desires turned away from all objects of sense, create this mind-ravishing form?”

Here the idea of disconnection is produced, in spite of the real connection which did exist between her creation and the sage *Náráyana* [who actually produced her.]\*

4. Connection in disconnection; as in the following :

“If two lotuses were planted in the disk of the moon, then her fair-eyed face would be exactly imitated.”

Here by the force of the particle “if,” the idea is hypothetically suggested of a possible connection between the subject and the object introduced.

5. The violation of priority and posteriority in cause and effect can happen in two ways,—*a.* in the production of the effect before the cause, and *b.* the occurrence of both at the same time.

*a.* “*First* indeed was the mind of the fawn-eyed maidens bewildered with regret, and *afterwards* appeared the beauty of the opening buds of the mango and *vakul* (*mimusops elengi*).”†

*b.* “Two things were seized together by the hero treading like an

\* For the legend of *Urvasí*'s birth, See Prof. Wilson's *Hindu Drama*, Vol. I. p. 202.

† Cf. the lines quoted by Mr. F. E. Hall from *Rámila* and *Somila* in *Journ.* Vol. XXVIII. p. 30.

elephant,—the throne of his father, and the circle of earth's monarchs.”  
(Raghu Vans'a.)

Here some authors maintain that ‘in the lines quoted above, the natural excellence belonging to the hair, &c. is described as supernatural by introsusception; since, otherwise, if you held that the hair &c. were really swallowed up by the peacock's tail, &c. [these being plainly different things,] the definition would not apply in such cases as the lines of § 2, “the grace of her limbs,” &c. [as the grace here described is not *really* different.]’ But this view is not correct, since even in this last instance the grace of her limbs, though really *not* different, is conceived, by introsusception, as if it were different. So too, if we altered the phraseology, and read instead of “*verily sui generis*,” “as it were *sui generis*,” it would then be a case of *utprekshá*, since the introsusception would be no longer definitely completed but only contingent and future. In the same way in the example quoted in § 5, “First indeed was the mind of the fawn-eyed maidens, &c.,”—the previous existence of the *vakul* blossoms, &c. is lost under the idea of their posteriority; but here too we should have an instance of *utprekshá* if we used “as it were.” And so too in other cases.”

It is this last paragraph which, as we observed in the beginning of the paper, is up to the present moment new to print, in spite of the two editions already published of the Sāhitya Darpaṇa. The MSS. used for the collation of the text (as, for instance, that in the Sanskrit College Library) were sadly deficient in this passage; and three or four lines were omitted which entirely destroyed the sense. We give below a correct copy of the whole paragraph from a MS. in the Society's Library.

इह केचिदाहुः “केशपाशादिगतो लौकिकोऽतिशयोऽलौकिकत्वेनाध्यवसीयते, केशपाशादीनां कलापादिभिरध्यवसायेऽन्यदेवाङ्गलावण्यमित्यादिप्रकारेषु अत्याम्लिर्लक्षण्येति” तत्र। अत्रापि ह्यनन्यदङ्गलावण्यमन्यत्वेनाध्यवसीयते। तथा ह्यन्यदेवेति स्थाने अन्यदिवेतिपाठेऽध्यवसायस्य साध्यत्वमित्युत्पेक्षाङ्गीक्रियते। “प्रागेव चरिणाक्षीणां” इत्यत्र वकुलादिश्रीणां प्रथमभावितार्थापि पश्चाद्भावित्वेनाध्यवसिता, अत एवात्रापि इवशब्दप्रयोग उत्पेक्षा। एवमन्यत्र।

The printed editions read *अध्यवसायेऽन्याङ्गीक्रियते*, and omit from *अन्यदेव* to *उत्पेक्षाङ्गीक्रियते*.

On the first and fifth kinds of *Atis'ayukti* another figure is founded called *Sahukti* (from *saha* ‘with’ and *ukti* ‘speech.’)

This is produced by the use of the word, 'with,' or any equivalent phrase, in connection with the exaggeration which is the especial object of Atis'ayokti itself. The last instance in the first class of the Sáhitya Darpana, ("The lover also had *rága* &c."), is thus an example of the two figures combined. We have an example of *Sahokti* in Byron's *Giaour* :

For courtesy and pity died  
With Hasan on the mountain-side.

To illustrate the subject further, I add a translation of the account of Atis'ayokti given in the tenth section of the *Kávyá Prakás'a*,—an older treatise on rhetoric compiled by Mammata Áchárya, a Cashmirian Bráhman, about five centuries ago.

*"Where the original topic is lost and swallowed up in something else,—where the original subject is viewed as itself changed,—where there is an artificial supposition by the force of if or its equivalent,—and where there is a contradiction of the priority and posteriority of cause and effect,—in these four cases we must recognise Atis'ayokti."*

a. The first kind is where the subject of comparison is swallowed up in the object, as—

"A lotus but not in the water, and two blue lotuses in that lotus, and the three on a golden creeper;—and the creeper itself tender and dear! what a series of portents is this!"

Here the face, the eyes, and the form are swallowed up in the lotus, the blue lotuses and the creeper.

b. The second is where the original is lost by apparently becoming something else, as,

"Her beauty is something quite different, the aspect of her form is quite extraordinary; this *S'yámá* was not the work of a common *Prajápati*."\*

\* The *Prákrit* of these lines is obscure,

असं लउहत्तण्यं असा विच्य काइ वत्तणच्छाया ।

सामा सामस्यपञ्चावदणो रेह्विच्च ए होइ ।

(The metre is *Áryá*.) The Schol. thus explains them अन्यल्लावणमन्यैव कापि वर्त्तनच्छाया । श्यामा सामान्यप्रजापतेरेखैव न भवति । लउहत्तणं लावणे देशी । वर्त्ततेनेनेति वर्त्तनं शरीरं । श्यामा तथापरिभाषितनायिकाविशेषः । रेखा शिल्पं । The *S'yámá* is technically defined thus शीते सुखेष्णसर्व्वंगी ग्रीष्मे तु सुखशीतला । तत्रकाञ्चनवर्णाभा सा स्त्री श्यामेति कथ्यते ॥

c. The third is where an impossible thing is supposed by the force of *if* or its equivalent, as—

“If the orb of the treasury of ambrosia (the moon) were void of spots at its full, then would her face endure the defeat of having its parallel found.”

d. The fourth consists in mentioning the effect *first*, to impress on the reader the rapid efficiency of the cause, as in these lines from the drama of *Málaviká and Agnimitra*.

“*Málaviká's* heart was *first* possessed by the god with the flowery bow,—and then by thee, beloved of the fair, standing as the object of her eye.”

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*The Kirán-us-Sa'dain of Mír Khusrau.*—By E. B. COWELL, M. A.

Among the poetical names of Muhammadan India, none stands higher than *Yamín-ud-Dín Abú-'l-Hasan*, more commonly known as *Mír Khusrau*. His great fault is his boundless prodigality of authorship,—it is said that he has left behind him some half million of verses!

Amongst his various works, the most celebrated are his five *Masnavis*, in imitation of the *Khamsah* of *Nizámí*; containing the *Matla'-ul-Anwár* on *Sufeyism* and morals, the loves of *Shírín* and *Khusrau*, *Lailí* and *Majnún*, the *Mirror of Alexander*, and the *Eight Paradises*, or adventures of *Bahrám Gúr*. But beside these better known poems, there are two of a different class, which are, for many reasons, much more interesting to a European reader. In his more ambitious poems, *Khusrau* had given the reins to his fancy, and let it carry him as it willed far away from the actual world into the ideal land of a remote antiquity; in the eras of *Shírín* and *Sekandar* he had no fear of facts or dates, every thing was lost in distance and obscurity, and the traditions could be moulded at his pleasure. He had indeed but followed the example of his predecessors; all Persian poets in their narratives had similarly thrown themselves into a legendary past, and it is only in their smaller lyric effusions, that we can trace the lights and shadows of their own time. But in two of his poems,

as we have said, Mír Khusrau strikes out a new line for himself; and he is, we believe, the *first*, and we might almost add the *last*, of his country's poets who has been bold enough to look away from the past to the present, and seek for his inspiration in the actual scenes transpiring before his eyes.

He lived in a stirring time. His father was a military chief of the Pre-Moghul empire, and fell in battle when his son was nine years old. Khusrau was born A. H. 651 (A. D. 1253,) and he died A. H. 725 (A. D. 1325.) For many years he was attached to the court, and he shared many of the adventures of his royal patrons. He was contemporary, in his youth, with the last Slave Kings, and he outlived the whole Khilji dynasty. He had been born under Násir-ud-Dín, and his early patron was Prince Muhammad, the 'Black Prince' of Indian history, whose valour and taste and untimely death throw such a colour of romantic interest round his father Bulbun's court, in spite of his mean jealousies and tyrannical policy. He was at the court when the revolution took place, by which the sceptre passed from the Slaves to the Khilji dynasty, and he saw the whole course of Alá-ud-dín's strangely eventful career,—beginning with the basest ingratitude and murder, and ending Lord of all India, with a wider empire than any of his predecessors; though that empire was not fated to remain in his family, but passed soon after his death to a stranger. Nor was the aspect of India itself less stirring than the changeful history of its Kings. When Khusrau was born, the great storm of Moghul invasion which had devastated all central Asia, was still threatening from the North-west. He was five years old when the tidings came which spread a thrill of horror through the Muhammadan world, that Baghdad was taken and the last of the Caliphs slain by the idolaters! He saw Alá-ud-dín's adventurous plunge into the unknown forests of the Deccan, and he lived to see Warangol taken in 1323, the last Hindu kingdom of the South subverted and its Rája brought a prisoner to Dehlí!

Living then, as he did, in such a busy time, we need not wonder that a man who with all his faults was a true poet, could see materials for romance in the present around him, as well as in the legendary glories of Alexander and Chosroes. Two of his poems have, for their subjects, scenes which he had either witnessed or heard of from

others who witnessed them,—the story of the contest between the Sultan Kai Kobád and his father, and that of the Mahratta Princess Dawal Devi, and her marriage with the crown prince Khizr Khán.

We have a copy of each of these poems in the Society's Collection ;

1. No. 541. *قران السعدين*, 163 foll. 12 lines in a page.\*

2. No. 990. *عشيقه امير خسرو*, or, as it is sometimes called, *قصه خضرخان و دول راني*,—it contains 4200 baits.

The present paper will confine itself to the former poem, the latter may be similarly taken up at some future opportunity.

Dr. Sprenger has given a brief notice of the *Kirán-us-Sa'dain* in his Catalogue of the Oude MSS. but his account lacks his usual accuracy, as the more detailed analysis in the following pages will sufficiently testify. He says of it that "It is an historical poem, the heroes are Násir-ud-Din and Moizz-ud-Din, but the facts are so much clad in allegories that the only historical value of the book is, that it offers us a specimen of the singular taste of the age in which it was composed." The style of the poem (as of all Khusrau's works) is full of exaggeration and metaphorical description, but the facts of the history are generally given with tolerable fidelity. In fact, few historical poems in any language adhere more closely to the actual order and character of the events, and when we compare Ferishta's account with the poetical version, we are struck by their great agreement in the main points.

The poem is composed in a singular form, and I do not remember any Persian work from which Khusrau may be said to have borrowed it. The main body of the poem is like an ordinary Masnavi, as for instance any one of Khusrau's own Khamsah, composed in the Metre — 0 0 — — 0 0 — — 0 —

Jane pater Jane tuens, omnium

Principium fons et origo Deum ;

but the rubrics of the different Chapters are (like those in Spenser's Faery Queen) in a different metre

— 0 — — 0 0 — — 0 0 — — 0 0 — †

\* The *Kirán-us-Sa'dain* was lithographed, with a commentary, at Lucknow, A. H. 1261, but, since the mutiny, copies have become very scarce.

† Dr. Sprenger, not observing this peculiar novelty, has apparently confused these two different initial lines of the poem.

each forming a couplet of a continuous *Kasídah* in the rhyme **ا**, which if collected together would, of course, supply a running analysis of the whole poem. Beside this, every now and then at the end of many of the chapters there is given a *ghazal*, which is supposed to express the poet's feelings, contemporary with that part of the story which has been just described, something like the songs introduced between the parts of Tennyson's *Princess*. These *ghazals* are in various metres and serve admirably to diversify the poem, while at the same time they form a running commentary, like the choruses of a Greek play, on the progress of the action and the hopes and fears which it may be supposed to excite in the minds of the spectators. The poet, having been actually present throughout the campaign, is in this way enabled to throw himself into the scene, and we have thus an interesting mixture of the epic and lyric elements, each portion of the action being represented from an objective and a subjective point of view.

The first couplet of the *Kasídah* Analysis is

شکر گویم کہ بتوفیق خداوند جهان بر سر نامه ز توحید نوشتم عنوان

but the opening lines of the poem itself are

حمد خداوند سرایم نخست تا شود این نامه بنامش درست  
واجب اول بوجود قدم نی بوجودی که بود از عدم

The usual praises follow to the Prophet and his family, and fill several chapters; then come the praises of the Sultán Moizz-ud-Din Kai Kobád in two chapters, followed by a description of Dehli and the Jámí' Musjid and other public buildings, &c.

At last, after this tedious series of preliminaries, the story itself opens with a description of December, "when the king of the sky lays his hand on the bow and shoots an arrow on the world in frost." A curious episode follows on the various means of exciting warmth in the cold season, by fires, warm clothes and festivities; and the young king adopts the last remedy. His realm is in peace, no sounds of war are heard, "the face of the earth is controlled under his sword as the dust of the ground is laid by the cloud." His carousings are rudely disturbed by news from the East, of his father's meditated revolt. Násir-ud-Dín (or, as Ferishta calls him, Baghrá Khán,) had hoped to succeed his father Ghaias-ud-Dín Bulbun when the eldest son Muhammad died, and had been grievously disappointed when the

old man fixed his choice on his grandson,—like Lancaster and Richard II. in our own history. Bulbun died shortly after, a broken old man, and civil war seemed imminent, when the dispute was settled by both the rivals retiring and leaving the vacant throne to Násir's own son, Kai Kobád; the son of Muhammad contenting himself with the Government of the Punjab, and the young King's father returning to his old province of Bengal. But his ambition was only stifled for the time, and the tidings of his son's incapacity and follies stirred it into new life; and he prepares to wrest the sceptre from his feeble hands.

Fierce blew the rumour that the Sun of the East  
 Has blazed like lightning across his meridian,  
 The Násir of the world, the conqueror of kingdoms,  
 Has drawn his sword seeking revenge.  
 He marched his army to the river of Hind,  
 That his host might raise up the dust of Sind.\*  
 See his fortune what ambition it awoke,—  
 The descending water inclines to mount up!

His army proceeds by land and by water into Oude and occupies the province.†

Night and day, his one speech is this,  
 "I am the Sekandar that shall break down Dará.  
 If my father is gone, then am I the world's keeper,  
 I am the heir of Sulaimán's diadem."

The King awakes from his dream, and prepares for the contest. He summons his various governors and jágírdars to supply their contingents, and a large army is soon collected from every quarter. If we could rely on the poet's accuracy in statistics, we could copy a roll call which he gives us; but we fear his laks are somewhat indefinite, like the sands and "sandillions" of older poets! Khusrau concludes his chapter by a warlike ghazal.

On "Monday in the early morning, in the month of Zúl Hijjah, at the end of the moon," the king first shakes his banner to the breeze, and begins his march from Dehlí. He proceeds leisurely by slow

\* So the MS., the printed ed. reads

راند زلكهتوتی و دریای هند تا سپهش گرد بر آرد ز سغد  
 آمد و اقصای اود در گرفت وان همه اقلیم سراسر گرفت †

marches and his time is chiefly occupied in festivities and hunting-parties. The action of the poem now moves very slowly too, and we wade painfully through a long series of descriptions, the varying scenery of every month being minutely described, and the different employments of the young King and his courtiers. His first stage is Kílú Kharí (کیلو کھری) where a grand castle, belonging to the King, is described, as well as the festivities in which he indulges on his arrival. While lingering here, he receives news of the invasion of his North Western territories by an army of Moghuls.

By the violence of their torrent as it burst in,  
The glory (آب) of Láhore passed over to Multán.

The king despatches 30,000 chosen horsemen to meet this new foe under the command of an officer named Khán Jahán Bárbik.\* They march to the Punjab and soon disperse the enemy. We have the names of several of the Moghul leaders mentioned, such as Tamur (تمر), Sarmak, Kílí, Khajlik and Baidú.

سرمک و کیلی دو بیکرو شتافت خچلک و بیدو بدگر سو شتافت

These transitory but desolating Moghul incursions are a continual feature in the Indian annals of this period, reminding us of those devastating inroads by the Danish pirates in our own Saxon period. We learn from Ferishta that such an invasion actually occurred at this time, and the poet has strictly kept to truth in narrating it; but he omits to mention, what is little to his hero's credit, that alarmed lest the many Moghul soldiers in his service should side with their countrymen, he assembled their chiefs and had them treacherously put to death,—a singular parallel to Ethelred's murder of the Danish huscarles in a somewhat similar juncture.

When the Sun entered the bull (the signs of the Zodiac forming the poet's usual calendar,) the king seems to have commenced the campaign in a more business-like manner, and he makes his second start in the middle of the month Rabí'-ul-Awwal.†

برسر شان باربک تیغ زن خان جهان چابک و لشکر شکن \*  
Ferishta gives Khán Jahán and Mullik Yarbeg (in the printed text باربیک Birlás as the leaders. General Brigg says elsewhere that Bárbik is a Turkish title for one of the classes of the gold stick; it may be rendered by the title "gentleman usher in the courts of Europe." (Ferishta, i. p. 281.)

† This month began April 16th in the year A. H. 686, A. D. 1287.

کوه بیک سوی و دگر سوی جون هردو شد از گرد سیه تیره گون

The pomp and circumstance of the march are of course not allowed to pass by unnoticed, but we may leave them to the readers of the original. The first halt is made in the district of Talpat and Afghánpúr, a district, according to the Scholiast, five or six cos from Dehlí, and there we have the old revelry renewed. It is singular to see by these ever-recurring scenes of dissipation and excess, how even the ideal descriptions of the court poet are bound down to the coarse actual world around him,—these days and weeks of debauchery being constantly referred to by the historians of the time as one main evil of the young king's reign, and as, in fact, ultimately leading to his early and miserable fall.

At this place, the court is enlivened by the arrival in the camp of 1000 Moghul prisoners from the Punjáb. The poet knew only too well the savage cruelty of these barbarians, for he had passed two years in captivity among them in Balkh, having been taken prisoner in the battle a few years before in which his patron prince Muhammad, then Governor of Cábul, had been killed. These captives are minutely described, the Tartar features, the high cheekbones, flat noses, yellow hue, &c.\* are dwelt upon with the exaggeration of the poet's hatred, and he evidently gloats on the fact, that they were all put to death by the royal order.

It is difficult to trace the King's route, as so few indications occur to define it, but we find the army starting from this last place and after two marches reaching the Jumna.

ماه علم بعد دومنزل بعون عکس نما شد بلب آب جون

The next stage mentioned is the city of Jaipur (جیپور); here Bárbik is sent forward with part of the army to the river Sarú. There

\* The description is so curious that I subjoin part of it.

|                            |                             |
|----------------------------|-----------------------------|
| روي چو آتش كله از پشم ميش  | آتش سوزان شد با پشم خويش    |
| رخنه شده طشت مس از چشم تنگ | ديده در انداخته در رخنه سنگ |
| چهره شان دبه نم يافته      | جاي بجا كچلك وخم يافته      |
| ارخ تارخ شده بيذي پهن      | وز كله نا كله لبا لب دهن    |
| بيذي پررخنه چو گور خراب    | يا چو تنوري كه زطوفان پراب  |
| موي زيبي شده بر لب فراز    | سبلت شان گشته بغايت دراز    |
| ریش نه پيرامن چاه زنج      | سبزه كچا بردمد از روي يخ    |

he is joined by several Zamindars with their contingents, among them by Chahjúí the Amír of Karrah,\* and the Khán of Awiz (عوض).

The father now determines to send a messenger to try his son's temper, to see if his thoughts be those of peace or war,—he accordingly sends a trusty ambassador named Shams Dabír. An interview takes place between the messenger and Bárbik, but of course little but idle compliments and threats passes between them. In the meantime the king continues his leisured marches varied with the same round of festivities. At length he reaches and crosses the Ganges and enters the province of Oude. The sun at the same time enters Gemini, and we have a very elaborate description of the hot weather, but the poet represents the army as marching on without suffering any inconvenience, 'not a soldier knew aught of the heat of the sun, under the canopying shade of the king, the Shadow of God!' He at length reaches the city of Oude and encamps by the river Gogra.

نصب شد اعلام شه‌نشاہ دهر بر لب گهگر بحوالي شهر  
گهگرازين سو و سرو زان طرف از ترف لشکر بلب اورده کف

Here follows a striking incident,—the first meeting of the father and the son. The son is on one side of the river with all his troops, the father with his troops on the other. The father bursts into tears as he sees his son in the distance and sends a messenger across in a boat. "Carry," he bids him, "the news of a father's tears to him who is dear to that father as the apple of his eye." The son recognises the messenger from the opposite shore, but a feeling of evil pride rises in his bosom and he shoots an arrow at him, forbidding him to advance, and the messenger has to return without delivering the message. Thus ends the first interview.

The father then sends a more official ambassador who delivers a formal speech, chiefly upbraiding the king for his youth and indiscretion, and trying to recal him to a sense of filial duty. This message is delivered in full durbar, and the young prince haughtily answers it,—his claim is that crowns come not by inheritance but by fate,

\* We read in Ferishta that "Mullik Juhoo, the nephew of Ghaias-ud-Dín Bulbun, assumed royal privileges in his government of Karrah," during the confusion which followed the accession of Jalál-ud-Dín Khilji.

—besides, he has a peculiar right to the throne from the choice of the old king, his grandfather.

The father, on hearing, at his messenger's return, these stormy words, "drooped his ear like a shell in the sea," but on maturer thought determined to send another messenger who might speed better in his mission. He accordingly despatches a very impersonation of Machiavellism—"a messenger he, who spent his whole life in discourse fine as a hair—if a secret came before him finer than a hair, he cleft its finest point with his keen wit." In this address the father assumes a bolder tone—he appeals from contests of the tongue to that of the sword—he boasts of the number and bravery of his forces, and especially the number of his elephants which he contrasts with the other's cavalry. He admits that his father *did* leave the throne to his grandson, but he maintains that it was the grandson's part to yield it up to the true heir. He concludes with a challenge,

If thou bindest firm the girdle of hatred  
I will enter ere thou dost on the conflict ;  
Or if this interchange of words leads to kindly feeling  
I will not turn my face from thy sincerity ;  
But on this condition that, according to my design,  
I take my father's place and thou take mine.

The young king easily repels his father's boasts of his elephants and extols his own cavalry—one of his arguments being a curious one—in chess an elephant (or bishop) is worth less than a knight.

دین که بشطرنج هم استاد کار پیدل کم از اسپ نهد در شمار

However with all this he feels his inferior place—he owns the moral untenableness of his position.

With all this strength and might of my army  
I do not wish to harm my lord.  
I am not equal to thee in the battle  
Though I could sew Mount Káf with my javelin as a needle.  
It is an evil rumour on the lips of men and women,—  
The wrath of a child against his father.  
The sword which Sohráb drew against Rustam,—  
Hast thou not heard what he found from fate ?  
If the jewels of peace could but be strung,  
With hearty goodwill would I bear the ring in my ear as thy slave.

He tries to justify his still occupying the throne, but with a faltering argument, and thus concludes,

But if in very truth this desire is in thy heart,  
I am thy slave—'tis thine to command.  
Thou askest for me my crown that touches the sky,  
Come and meet me that I may throw it at thy feet.

This message a little touches the father's heart and he now disclaims all idea of seizing the throne.

What though I could take the throne from thee?  
If I took it from thee, to whom should I give it?

He then expresses his loyalty and devotion in a style of truly oriental hyperbole and concludes by begging an interview. The son dictates an answer—"What though my crown reaches to the moon? my head shall be under thy foot." The father receives it with great joy, and sends his second son Káús with a reply and many magnificent presents.

The brother proceeds to the king whom he finds in all his magnificence, which is well described. He advances to the throne and "when the king's eye fell on him, straightway he recognised himself in that mirror; in haste he leaped from the lofty throne and seized his princely form in a close embrace." He seated him by his side on the throne and treated him with the most cordial affection.

The next day early the king calls for his own son Kaiomars (then quite a babe) and sends him to his grandfather with many rich presents,—with him he sends an experienced councillor to carry the secret instructions, and the two set off to the prince of Bengal.

They crossed the water—they went to the king of the East,  
Like rose and nightingale they went to the garden.  
The news came to the king of the realm  
That those fresh fruits are coming from the orchard.  
He went and sat on his Sakandar-like throne  
And with lines of elephants built up a Magog's wall.

The governor descends from his throne and meets his grandson as he enters his presence, and leads him to his seat where he places him by his side. He is at first absorbed in the pleasure of seeing his grandson, and totally neglects the minister and the presents, until his eye happens to fall in that direction, when he recalls himself

from his pre-occupation. The minister then presents his message, and, after a very lavish interchange of gifts, the great interview is fixed for the morrow and the two return to the king.

On the morning of the day every body is astir—the whole day passes in busy preparations—until evening draws near.

When the day waned to its close and the sultry heat had passed  
And the sun was about to sink into the ocean,  
The king of the East to cross the river  
Asked for a boat swift as the revolving heavens.

The description of this boat fills half a chapter and then follows the meeting. The prince of Bengal crosses.

The prince's boat flew swifter than an arrow  
And in the twinkling of an eye crossed the river.  
Soon as he had touched the shore  
He saw his pearl on the bank of the stream.  
He longed in the agitation of his restless heart  
To leap ashore and clasp it to his bosom.  
He sought for patience, but it came not to him,  
He sought not for tears, but lo! they came.  
On the other side stood the King Moizz-ud-Dín  
With all preparations of courtesy after the manner of kings.  
When the king's eye fell on his bewildered visitant,  
The more he gazed, the more bewildered himself became,  
He rushed forward and scattered a donative of tears,  
He flew to meet him and clasped him in his arms.  
Each locked the other in a close embrace,  
Each lingered long in the other's arms;  
Like rose and rosebud when they leap forth from winter,  
This parts not from that, nor that from this.

A tender dialogue ensues between them and all their jealousies and suspicions are soon set at rest in mutual confidence and affection.

The poet himself looked on the scene amid the crowd of courtiers, and he expresses his own feelings in a triumphant ode of joy, beginning :

Happy the moment when the lover gains the beloved.

The best couplets are the following.

None knows the joys of presence but he the sorrow-consumed one  
Who after long exile reaches the beloved.  
None knows the worth of the rose but he the captive bird  
Who has felt the cold of winter and *then* beholds the spring.

As a specimen of the series of Ghazals which, as we have said, are continually interspersed through the narrative, we subjoin it in the original.

### غزل

خورم آن لحظه که مشنابق بیاری بر رسید  
 آرزومند نگاری بنگاری بر رسید  
 دیده بر روی چو گل بنده و نبود خبرش  
 گرچه در دیده ز نوک مزه خاری بر رسید  
 تن چو بیدنش که بر سیل مژه کشتی راند  
 از پس قطع سواحل بکناری بر رسید  
 لذت دیدن دیدار بجان گار کند  
 جان بیکار شده باز بکاری بر رسید  
 گرچه در دیده کشد هیچ عبارش نبود  
 هر کجا از قدم دوست عباری بر رسید  
 ای خوشا تلخی پاسخ که دهد بعد از هجر  
 که خماری شکن از بهر خماری بر رسید  
 لذت وصل ندارد مگر آن سوخته  
 که پس از دورئی بسیدار بیاری بر رسید  
 قیمت گل نشناسد مگر آن مرغ اسیر  
 که خزان دیده بود پس بهاری بر رسید  
 خسروا یارتو گرمی نرسد خون میگو  
 بهر تسکین دل خویش که آری بر رسید

We have next an account of the mutual gifts of the father and son, and the splendid entertainment which followed, and here the action of the poem may be said to terminate. The remainder 'drags its slow length along' through a wilderness of extraneous matter and irrelevant description.

The poet first describes the night of the festivity, then follow chapters devoted to the taper, the lamp, the 27 mansions of the moon, and the astrological position of the heavenly constellations at the hour of the "conjunction of the two auspicious planets" of the earth. After this we have a curious series of chapters on the wine, the flaggon, (صراحی) the flask (قرابه) the cup, the cupbearer, the harp, the *Kásrabáb*, the pipe, the tabour, the singers, the festal board, the betel, &c., and the king's crown and throne. Several

similar interviews are described, and in one of them the father takes an opportunity of instilling into his son's ear some salutary counsel as to his future reign, while in the parting visit he is represented as warning him against certain evil counsellors.\* We know from the narrative of Ziá Barní that such was actually the case, but the poet only gives us vague generalities where the historian adds a contemporary edge.

The Sultan returns to his capital in the rainy season, which is described, as each of the other seasons have been, at great length. Then follows a very pleasing and natural chapter of the poet's personal history, the best in the whole book.

He had accompanied the royal expedition and had been an eye-witness of many of the scenes described, but he returns with it only as far as Kantipúr. His immediate patron† had just received a jágír in Oude, and the poet stays behind with him and remains two years there. At last however he wishes to return to his family at Dehlí, and after some time he obtains leave, of which he gladly avails himself. After one month of weary travelling, he reaches the imperial city in the month Zú'l Ka'dah, and he describes his joy at meeting his aged mother and his friends. Two days after the king hears of his arrival and sends for him to court, where he is appointed to an office about the royal person. The king then in a private interview condescends to ask a favour. The poet expresses his astonishment at such condescension, and then the king bids him write in verse the history of the meeting of the two Sultans, "the conjunction of the two auspicious constellations of the time;" that he may divert his mind by its perusal while parted from his father, who of course remains in his quasi independent province of Bengal. From this command the poem itself took its birth. Khusrau tells us that it

دور میندار فلانرا ز پیش خاص مکن آن دگیرا بخویش \*  
در حق این شو بگرم ره نمون و این دگیرا بزمین ریز خون

† His patron's name is given as

خان جهان حاتم مفلس نواز

Amir Ali was Khusrau's patron at Dehli after the death of prince Muhammad, and we learn from Ferishta that in the beginning of Jalál-ud-Dín Khilji's reign, Amir Ali was "holding the government of Oude under the new title of Hátim Khán."

occupied him six months, it was finished in the month Ramazan of the year A. H. 688 corresponding to our A. D. 1289. The poet was then in the 37th year of his age and the number of baits in the poem he states to be 3944.

Then follows a description of the king's triumphant entry into his capital, and in the closing chapter the poet expresses himself as weary of making poetry, and declares, that he did not write the poem for the sake of gold but *fame*. "If the king gave me the treasures of Faridún and Jamshíd, they would be a poor payment for one letter, my desire for this highly decorated book is that my name may remain high in its place." The poem then ends with the usual moral reflections on the vanity of wasting life in the composition of verse and devotion to earthly objects.

Nor are these last commonplaces wholly inapplicable. The book is curious, rather for what it professes to be, than for what it *is*; it reminds us too much of what it *misses*, to be really a good poem. We read the simple account in Ferishta's plain prose, and we feel that the poet would have shewn a truer knowledge of his craft, had he kept closer to the actual facts as they occurred; and, little as he *has* deviated from them, every deviation is a positive blemish in his work. We miss too in the poem the evil genius of the true history, the treacherous vizier Nizám-ud-Dín, whose secret machinations had produced the lamentable rupture from the first. The poet's moral cowardice could only venture to disguise this power "behind the throne," and his characters act without sufficient motives in his pages; he dared not depict the arch villain\* of the court, for the vizier had returned to Dehlí in unbroken influence with the king. It was he who had endeavoured, by every means, to exasperate the parties into an open rupture, and to stop every attempt at pacific negociations; and when Baghrá Khán had appealed too strongly to his son's unhardened heart to be wholly unheard, the vizier had endeavoured to frustrate all the good effects of the interview. He had drawn a line

\* The only allusion to him in the poem is perhaps in certain secret instructions and counsels of state which are two or three times mentioned in the interviews between Kai Kobád and Násir-ud-Dín. Ziá Barní gives long secret dialogues between the king and his father, where the latter warns his son against the minister's treachery.

of humiliating ceremonies round the king to chill the paternal heart from the approach. "To all these the prince submitted; until after repeated obeisances he found the king remaining unmoved on his throne, when, shocked by this unnatural behaviour, he burst into tears. This sight overpowered all the king's resolutions; he leaped from his throne and ran to throw himself at his father's feet; and the father hastening to prevent him, he fell on his neck and they remained for some minutes weeping in each other's arms, while the whole court was almost as much affected as themselves." One feels that there is nothing in Mír Khusrau's *poem* one half so truly pathetic as this plain prose; it is one of those touches of nature which make the whole world kin, but which Mír Khusrau completely overshoots in his endeavours to be original and sublime.

There is only one observation more, and that relates to the final issue of the dramatis personæ. We read that the poet wrote for the king in the year 688, but in that very year\* the king murdered the vizier who had been such an evil guide for his youth. Cowed by that superior will, he dared not openly to assume his authority, and he could only turn to the poison bowl to rid him of the too powerful servant. But his own hands were too enervated to seize the reins which the dying minister dropped; the whole empire relapsed into confusion, and the great military chiefs openly contended for the falling fragments. The dissolute young king found himself utterly powerless in the midst of the confusion which he had evoked, and he was soon assassinated in Kilú Khari, the scene of so many of his revelries; and one of these Turkish chiefs, Jelál-ud-Dín Khilji, mounted the vacant throne. A party in the court endeavoured to secure the crown for the little child Kaiomars whom we watched on his baby mission to his grandfather in Bengal; he was then an infant in arms, and he is even now only three years of age; but the attempt fails, and Khilji's first exercise of power is to sweep the poor child for ever out of his path. Baghrá Khán retained Bengal through *these* confusions as through the last, and thirty-six years after, we still find him there, as Ghaias-ud-Din, the founder of the Toghlok dynasty, confirms him in his government.

\* Ferishta gives 687 as the last year of his reign, but this must be wrong.

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*Ornithology of Amoy.*—BY ROBERT SWINHOE, ESQ.

The position of Amoy Island and its relative bearings to the mainland of China may be ascertained from any ordinary map. A few words will therefore suffice to explain the nature of the country in which I have followed my favourite pursuit. This island, the neighbouring shore of the mainland, and the banks of both the rivers (the chief one leading to Changechow Foo and the other to Tunggan Hien) are all densely populated, and have remarkably little wood excepting occasional banyans thriving in the midst of villages. The plains are well cultivated and planted for the greater part with rice, maize, sugar-cane, *Cucurbitaceæ*, and hemp during summer, and *bearded wheat*, spinach (*Basella rubra*), taro, cabbages, and peas during winter. The hills are either composed of granite debris studded with large black blocks of granite and extremely barren, or of clay; and are covered with small stones and scanty herbage. The character of the country will probably account for the paucity of our resident species among *land birds*, as compared with the occasional visitants or stragglers in the same group.

The water-birds, however, shew a finer list of winter residents, no doubt owing to the suitable feeding-ground afforded them by the large mud-flat of the Amoy creek, those of several other inlets and creeks into the mainland, and the marshes at the mouth of the rivers.

In identifying the following birds, Mr. Blyth of Calcutta has rendered me much service, and indeed without his valued aid I could have done little among the non-European forms. I have also to thank Mr. Stevenson of Norwich for the help which he has afforded me; and Mr. G. Schlegel at Amoy, son of Dr. Schlegel of the Leyden Museum, merits my warm thanks for the loan of a copy of the *Fauna Japonica*, from which work I have gained considerable assistance.

Amoy, 19th November, 1859.

*Ornithology of Amoy. China.*

(Classified according to Dr. J. B. Hay's Catalogue of Genera.)

1. *Buteo vulgaris*, var. *japonicus*, Temm. and Schleg., *Faun. Japon.*

- A regular winter visitant.
2. *Pandion haliaëtus*, (L.) ?  
Lives on the rocks at the mouth of the harbour and comes occasionally to Amoy, but is very shy and unapproachable. I have never been able to procure a specimen.
  3. *Falco peregrinus*, (L.)  
Breeds in the neighbourhood and is not unfrequent.
  4. *Hypotriorchis subbuteo*, (L.)  
Rare.
  5. *Tinnunculus alaudarius*, Brisson.  
A common resident.
  6. *Milvus govinda*, Sykes, var. *melanotis*, Gray. Faun. Japon.  
[*Ante*, p. 95.]  
Very common, especially in the harbour.
  7. *Accipiter nisus*, (L.) ?  
Rare. Differs from the European bird chiefly in having *white* axillaries, as well as in many minor points.
  8. *Micronisus badius*, Gmelin.  
Received from Fouchow, and shot in Amoy, November of this year.
  8. *Circus cyaneus*, (L.)  
Pretty common.
  9. *Circus æruginosus*, (L.)  
Very common up the rivers.
  10. *Ninox scutellatus*, (Raffles.)  
A straggling winter visitant, common in summer at Fouchow where it breeds. The immature plumage is brown, banded with ochreous.
  11. *Bubo maximus*, Sibbald.  
Occasionally seen of a winter's evening. Breeds somewhere in the neighbourhood, as every early spring the young are sold in the streets of the town.
  12. *Ephialtes bakkamaena*, Pennant.  
Rare. I procured two one winter, one mottled brown on the upper-parts, the other mottled buff; the first I take to be the immature plumage, as both these examples were females. Mr.

Blyth informs me that this is not an uncommon species in the vicinity of Calcutta.

13. *Caprimulgus dyticatorus*, nobis. [*C. indicus*, large var., Blyth, *J. A. S.* XIV, 208; the small var. there also noticed being *C. Kelaarti*, Blyth, *J. A. S.* XX, 175, from the Nilgiris and mountains of Ceylon.]

This species is closely akin to the *Caprimulgus jotaka* of the *Fauna Japonica*; the following being the most striking points of difference. Our's has the wing  $\frac{1}{2}$  inch longer and the beak 2 lines longer. Instead of the 2nd, 3rd and 4th quills in the male having a white band, our's has a white spot on the inner web of the 1st, and a band across the 2nd and 3rd only. The sides of the head, greater and lesser wing-coverts, and scapularies are frosted with white, and a narrow line of frosted white runs from the bill to the top of the eye and extends in a broken manner beyond. In most other respects it resembles *C. jotaka*, the tail is banded with white pretty much in the same style, and the tarsus is feathered to the base of the toes. It stays in Amoy the greater part of October and November, and is there seen hawking over paddy-fields for water-beetles which fly at night. Out of the stomachs of birds shot I have repeatedly taken out whole individuals of *Dyticus marginatus*, and in one instance *two* perfect specimens were so found, but with the hind-legs reversed, apparently with the intention of affording no impediment to the passage of so large a beetle down the *oesophagus*. This species breeds at Fouchow.

Another and smaller species is met with in a copse about twelve miles distant from Amoy during the months of September and October. It has *naked* tarsi, is 10 inches long and has the lateral tail-feather white except just at the tip. The 1st and 2nd quills are blotched with a large spot of white on each, and two white spots occur on the throat. A yellowish circle girts the eye. Not having been able as yet to identify the species, I have named it *passim*.

14. *Caprimulgus stictomus*, nobis. [Akin to *C. monticolus*, Franklin, and *C. affinis*, Horsfield; but much richer in colouring, *E. B.*]  
 15. *Cypselus vittatus*, Jard. and Selby.

Frequent in spring, flying high in fine weather, but darting about low during rain. Does not build here.

16. *Cypselus subfurcatus*, Blyth. [*Ante*, p. 95.]

A permanent resident, associating in parties and twittering together at a great height in the sky, then, suddenly separating, the birds dart to all quarters, each displaying its command of wing in the chase after insects; then, again, they meet as before, and so on for the greater part of the day, seldom resting. The nest is often placed under the rafters of verandahs, and resembles that of the House-Martin (*Chelidon urbica*) at a distance; but is composed of straw and other soft materials glued together in regular layers. The old birds roost every night in their nests all the year through.

17. *Hirundapus nudipes*, Hodgson.\*

A straggler in spring during rain-storms.

18. *Hirundo rustica*, L., var. *gutturialis*, Scopoli.

This appears to be merely a degenerate variety of the European species. It is a summer resident here and pretty numerous, building mud-nests shaped like a half-dish, and lined with straw and a few feathers, over the doors of Chinese huts, where they are revered as the harbingers of good luck.

19. *Hirundo daurica*, L.; *alpestris*, Pallas.

A few passing flocks spend a day or two in Amoy during winter. In Formosa it takes the place of the common species, and builds domed nests of clay and mud under the roof-tops. Those nests are lined properly with feathers, and contain from 3 to 5 fine white or pinkish eggs.

20. *Eurystomus orientalis*, L.

Very rare.

21. *Halcyon smyrnensis*, L.

A common resident; called "Fei-tsuy" by the Chinese, who glue the feathers, chiefly those of the wing, over ornaments worn by their women. Thus treated the lustrous blue feathers give the appearance of turquoise stone. The bird is shy and is remarkable for its loud screeching cry.

\* A specimen since sent accords exactly with Gould's figure of the Australian species; but I consider the latter not to differ from the Himalayan.—*Cur. As. Soc*

22. *Halcyon atricapilla*, Gmelin ; *pileata*, Boddäert.

Rarer than the preceding ; its feathers are also used for ornaments, to which they give a deeper tone.

23. *Alcedo bengalensis*, Gmelin.

A very common resident and generally known as the " King of the Shrimps ;" called by Amoy Chinese *Ang tony mng*.

24. *Ceryle rudis*, L.

Very common on the river ; where it rises on the wing at a height above the water, and drops suddenly on its scaly prey. I have also seen it strike obliquely when flying close to the surface of the water.

25. *Upupa epops*, L.

Stays all the year and is nowhere common ; builds in the holes of walls and exposed coffins ; is called by the natives the Coffin-bird, and flies with long undulating sweeps.

26. *Orthotomus phyllorapheus*, n. sp. [*Ibis*, Vol. II, 49.]

Length  $4\frac{1}{2}$  inches ; wing  $1\frac{9}{10}$  ; tail 2. Bill along culmen  $\frac{1}{2}$  ; to gape  $\frac{7}{10}$ . Tarsus  $\frac{8}{10}$  ; mid-toe  $\frac{6}{10}$  ; hind-toe  $\frac{5}{10}$  ; outer toe rather longer than the inner. Bill pale flesh-colour, along the ridge dark hair-brown. Legs and toes pale yellowish-brown. Iris buff ; narrow circle round the eye, pale buff. Forehead ferruginous, gradually changing to olive-brown on the head. Back bright olive-green. Wings and tail hair-brown, the coverts margined with olive-green, and the quills with yellowish olive-brown. Round the eye and all the under-parts, including the shoulder-edge, ochreous-white, darker on the flanks, and buff on the tibiæ. The two central tail-feathers of the male gradually lengthen at the commencement of spring until May, when they are about  $1\frac{1}{2}$  inch or so longer than the others, which are all somewhat graduated. I observe that these lengthened feathers soon become worn and usually drop after the first nesting, to be replaced by others scarcely longer than the lateral ones.

Mr. Blyth remarks—" Your *Orthotomus*, I think, is new, and constitutes the 12th species (!) now to be recognised. The other 11 are described by Mr. F. Moore in his monograph on the genus, read before the Zoological Society, 28th February, 1854."

This bird is usually seen in pairs, and is very common in most

bushy places. Besides at Amoy, I have also observed it at Hongkong and Fowchow.

27. *Prinia sonitans*, n. sp. [*Ibis*, Vol. II, 50.]

I have named this from the crackling noise it produces when hopping or flying from twig to twig.

Length  $5\frac{3}{10}$ ; wing  $1\frac{7}{10}$ ; tail 3. Bill along culmen  $\frac{9}{20}$ , to gape  $\frac{5}{10}$ . Tarsus  $\frac{8}{10}$ ; middle toe  $1\frac{3}{10}$ ; outer slightly longer than the inner, hind-toe  $\frac{5}{10}$ . Bill and inside of mouth black. Irides orange-yellow. Legs buff, browner on the claws. Head fine deep bluish-grey; chin and cheeks white; occiput and back olive-green, blending with the grey towards the fore-part and becoming tinged with sienna on the rump. Wings light hair-brown margined with buff olive-green. Tail pale brown, margined and tinged with buff olive-green. Breast a clear pale buff tinged with primrose, deepening on the under-parts and very deep on the thighs.

The female has the head less bluish than the male; and in the young the head is uniform with the back.

This species is resident here, and builds domed nests on the stalks of reed-plants; the eggs, 7 or so in number, are strangely red. Mr. Blyth remarks on our bird—"Your *Prinia* from Amoy comes exceedingly close to *P. flaviventris*, Delessert, which is common in the Bengal Sundarbans, Tenasserim, &c., and I have received it also from Singapore; but yours has a longer tail, wants the bright yellow of the lower-parts below the breast, and there is an admixture of white in the loreal region and ear-coverts not seen in our species. Moreover, *Pr. flaviventris* lays a similar red egg, as I am informed by Major S. R. Tickell."

28. *Drymoica extensicauda*, n. sp. [*Ibis*, Vol. II, 50.]

A common resident, and seems to delight in fields of grain, long grass, &c. It is often seen standing on a stalk, throwing up its tail and twittering a short series of unmusical notes.

Length  $5\frac{1}{10}$ ; wing  $1\frac{9}{10}$ ; tail  $2\frac{1}{2}$ , long and graduated deeply, the outer feather measuring only  $1\frac{3}{10}$ . Bill along culmen  $\frac{4}{10}$ , to gape  $\frac{6}{10}$ ; deep blackish-brown, paler just at the tip, and yellowish flesh-colour at the base of the lower mandible; inside

of mouth pale flesh-colour. Iris orange-yellow, margin of eyelids buff. Tarsus  $\frac{7}{10}$ ; middle-toe  $\frac{7}{20}$ ; outer toe slightly longer than the inner which is  $\frac{9}{20}$ ; hind-toe  $\frac{11}{20}$ ; legs yellow-ochre, flesh-coloured on the upper surface of the toes. Upper parts olive-brown; region of the eyes, curvature of wing, and tibiae, buff-ochre. Under parts pale ochreous, with a tinge of primrose-yellow. Wings and tail light hair-brown; the feathers of the former margined with yellowish brown-olive on the coverts, and reddish on the quills; those of the latter indistinctly barred with a darker shade. "Your *Drymoica*" adds Mr. Blyth, "is nearly akin to the common *D. fusca* of Bengal, Nipal, &c., represented by *D. inornata* in S. India, but has a conspicuously longer tail, more decidedly rufescent lower-parts and around the eye, and the crown is distinctly striated, in which last it approximates the *Cisticolæ*."

29. *Cisticola tintinnabulans*, nobis. [*Ibis*, Vol. II, 51.]

This bird is of rare occurrence in Amoy, but is frequent in Shanghai and West Formosa. I have described it as *Calamanthella tinnabulans*, in the II. Vol of the 'Journal of the N. China Branch of the Royal Asiatic Society.' On comparing ours with *C. brunniceps* of the Fauna Japonica I note the following differences. Ours is  $\frac{1}{2}$  inch longer, and 5 lines shorter in the wing. The 1st quill is very short instead of being nearly equal to the 2nd, which is  $1\frac{1}{2}$  lines shorter than the 3rd, 4th and 5th equal and longest. The bill is longer. The feathers of the head are bordered with yellowish-brown. No greyish-brown occurs on the breast, but the medial line from the throat to the vent is pure white, both sides of it being more or less washed with sienna-buff.

30. *Acrocephalus magnirostris*. [*Ibis*, Vol. II, 51.]

This bird abounds from Amoy to Shanghai in all reedy places and is described in the Fauna Japonica under the term *Salicaria turdina orientalis*, and stated there to be found also in Borneo, Macassar, and Sumatra.

Length  $7\frac{2}{10}$ ; wing  $3\frac{2}{10}$ . Tail graduated and 3. Bill  $\frac{8}{10}$ , to gape  $1\frac{1}{10}$ . Upper parts a sienna or yellowish brown; wings brown,

margined with the same; tail do., and tipped with yellowish grey, eye-streak and throat yellowish-white. Under parts sienna-yellow with more or less white, and occasionally with a few pale brown streaks on the throat.

Mr. Blyth says, of our *Acrocephalus*, it may be remarked—"that (like the two figured in Gould's Birds of Australia) it helps to fill up the gap between the large and small species of Europe and India respectively; and that it is remarkable for the great disproportionate size of the bill, which equals that of the European *A. arundinaceus*, (L.), or of the Indian *A. brunnescens*, (Jerdon,) both of which are much larger birds." Its song is hurried, though sweet and sometimes powerful.

31. *Acrocephalus (?) bistrigiceps*, n. sp. [*Ibis*, Vol. II, 51.]\*

This small species is easily distinguished by a line of black over a yellowish streak above each eye. Length  $5\frac{2}{8}$ ; wing  $2\frac{3}{10}$ ; tail  $2\frac{1}{10}$  and graduated. Bill  $\frac{1}{2}$ , to gape  $\frac{6}{10}$ . Upper parts olive-brown, tinged with sienna, and redder on the rump and edgings of the tail. Wings hair-brown margined with the prevailing colour. Throat, belly, and under wing-coverts whitish, the rest of the lower parts deeply washed with sienna-buff.

32. *Arundinax (?) canturians*, n. sp. [*Ibis*, Vol. II, 52.]

A winter visitant at Amoy, but found in summer at Shanghai, uttering its notes from its concealment, which are so rich and full that when first heard you expect them to be the commencement of a fine song; but alas! these 3 or 4 notes are all that the bird possesses, and though you strain your ear, listening, from the same bush you hear at intervals only the same few rich notes.

Length  $6\frac{1}{2}$ ; wing  $2\frac{8}{10}$ , tail  $2\frac{9}{10}$ . Bill  $\frac{1}{2}$ , to gape  $\frac{8}{10}$ . Forehead and crown rufous-brown; upper-parts and tail olive-brown. Wings hair-brown with yellowish-brown margins. Throat, under wing-coverts, and belly white; eye-streak and under-parts ochreous and yellowish grey. Bill and feet brownish.

Mr. Blyth observes: "This seems very like a second species of

\* This does not range well in *Acrocephalus*, nor is it a *Calamodyta*, but in form of tail approximates *Locustella*. It is, however, a distinct form, and will have to be so recognized.—*Cur. As. Soc.*

my genus *Arundinax*. The tail, however, is obscurely striated across, which I do not observe in my *A. olivaceus*; and your bird has also a much stronger hind-toe and claw, quite disproportionately so as regards the anterior toes. The white of its wings underneath is remarkable. The tail is less graduated than in *A. olivaceus*.

I have compared this with the descriptions of *Salicaria cantans* and *cantillans* in the Fauna Japonica, and though closely allied to the former it certainly is not the same. The *cantans* seems to bear to the *cantillans* the same analogy that this species bears to the succeeding."

33. *Arundinax* (?) *minutus*, n. sp. [*Ibis*, Vol. II, 52.]

This is a most singular miniature of the foregoing, resembling it almost exactly in colour, but differing considerably in size. Length 5; wing  $2\frac{2}{10}$ ;  $2\frac{1}{10}$ . This bird is also more robust in build, livelier and more open in habits, and is rarer here than the foregoing. Were it not for both birds occurring at the same season, one would be inclined to look upon this as merely a degenerate variety of the other.

34. *Phylloscopus fuscatus*, Blyth.

Common during winter, and stays so late in spring that I have a strong suspicion that it nidificates in the neighbourhood. It entertains us during the early vernal months with its pretty shake song, but its most frequent note is "*chick chick*."

35. *Phylloscopus tenellipes*, n. sp. [*Ibis*, Vol. II, 53.]

This species has delicate light pink-coloured feet, hence the name. Length  $4\frac{9}{10}$ , wing  $2\frac{1}{2}$ , 1st quill  $\frac{1}{2}$  in.; 2nd  $1\frac{5}{8}$ , 3rd 2 in. the 4th slightly longer and the longest in the wing. The 4th, 5th, and 6th quills sinuated on the outer web; the rest inwards with mucronate tips. Tail 2, the feathers nearly equal, moderately broad, rounded on the outer web towards the tip, and sinuated on the inner, both leading to a point. Expanse  $7\frac{6}{10}$ . Bill  $\frac{9}{20}$ , to gape  $\frac{6}{10}$ . Tarsus  $\frac{1}{2}\frac{5}{8}$ ; middle toe  $\frac{6}{10}$ ; outer longer than the inner; hind toe  $\frac{1}{2}$ . Beak brownish, pale flesh-coloured on the tip and tomia of upper mandible and basal half of lower. Inside of mouth flesh-ochre. Upper-parts olive-green, brown on the head and upper back. Eye-streak and

cheeks cream-colour. Through the eye and below the eye-streak runs a dark line of olive-brown, darker on the coverts; the eye-streak whitening and increasing towards the occiput. Wings light hair-brown, margined and tinged with olive-sienna; quills darker hair-brown with dark shafts. Some of the large coverts tipped with yellowish. Tail light hair-brown, margined and tinged with olive-sienna, browner on the rump. Lower parts pure white, except sides of the neck, flanks, and thighs, which are slightly fibrous and grey. The shoulder, under wing- and tail-coverts, are tinged with primrose-yellow.

This is a straggling visitant during the cold weather, and may be distinguished by its note "charr."

36. *Phylloscopus sylvicultrix*, n. sp. [*Ibis*, Vol. II, 53.]

Mr. Blyth remarks on this—"a new species, differing from all but the European *sibilatrix* in the minute size of its first primary, in which character however *sibilatrix* exceeds it."

Length  $4\frac{1}{2}$ , wing  $2\frac{1}{2}$ , 1st quill  $\frac{5}{10}$ , 2nd  $1\frac{1}{2}$ , 3rd and 4th  $1\frac{9}{10}$ . Tail  $1\frac{7}{10}$ . Bill  $\frac{1}{2}$ ; to gape  $\frac{1}{2}$ . Upper mandible brown with a yellow edge, lower yellow with a patch of brown on the terminal half. Tarsus  $\frac{1}{2}$  pale yellowish-brown, yellower on the under surface of the toes and browner on the claws. Upper parts olive-green, brownish in some lights, especially on the crown. Line over the eye, a row of feathers on the lower half of eye-circle, and part of the cheeks, pale chrome-yellow; loreal space blackish-olive. Feathers of the wings and tail hair-brown, broadly margined with olive-green, a spot of yellowish-white marks, the tip of the outer web of the first 5 2nd coverts. Under-parts pale yellowish or primrose white, varying in tint. The under-shaft of all the tail feathers white, and the margin of the inner web of the 3 outer tail-feathers faint white. The size of the bill differs considerably in different individuals.

It is very numerous here during the months of April and May, and again in October and September, on its migrations.

37. *Phylloscopus coronatus*, (Temm. and Schleg.)

This species is noticeable from having a faint line of yellow on the crown like a *Regulus*, and is identical with that of the

Fauna Japonica. It wanders to Amoy occasionally during its vernal and autumnal migrations.

38. *Reguloides proregulus*, (Pallas.)—*modestus*, Gould,—*inornatus*, Blyth.

Winters here and is solitary in habits, uttering as it pursues its food a long plaintive "sweet," which, in spring, repeated several times in rapid succession, constitutes its song.

39. *Reguloides chloronotus*, (Hodgson.)

Often seen in pairs during winter, roaming about from tree to tree.

40. *Copsychus saularis*, (L.)

A common resident; native name *Chuy Kam-Chay*.

41. *Pratincola indica*, Blyth.

Winters here.

42. *Ruticilla aurorea*, (Pallas.) [*R. leucoptera*, Blyth.]

Winters here.

43. *Larvivora cyana*, Hodgson?

Straggles here occasionally, in its migrations.

44. *Ianthia rufilatus*, (Hodgson); *cyanura*, Temm. and Schleg., Fauna Japon. Winters here.

45. *Muscicapa mugimaki*, Temm. and Schleg., Fauna Japon. (see Appendix.)

[Genus. ERYTHROSTERNA, Bonap. In winter dress, I cannot distinguish it from the common *E. leucura* of India. *E. B.*]

This is a species of lively Chat-like habits, but fond of jerking up the tail like a robin. It straggles here during its autumnal migrations. The female or immature plumage, which has occurred here most frequently, may be thus described:—

Length  $4\frac{8}{10}$ . Wing  $2\frac{7}{10}$ ; expanse  $7\frac{1}{2}$ ; 1st quill  $\frac{8}{10}$ , 2nd  $1\frac{9}{10}$ , 3rd and 4th  $2\frac{1}{10}$ . Tail  $2\frac{2}{10}$ , feathers rounded on the outer web, sinuate on the inner, and ending in a point. Bill  $\frac{4}{10}$ , to gape  $\frac{5}{10}$ . Tarsus  $\frac{6}{10}$ , middle toe  $\frac{1}{2}\frac{3}{10}$ , inner toe slightly shorter than the outer, hind toe  $\frac{5}{10}$ ; tarse thick; claws, especially the middle and hind one rather long and pointed all black. Inside of mouth ochreous. Irides black. Upper parts brown with an ochreous wash. Wings hair-brown edged paler; 2nd coverts tipped with ochreous, forming a transverse wing-

bar ; 3res and a few of the interior and 2nes tipped and edged with whitish. Uropygials and tail black-tipped and edged paler, the lateral rectrices with more than half the basal inner web and shaft, the 2nd and 3rd both webs, and the 4th a part of the outer web, white, all having some black near their bases. Throat, belly, and under tail-coverts pure white. Sides of neck and throat, breast, flanks, and under wing-coverts brownish with more or less ochre. Thighs brownish. Edge of inner webs of quills pale brownish.

46. *Parus minor*, Temm. and Schleg. (Figured in Gould's 'Birds of Asia.')

The same species as that described in the Fauna Japonica. It prevails along the coast of China from Hongkong to Shanghai. The *trivirgatus* of the same work is common at Shanghai, but is not met with so far South as this.

47. *Zosterops japonicus*, Temm. and Schleg.

This answers in every respect to the bird of the Fauna Japonica, except that the 1st quill, though very *minute*, is yet not *wanting*. The bill and legs are of a slaty blue when the bird is alive, and not of a *blackish brown horn-colour* (a fault evidently attributable to the descriptions being taken from a dried skin). The breast and flanks are of a pale dingy colour, with but very little reddish. Iris dark blackish-brown. It is resident in the neighbourhood, and often wanders to Amoy during winter in search for food.

48. *Motacilla boarula*, (L.)

Common winter visitant.

49. *Motacilla luzoniensis*, Scopoli.

Common in winter ; a few breed here.

50. *Motacilla lugubris*, Temminck.

Common in winter.

51. *Budytes flava*, (L.)

I think the European species ; rare.

52. *Budytes sulphurea*.

Both these species are found in autumn, in rice-fields.

53. *Anthus thermophilus*, Hodgson.

Common during winter. Two other species occur, but they still remain unidentified.

54. *Pipastes agilis*, (Sykes.)  
Common during winter.
55. *Corydalla Richardi*, (Vieillot.)  
A common winter visitant; deeply ochreous on its arrival, but this appearance wears of as the season advances.
56. *Myiophonus cæruleus*, (Scopoli). [*Nec*. M. TEMMINCKII, Vigors.]  
Lives among rocky caverns; not common, and very shy; native name *Aw-chuy*.
57. *Turdus daulias*, Temminck.  
Our commonest winter Thrush, answering in every respect to the description of the species in the Fauna Japonica, which work represents a figure of the bird on Plate 26; but the first notice of it is due to M. Temminck, who published a representation of it in the *Planches color.* Pl. 515.
58. *Turdus pallens*, Pallas,—*pallidus*, Gmelin.  
This species varies *greatly* in size, and is remarkable for its white eye-streak. It strikes me that this is the *rufulus* of Drapiez and *modestus* of Eyton, rather than the following.
59. *Turdus chrysolais*, Temminck. *Planches coloriées* from Japan.  
It arrives here in small parties in early spring, and at that time is of frequent occurrence among bushes and gardens. Besides the above three, I have procured two other species still unidentified.
60. *Merula cardis*, (Temminck.)  
This small and handsome species, so remarkable for the changes it undergoes from the plumage of a *Turdus* to that of a true *Merula*, seems to form a natural link between the two subgenera. These changes of plumage have been well described and beautifully figured in the 'Fauna Japonica.' It visits us chiefly during winter, but I have no doubt that some of them spend the summer near at hand, as I have met them here late in spring.
61. *Merula mandarina*, Bonaparte; *M. vulgaris* of China, *auctorun.*  
A common resident everywhere up the coast.
62. *Oreocinclæ varia*, (Lath.,) *nec* Horsfield; *Turdus Whitei*, Eyton.  
A straggling visitant. Number of *rectrices* 14.

63. *Petrocossyphus manillensis*, (Boddäert.)

Common among the rocks all the year through.

64. *Garrulax perspicillatus*, (Gm.)

Length 12 inches. Wing  $4\frac{7}{10}$ . Tail  $5\frac{2}{10}$ . Bill  $\frac{9}{10}$ , to gape  $1\frac{3}{10}$ .

Back, wings, and tail yellowish-brown. Head and neck yellowish-grey. A band reaches from one ear-covert over the forehead to the other, forming a broad mark over the eyes. Under parts pale rufous-ochre, very deep on the vent. Beak and legs brown.

This large Butcher-thrush is common in some parts of the country, building a nest a good deal like that of the Blackbird. It is a shy bird, but may be known a long way off by its loud cry of *teó-teó*, uttered from time to time, or followed by a liquid guzzling low chatter.

65. *Garrulax sinensis*, (L.) [*Leucodiotron canorum*, Schiffer, *apud* C. L. Bonaparte; *Turdus canorus*, *T. sinensis*, and also *Lanius infaustus*, L.; nec *L. chinensis*, Scopoli.\*]

This is the *Hwa-mei* or Spectacled Thrush of the Chinese, by whom it is prized for its fine vocal powers, as well as for its pugilistic propensities. It is, strictly speaking, a hill-bird, and very abundant on the hills near Fowchow, but as I have, on more than one occasion, met with it in the bushes here, I must include it in my list.

66. *Oriolus chinensis*, L.

A rare straggler here, but very common in S. W. Formosa. The female is slightly greener than the male on the back and wings, and is considerably larger. Another species resembling this, but spotted on the breast, I have received from Mr. Holt at Fowchow, which I take to be the *Oriolus maculatus* of Vieillot. [Young of the preceding? *E. B.*]

67. *Pycnonotus sinensis*, (Gmelin); *Turdus occipitalis*, Temminck.

\* The latter is *Corvus auritus*, Daud., *Turdus shanku* et *T. melanopsis*, Gmelin, *Crateropus leucogenys*, nobis, *passim*; a true *Garrulax* inhabiting the Tenasserim hills, but doubtfully Chinese. In Horsfield's Catalogue, the name *Turdus canorus*, L., is referred to the *Merula bengalensis*, Brisson, and the former specific name adopted for that most unmusical of birds, which properly stands as *Malacocercus bengalensis*, (Br.)—*Cur. As. Soc.*

Very common all over the coast from Hongkong to Shanghai, and everywhere in Formosa.

68. *Pycnonotus atricapillus* [*Muscicapa atricapilla*, Vieillot, nec L.; *Hæmatornis chrysoorrhous*, Lafr., and *P. hæmorrhous apud* Hartlaub, *Rev. Zool. &c.* 1846, p. 1.\*]

Found abundantly in some places in this neighbourhood, but peculiarly local, seldom straying far.

69. *Tchitrea principalis*, (Temminck.)

Figured in the Planches coloriées, and subsequently in the Fauna Japonica. A rare spring straggler here.

70. *Tchitrea cæruleocephala*, (Quoy et Gaim.)

71. *Hemichelidon latirostris*, (Raffles); *cinereo-alba*, Temm. and Schleg., Faun. Japon.

A common winter visitant; remarkable for its singing notes, like those of a Red-breast, or chinking of two pieces of silver.

72. *Hemichelidon fuliginosa*, Hodgson.

Straggles to Amoy in its vernal migrations.

73. *Hemichelidon rutilata*, n. sp.

This species approximates *H. latirostris* in form, but has a bill even broader at the base. It is of rare occurrence here and only during spring.

Length  $4\frac{7}{10}$ . Wing  $2\frac{9}{10}$ . Tail? Bill  $\frac{4}{10}$ , to gape  $\frac{6}{10}$ , breadth  $\frac{7}{20}$ . Tarsus  $\frac{5}{10}$ . Head and upper neck blackish-grey. Back and scapulars reddish-brown. Wings blackish, margined with burnt-sienna. Rump and tail tile-red, the feathers of the latter more or less marked with blackish. Throat and fore-neck white, yellowish on their sides. The rest of the lower parts, excepting just the abdomen which is white, reddish or burnt-sienna ochre, more or less intense.

74. *Xanthopygia narcissina*, (Temminck);—*chrysophrys*, Blyth.

A rare spring visitant.

75. *Cyanoptila cyanomelanura*, (Temminck.)

Figured in the Fauna Japonica. Of rare occurrence here.

*Myiagra cærulea*, Gmelin?

A blue Fly-catcher with a small bill; procured here *once*.

\* The *Pycnonotus atricapillus* of my Catalogue, founded on *Ægithia atricapilla*, Vieillot, v. *Sylvia nigricapilla*, Drapiez, a Ceylon bird, is referred to a new genus, *Meropixus*, by the Prince of Canino.—*Cur. As. Soc.*

76. *Campephaga cinerea*, Blyth ?\*

Of a deep bluish-grey; with green-black wings and tail, the feathers of both tipped more or less with white, the graduated tail-feathers deeply tipped. Vent white. Bill and legs black. Length 9; wing  $4\frac{1}{2}$ ; tail  $3\frac{7}{10}$ . The immature plumage is lighter grey, tinged with sienna-yellow, and indistinctly barred on the under-parts. The basal part of the inner webs of several of the wing-feathers are marked with white, forming a large bar, conspicuous on the under side or when the bird is seen on wing. This species occasionally shews itself here, in autumn and in spring.

77. *Pericrocotus cinereus*, Strickland.

Length 8, wing  $3\frac{8}{10}$ . Tail 4, the 3 outer feathers being shorter than the rest and equally graduated, measuring  $1\frac{1}{2}$ , 2, and  $2\frac{1}{2}$  respectively; the 6 central ones are nearly equal. Expanse  $10\frac{1}{2}$ . Bill  $\frac{1}{2}$ , to gape  $\frac{8}{10}$ . Bill and feet black. The description from de la Fresnaye runs thus "Cendré en dessus; lorums, ailes, et queue, noirs; front, une tache médiane alaire, pli de l'aile, bord externe des rémiges tertiaires, la presque totalité de trois rectrices latérales et tout le dessous de corps, blancs. Longueur totale 0m. 193. Habite l'isle de Luçon (Philippines"). The *female* in all mine has *greyish-brown* wings; the black of the lore extends over the beak; and *four* instead of *three* lateral rectrices have a good deal of white on them.

The male has a broad white forehead, and a black crown which gradually blends with the bluish-grey of the back. The wings are also blacker, and there is more grey on the sides of the breast. In fact the plumage of the male bears great affinity to that of the Wagtails; and this species forms a happy transition from the *grey* of the *Campephagæ* to the *crocus* tints of the *Pericrocoti*. It looks in, at Amoy, in parties during the vernal and autumnal migrations, and is noticeable for its pretty Canary-like trill call-note.

78. *Dicrurus macrocerus*, Vieillot.

By no means common in this neighborhood, but remarkably so in S. W. Formosa, where several may be seen during the

\* No name of my bestowing.—E. B.

season, sitting on nests in the same bamboo-tree, swaying to and fro with every puff of wind.

79. *Lanius schach*, L.

Very common; has a great habit of shrieking. This is a *much* larger race than that found in the Indian archipelago, and is no doubt worthy of specific distinction; it remains only to be ascertained to which of the two the name was first applied.

80. *Lanius lucionensis*, Strickland.

With reference to this species, Mr. Blyth observes that this "is decidedly the true *L. lucionensis*, vide Strickland, Ann. Mag. N. H. XIX (1847), p. 132. He considers there that all the various allied races are varieties only of the same. My notion is that there are 3 or 4 cognate races, which may breed together when circumstances permit of it, and so grade into one another. Certes a Malayan *superciliosus* is very unlike your *lucionensis*."

These are common here during the seasons of migration, and I have received them this autumn from Mr. Holt at Fowchow.

81. *Enneoctonus bucephalus*, (Temm. and Schleg.)

I have never met but one of this species here, and that proved a female. It has a large rufous head without the usual black face-band of the family, and answers in every respect to the description of the female in the Fauna Japonica.

82. *Corvus torquatus*, Cuv. [Vide J. A. S. XXIX, 96.]

Our common and only crow at Amoy.

83. *Pica media*, Blyth;—*sericea*, Gould.

Very common.

84. *Acridotheres cristatellus*, (L.)\*

A very common species from Hongkong to Shanghai; builds in holes of trees or walls, or makes large oval nests in trees; learns to speak with facility and soon becomes docile.

85. *Gracupica (nigricollis)*, Paykull; *temporalis*, Temminck; *tricolor*, J. E. Gray.

A common resident, associating in small parties; builds round

\* The Prince of Canino considered this to be different from true *cristatellus* of the Philippines, and adopted the name *fuliginosus*, Bl., for the China species.  
Cur. As. Soc.

nests on high trees, and lays clear blue eggs with very fragile shells ; is a noisy bird ; and is also found in Siam.

86. *Temenuchus turdiformis*, (Wagler) ; *sinensis*, Gmelin ; *elegans*, Lesson.

A common summer resident ; very restless ; builds in holes of walls ; and is also found in Pegu. Its habit of poking about among brick-holes in houses, &c. during the nesting season soon causes its newly moulted white plumes to be stained of a reddish hue, and the feathers of the wings and tail to be much abraded. Before taking its departure from us it undergoes a complete moult, and then the plumage is clean enough.

87. *Temenuchus sericeus*, (Latham.)

A winter visitant ; feeds largely on banyan berries.

88. *Temenuchus cineraceus*, (Temminck.)

This resembles the foregoing a good deal in form, but is broader across the back, and generally more robust. It also visits us during winter ; and is identical with the bird found in Japan.

89. *Eophona melanura*, (Gmelin.)

Found here the winter through ; but leaves us before summer ; breeds in Shanghai.

90. *Munia malacca*, (L.) common in autumn. } [Distinct, *E. B.*]  
91. *Munia molucca*, (L.) scarce. }

92. *Munia rubronigra*, Hodgson, very scarce.

93. *Oryzornis oryzivora*, (L.) Occasional winter flocks.

94. *Ligurinus sinicus*, (L.)

*Fringilla kawarakiba minor*, Fauna Japonica.

Half Goldfinch, half Greenfinch ; not uncommon all the year, has a pretty tinkling note ; and feeds on thistle-heads as well as grain, &c.

95. *Passer montanus*, (L.)

Common about houses, resembles in habits *P. domesticus*.

96. *Emberiza fucata*, Pallas.

Met among standing grain during winter ; difficult to procure from its habit of dropping under cover of the grain, and seldom perching on exposed places.

97. *Emberiza pusilla*, Pallas.

Occasional flocks during winter.

98. *Emberiza canescens*, n. sp. [*The Ibis*, Vol. II, 62.]

This occurs during winter, and is probably new.

Length  $5\frac{2}{10}$ . Wing  $2\frac{9}{10}$ . Tail  $2\frac{1}{2}$  and somewhat forked. Bill  $\frac{7}{20}$ .  
 Head and neck sienna-gray; crown, cheeks and throat, blackened, of a frosted appearance. Back and scapularies black, each feather broadly margined with white and more or less tinted with reddish-sienna. Wings blackish-brown, broadly margined with sienna-white. Under-parts and rump white, sienna-washed. Tail blackish-brown, having the two central feathers broadly margined with white, the rest on each side hardly at all; the outer feathers white except a small broad portion of the inner web, the 2nd broadly tipped with the same.

The female is deeply tinged with reddish-brown above and reddish-ochre beneath.

99. *Emberiza personata*, Temminck.

Our commonest winter Bunting.

100. *Emberiza aureola*, Pallas.

Met in flocks in autumn feeding on the ripening corn.

101. *Emberiza Lathamii*, Gmelin.

Common in winter; a few breed in the neighbourhood.

102. *Emberiza fruticeti*, Kittlitz; *sulphurata*, Fauna Japon. Rare.

103. *Alauda cœlix*, Swinhoe.

This bird, which I have described under the above name in the III vol. of Shanghai Asiatic Society's Journal, differs from the Japanese Lark, *A. japonica*, Temminck, in being much smaller. The largest specimen I have measured is one inch shorter than the Japanese, though the wing is much the same length. The inner toe is  $\frac{3}{24}$  longer than the outer instead of being shorter. A close comparison of the two birds is of course required before any decision can, with safety, be arrived at, but it must not be forgotten that our's is a peculiarly Southern Chinese Lark, not being found even so far north as Shanghai.

104. *Yunx torquilla*, L.

Common during winter. The  $\frac{1}{4}$  inch red tree-ant appears to be its most favourite food, but it does not despise the large black bush-ant.

105. *Cuculus canorus*? L.

Taken here on its autumnal and vernal migrations, but breeds at Fowchow and Shanghai.

106. *Cuculus tenuirostris*, Gray.

A summer visitant; has a loud-toned whistle repeated 4 times and terminating with a shake.

107. *Turtur chinensis*, (Scopoli.)

Common everywhere from Hongkong to Shanghai.

108. *Turtur humilis*, (Temminck.)

A summer visitant; extends as far North as Shanghai, and is there of a larger size, though evidently of the same species.

109. *Turtur orientalis*, (Latham); *gelastis*, Temminck.

This large species, found in Lapland and Japan, countries so far situated apart, has been shot here by myself during winter, but it makes short stay with us. I have seen the bird in Formosa, and one was caught by a ship off the Madjicosima group.

110. *Francolinus perlatus*, (Gmelin.)

Birds of this species are brought to market by the natives from some neighbouring part of the country.

111. *Coturnix chinensis*, (Gm.)

Met in winter among standing corn; and evidently as distinct from the European species, as from the Japanese. [Evidently a misnomer. E. B.]

112. *Squatarola helvetica*, (L.)

Winter visitant; met with in small flocks on the river mud-flats.

113. *Charadrius virginicus*, Bechst. [*Pluvialis longipes*, Bonap.]

This species, I think, rather than *pluvialis*. Winter. Tail not distinctly banded, breaking off in the middle; size smaller than the European. Axillæ *mottled-gray* and not *white*.

114. *Charadrius cantianus*, Latham.

Arrives with the water-fowl, and frequents our sea mud-flats, often in large flocks.

115. *Charadrius philippinus*, Latham.

Found on inland marshes, and new-turned fields during winter.

116. *Charadrius Leschenaultii*, Lesson.

I have only one specimen, which was shot out of a flock of *C. cantianus*. It is very much larger than the so-called

Kentish Plover, but resembles it in winter garb, except that this has no *ventral* white, indications of a perfect breast-band, and lighter brown *remiges* and *rectrices*.

117. *Hæmatopus ostralegus*, L.

Rare winter-visitant.

118. *Ardea cinerea*, (L.)

Often seen here ; but builds large *heronries* at Fowchow.

119. *Herodias egretta*, (L.) ? *H. modesta*, (Gray).

A large white Heron, seen occasionally ; not identified.

120. *Herodias garzetta*, (L.)

The common resident species ; building in company on large banyan trees.

121. *Herodias eulophota*, n. sp.

This differs from *H. gazetta* strikingly in having a *yellow* bill, full-crested occiput, *round* instead of *square* tail and shorter legs. It is moreover rare and solitary in habits while with us during summer. It bears considerable affinity to *H. candidissima*, Wagler, of N. American Ornithology. Bill fine yellow, becoming flesh-coloured and purplish on the lores and round the eye. Irides pearl white. Long loose feathers spring from the occiput forming a full crest, the highest ones being longest and measuring  $4\frac{1}{2}$  each, the length diminishing gradually in the lower ones. Long loose feathers also spring from the lower neck, and from the back where they become decomposed into hair like silky webs curling upwards at their ends. The whole plumage is of a snowy white. Legs and toes yellowish or red-green, yellower on the soles and joints ; the upper surface of the lower portion of the tarsus is blackened, as also are some of the toe-joints but irregularly ; claws blackish-brown.

Average length 25 inches ; wing  $9\frac{8}{10}$  ; tail  $3\frac{1}{2}$ . Bill  $2\frac{9}{10}$ , edge of lower mandible  $3\frac{6}{10}$ . Naked part of tibia  $1\frac{6}{10}$  ; tarsus  $3\frac{3}{10}$  ; mid-toe  $2\frac{1}{2}$ , outer-toe  $2\frac{2}{10}$  ; inner  $2\frac{1}{10}$  ; hind-toe  $1\frac{1}{2}$ .

122. *Buphus coromandus*, (Boddäert) ; *russata*, Temminck ; *caboga*, Pen.

A numerous summer resident.

123. *Ardeola prasinoscelis*, n. sp. [*The Ibis*, II, 64.]

I have long had suspicions as to the identity of our bird with either

the *speciosa* from Java or the *leucoptera* from Bengal, and now, having satisfied myself, I will endeavour to shew the difference. In the first place on comparing our *Ardeola* with the description of *A. speciosa* in "Horsfield's Researches in Java," the distinction is at once apparent. We begin with ours. Description of male shot 30th May. Bill black for nearly one half from the apex, middle portion chrome yellow, base and cere indigo-grey. Legs *greenish-chrome*. Irides orange-yellow. Head and neck Indian-red, changing into purple as it descends to the back. Throat, median line of under neck, belly, rump and wings white. Back having long loose *bluish-grey* feathers decomposed and hair-like. Long and hair-like feathers also spring from the lower neck, nearly covering the blue feathers of the breast. Crest composed of two long subulated feathers  $4\frac{1}{4}$  long, with several shorter ones fitting into the grooves on their under sides; these feathers are the *same colour as the head*. Now Horsfield states that the *A. speciosa* has "in its complete dress the head above, &c. isabella-yellow with a rufous tint \* \* \* \* colour of the back *intensely black* \* \* \* \* feet *dark yellowish-brown* \* \* \* the crest consists of from 4 to 6 greatly lengthened linear plumes of a *very pure milk white* colour. The bill is dusky at the base."

This comparison of the adult plumage is surely convincing of non-identity of the two birds. The immature and winter plumage would appear to be more similar, but even here there are differences. In the Malayan species apud Horsfield "the wings and the tail are pure white," in ours they are more or less darked with blackish. In his "the feet and the upper mandible throughout its whole length, are black." In ours the former are bright yellowish-green with brownish claws, and the bill pale liver-brown, black on the apical quarter of its length; the naked or loreal space greenish-yellow, bluish at the base of the bill.

It will thus be seen that our species is perfectly distinct from the Malayan, *A. speciosa*, and for its non-identity with the Bengal species I give the testimony of Mr. Blyth who re-

marks on some skins sent<sup>d</sup> by myself to him, "It is so exceeding like our common *A. leucoptera* in winter dress as to be hardly, if at all, distinguishable; but utterly unlike it in summer garb."\*

Our bird resides here all the year through, feeding in paddy-fields and marshy ground. Its food is not confined to fish, but grasshoppers, and insects of most kinds are acceptable. In confinement it soon becomes omnivorous. It is more or less solitary in habits, building loose nests of sticks on the topmost boughs of banyan trees. The fledged young keep together for some time after they leave the nest. [I consider this bird to be true *speciosa*. E. B.]

124. *Ardetta flavicollis*, (Latham.)

Rare here; but common during summer at Fowchow.

125. *Ardetta cinnamomea*, (Gmelin.)

A summer visitant.

126. *Ardetta sinensis*, (Gmelin); *lepida*, Horsfield.

Common during summer among the bushes that line the banks of the river.

127. *Butorides javanica*, (Horsfield.) Summer visitant.

128. *Nyctiardea grisea*, Vigors.

Rare here, but common at Fowchow.

129. *Platalea leucorodia*, L. Rare winter visitant.

130. *Numenius major*, Fauna Japon., Temm.

Regular winter visitant; frequents mud flats.

131. *Totanus glareola*, (L.)

Common on inland marshy ground during winter.

132. *Totanus ochropus*, (L.)

Met by small streams of fresh water during winter, very seldom near pools of salt water.

133. *Totanus chloropygius*, Vieillot?

Resembles the former in appearance and in habits, but is rarer.

134. *Totanus glottoides*, Vigors. [Identical with *T. glottis*. E. B.]

Common during winter on mud flats at the river's mouth.

*Totanus pulverulentus*, Müller and Schleg.

In the collection of G. Schlegel, Esq., and shot at Amoy.

\* The same<sup>d</sup> remark applies to the European and African *A. comata* *r. ralloides*. E. B.

135. *Tringoides hypoleucos*, (L.)

Our common species, found the greater part of the year on the sea-shore.

136. *Recurvirostra avocetta*, L. Occasional winter visitant.

*Chinensis*, Gray.

137. *Tringa cinclus*, L.

Upper tail-coverts *black*, and not *white* as in *T. subarquata*; bill long and curved.

Frequents our shores in *large flocks* during winter.

138. *Tringa minuta*, Leisler.

Autumnal flocks drop here.

139. *Tringa Temminckii*, Leisler.

Found in small parties scattered over wet fallow paddy-fields in the cold season.

140. *Scolopax rusticola*, L.

Drop here during their migrations or on their first arrival.

141. *Gallinago uniclava*, Hodgson.

Our commonest species in paddy-fields; retires in summer to breed.

142. *Gallinago stenura*, (Temminck.)

Also common, but more solitary than the above.

143. *Gallinago solitaria* (?), Hodgson.

Found in ravines among the hills; very solitary. It is a large species and has the tail slightly rounded and consisting of 20 nearly equally long feathers; the 8 middle ones broad and the 6 lateral ones narrow, beginning with the 1st which is little more than  $\frac{1}{10}$  wide and gradually increasing towards the outermost of the 8 central, which is narrower than the rest.

It differs a good deal from the species described as *solitaria* in the Fauna Japonica.

144. *Gallinago major*, (L.)

This species I have met only during the month of September in fields overflowed with salt water. It is rather solitary and rises with a cry. It resembles *G. major* more nearly than any I am acquainted with, but has *eighteen* tail-feathers instead of *sixteen*, and the outer toe is disproportionally long.

145. *Gallinula orientalis*. Rare.

146. *Gallinula phænicura*, Pennant ; *javanica*, Horsfield ; *chinensis*, Boddaërt.

Rare.

147. *Anser segetum*, Latham ?

Frequents the mouth of the river in immense flocks during winter.

148. *Tadorna vulpanser*, Fleming.

149. *Casarca rutila*, (Pallas.)

150. *Anas boschas*, L.

151. *Anas pæcilorhynca*, Gm.

152. *Dafila acuta*, (L.)

153. *Querquedula crecca*, Stephens.

All more or less common during winter in the river.

154. *Querquedula falcata*, (Pallas) ; *multicolor*, (Scop.) ; *manillensis*, Gmel. ?

155. *Fuligula marila*, (L.)

156. *Fuligula cristata*, Stephens.

157. *Mergus serrator*, L.

158. *Colymbus glacialis*, L.

159. *Podiceps cristatus*, L.

160. *Podiceps auritus*, L.

More or less common during winter.

161. *Podiceps philippensis*, Bonn.

A resident species in large rush-covered ponds ; *chinensis*, Temminck.

162. *Diomedea brachyura*, Temminck ?

163. *Diomedea fuliginosa*, L. ?

Caught by fishermen outside the harbour and brought to market.

164. *Larus canus*, L.

165. *Larus fuscus*, L. ; *flavipes*, Meyer.

166. *Larus melanurus*, Temm. and Schleg.

167. *Larus* ——— ?

168. *Gavia Kittlitzii*, (Bruch) ; *maculipennis*, Bonap.

169. *Sterna caspia*, Pallas.

170. *Sterna cristata*, Stephens ; *pelicanoides*, King ; *velox*, Rüppell.

More or less common during winter.

171. *Sterna minuta*, L.

172. *Hydrochelidon javanica*, Horsfield.

Rare summer visitant.

173. *Pelecanus crispus*, Bruch : *philippensis*, Gmelin.

Common in winter.

174. *Graculus carbo*, L.

#### APPENDIX OR ADDENDA.

(Remove No. 45 to the *Muscicapidæ* and before the description of the female add)

The bird that formed the subject of description in the Fauna Japonica was most probably in full summer plumage. The account in that work runs thus :—“ Les parties inférieures de cet oiseau, à partir du menton, sont d’un brun ferrugineux jaunâtre et très-vif, mais passant au blanc sur le bas ventre. Cette dernière teinte occupe également les couvertures inférieures de la queue, et les supérieures des grandes couvertures extérieures de l’aile. La moitié postérieure de la barbe externe des cinq paires extérieures des pennes de la queue est également teinte de blanc, les supérieures des rémiges secondaires sont bordées de blanc, et on observe une raie blanchâtre mais très peu apparente au dessus de la région des oreilles. Toutes les autres parties de l’oiseau sont d’un noir, plus pâle et tirant au brunâtre sur les ailes. Les plumes axillaires sont d’un brun ferrugineux jaunâtre, et les petites couvertures inférieures des ailes, noires mais bordées de blanc.”

The only male as yet shot here was procured by G. Schlegel, Esq. on the 15th November, but instead of a black crown, back and scapularies, it has those parts olive-brown with a reddish wash. The *white* on the upper coverts is more indistinct; and the basal portion of inner webs of the 5 lateral rectrices are more or less white. In all essential points it is so similar, that I have little doubt of its being the Japanese species in male winter plumage.

(Add, as a species, after No. 36, *P. sylvicultrix*.)

*Phylloscopus hylebata*, n. sp.

From one individual in the collection of G. Schlegel, Esq. of Amoy. I have compared this specimen with upwards of 20 or 30 specimens of *P. sylvicultrix*, and come to the conclusion that it must be distinct. Though the size of this species is greater, yet the 1st quill is more minute than in the foregoing.

Length 5, wing  $2\frac{6}{10}$  tail 2. Bill  $\frac{9}{20}$ , deep blackish brown with pale tomtia. Tarsus  $\frac{8}{10}$ . Legs and claws deep blackish-brown with yellow soles and tips to claws. The olive-green above is much the same as in *sylicultrix*, but the eye-streak and under-parts are much yellower.

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*On the Translation of Waves of Water with relation to the great flood of the Indus in 1858.—By J. OBBARD, Esq.*

“At 5 A. M. on the 10th August, 1858, the Indus at Attock was very low. At 7 A. M. it had risen ten feet. By 0.30 P. M. it had risen fifty feet, and it continued to rise until it stood ninety feet higher than it did in the morning. The Cabul river continued to flow upwards for ten hours. The fall was at first slow; but the river was about eight feet below its maximum by sunset; and continuing gradually to fall, it had during the 12th returned very much to the position it occupied before the flood came down.”—*Extracts from Journal of Asiatic Society, 1858, 1859.*

1. Several papers have been recently forwarded to the Society upon the great flood of the Indus in August, 1858, and, as it is a subject in which I take great interest, I trust that I may be excused in submitting my views regarding it.

2. I propose, therefore, in the following paper, to consider the mode in which this vast body of water passed Attock, and with this view, I shall first treat cursorily of the nature of waves of water generally, more especially, however, dwelling upon waves of the class which from their formation and size, seem to be analogous to that which is under consideration, stating in general terms, their mode and rate of transit; and the limit within which wave translation is possible; and I shall then endeavour to shew the application of these laws to the specialities of the Indus wave, touching briefly upon some erroneous speculations which seem to have been made upon insufficient data.

3. A wave is an inequality of surface or variation of level in a stream of water, which may be of any size according to the force of its original cause. It is unnecessary to enquire into the origin of a wave for the purpose of elucidating its specialities, as all waves when

once formed and the original cause withdrawn, or as they may be termed *free*, obey the same laws, and are subject to the same peculiarities.

4. The undulation upon a smooth sheet of water from a school boy's pebble; the ocean wave thrown up by the wind; the gush of water from a destroyed dam or suddenly-withdrawn barrier; the swell from a steamer's paddle; and the great free tide-wave which, twice in the twenty-four hours is poured into all estuaries and rivers through the inequality of the attraction of the heavenly bodies:—all these waves so different in origin, size, and formation, are subject to the same series of laws, which have been, to a certain extent, investigated.

5. It should first be remarked that the progress of a wave is not the progress of the particles of which it is composed. A traveller, upon visiting the sea-shore for the first time, might be led to suppose that each wave was bringing with it the mass of water of which it was originally composed, and depositing it upon the shore. A little closer observation would, however, soon convince him of his mistake, as he would perceive that a piece of drift wood or of foam, would maintain the same mean distance from the beach, although several successive waves lifted it upon their crests, and deposited it in their succeeding hollows.

6. The same law may be shewn to hold with the tidal wave. In the accompanying tide table (with a copy of which, if thought useful, I shall be happy to furnish the Society annually)—the time of high water at Calcutta, or of the passage of the crest of the tidal wave at that place, is predicted for every day throughout the year. In the lower part of the sheet, the distances of places from Calcutta along the river are given in geographical miles, and against each, under the column of "correction for high water," is the interval of time which the crest of the wave occupies in travelling that distance. With these data it will be seen that the tidal wave of the Hooghly has a mean speed between Saugor and Calcutta of about  $20\frac{1}{2}$  geographical or 24 British miles per hour—while the speed of the water perhaps never exceeds eight, and is frequently as low as 2 miles per hour—without any corresponding variation in the rate of translation of the wave. The position, moreover, of the junction of the salt water of the ocean, with the fresh water of the river stream, is

not permanently affected by the passage of the wave, but oscillates between two fixed points upon flood and ebb, according to wave laws which will presently be indicated.

7. The progress of a wave then may be described as the translation of a shape or form, in which the particles are continuously changing—but these particles although they are successively cast off, have a certain motion communicated to them by the wave, though it is not that of the wave itself.

8. The sea side observer would with attentive watching perceive, that the piece of drift wood or foam is actually carried forward by the crest of the wave to a certain extent, though not in anything like the ratio of progression of the wave itself, and that when the wave has passed, it is carried backward in the succeeding hollow, so that it always occupies the same mean position; and in like manner, a boat or a ship, and the termination of the salt water, are carried a certain distance up a river by the flood or crest of a tidal wave, and down again by the ebb or hollow, so that if uninfluenced by other causes they will recover their original position.

9. It has been mathematically demonstrated, and direct experiment has established, that the particles of water of which a wave is composed, actually move in a circle; or an ellipse; the formation of which varies in proportion to the mass of the wave, and the depth of the water.

10. When the wave is small, and the water deep, the particles move nearly, if not quite, in a perfect circle,—in other words the vertical and horizontal displacements are about equal; but when the wave is very large, as the tidal wave, and the water shallow, the vertical displacement is wholly insignificant to the horizontal, and the motion of the particle, measured from any fixed point, is an extremely flat ellipse, of which the horizontal is the major axis.

11. In the accompanying sketch, a wave is supposed to be travelling along a level sheet of water from X. to Z.—A. is the centre of the preceding hollow:—B. the middle of the anterior slope:—C. the crest of the wave:—D. the middle of the posterior slope:—and E. the centre of the succeeding hollow. A particle of water which is at A. will be carried backward or towards the wave:—At B. its horizontal motion will be neutralized and it will be found



Sketch of the Motion of Wave Particles.



to move directly upwards. At C. it will be carried forwards with the wave:—At D. it will have no horizontal motion, but will be carried downwards to the same extent it was moved upwards at B. and at E., it will be again carried backwards:—at which point the whole wave having passed, it will hold the same actual position which it did at A., the vertical and horizontal displacements having exactly balanced each other. It is scarcely needful to remark that there is no sudden alteration from the horizontal to the vertical motions, and vice versâ, but that at each intermediate position the motion is a compound one, forming a gradual curve:—these fixed points having been only selected for convenient illustration. All the particles below the surface pursue the same course as those above them; i. e.—all those below the crest of the wave move forwards; and all those below the hollow move backwards, but where the water is deep the motion low down becomes imperceptible, and where it is shallow it is practically the same as at the surface.

12. The motion of a wave therefore, being simply the translation of a shape, is unaffected by any current which may be running in the stream on which it is generated. According to the direction of its original impetus it may travel with a current, at right angles to it, or even directly against it; and either up hill or down hill; without its speed or rate of transit being materially affected thereby. I say materially, for a current does, to a certain extent, modify the conditions of a wave, and I have reason therefore to think that it may also affect its speed, but that this effect, if there be any, is very slight, may be easily demonstrated.

The Hooghly, like all other rivers, must be considered as a stream of fresh water running towards the sea, into which is poured, once every twelve hours, a large wave. As the crest of this wave is approaching or passing a given spot within the river, the particles of which it is temporarily composed are flowing upwards, or it is technically termed flood tide. It is evident that the upward speed of the particles is checked by the constant resistance of the river stream, and that in like manner when the crest of the wave has passed, and the particles receding in the hollow, they are aided in their backward course, by the velocity of the river stream.

13. The river stream is therefore a constant—plus to the ebb, and minus to the flood.

14. But the speed or force of the river stream varies considerably at different times of the year. In the month of March, or the dry season, its rate off Calcutta does not exceed half a mile per hour; whereas in the month of August, or the height of the freshets it may amount to three miles per hour. Now, if the river stream does sensibly retard the passage of the wave itself, it is evident that its effect is far more potent when it is large, and we have thus a direct experiment of variation afforded us to discover if this be the case.

15. When the time of the lunar transit is 0h. 0m. or when the sun and moon are in conjunction; the crest of the tidal wave passes the floating light vessel, which is 119 miles below Calcutta, at 9h. 0m. throughout the year. This is not critically correct but sufficiently so for the purpose. In the month of March the same wave reaches Calcutta, at 2h. 35m.; and in the month of August at 2h. 10m. by which it would appear that it actually takes less time by twenty-five minutes to travel to Calcutta during the height of the freshets, than it does in the dry season, and this, although the upward current of the particles of which the wave is composed, is entirely neutralised by the increased rush of the river stream.

16. The fact is, that the speed of the wave depends almost entirely upon two other contingencies, viz. the depth of the water, and the mass of the generated wave.

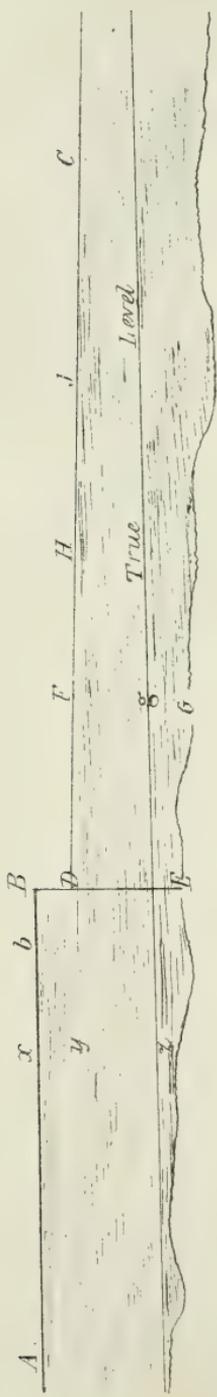
17. When the depth of the water is greater than the length of the wave, the rate of translation depends entirely upon the mass of the wave, and is proportional to the square root of its length.

18. When the depth of the water is small and the wave very great, as in the tidal wave in rivers and those analogous to it, the velocity of translation depends solely upon depth of the stream, and is proportional to the square root of the depth.

19. From what has been above stated, the cause of the superior velocity of the tidal wave up the Hooghly in August is apparent; and that, if the river stream exerts any sensible retarding effect whatever, the increased natural velocity of the wave, through the river being surcharged with water, is sufficient to neutralise it altogether.

20. The rapidity therefore of a river stream or current is no criterion whatever of the rate of translation of a wave upon it; and such a supposition may lead to very erroneous conclusions, as the speed of





Portion of river with a barrier

a current is markedly increased by compression, which on the contrary, retards the translation of a wave through friction.

21. It is now necessary to trace the connection between the phenomenon of the flooding of the Indus, and the preceding laws; in fact, to answer the question which has been proposed on the assumption of the cause being some obstruction above. Why may not all the water which was heaped up above the dam be supposed to have come down the river as a huge cataract when the barrier was overborne: without taking the formation of a wave at all?

22. To this it may, I believe, be answered. 1st. That it is impossible according to the laws of fluids, that a variation of level, however it may have been caused, should do otherwise than alter its position by wave motion, (excepting in the case noted in a succeeding section.) The huge superincumbent mass must necessarily force up the water about and beyond it, far more rapidly than its own particles could run down the declivity for the following reasons.

Let A B C be a portion of a river flowing towards the sea on a slightly inclined plane, and let there be a barrier at B which has so completely shut off the water above it, that by the accumulation of rain, melted snow, &c. it has risen several feet above the level of the river below it. Now, let us suppose the barrier B to be suddenly destroyed, what will be the motion of the waters?

The triangle A B D is then evidently, for all purposes of calculation, a ready formed wave, which will follow the laws of a wave in the mode of its translation. A small portion of the water near to B will of course topple over upon the water below it in foam through lateral pressure, but this will only continue so long as a sufficient slope is forming, to support the wave unbroken. The great body of the water will follow a different course.

Let us take the column of water x y z; each particle under x is pressed downwards, but finds no outlet in that direction; and as fluids press equally in all directions, the forces towards A and B are equal; but from A it is also shut out, and it is consequently directed towards B with a force proportional to the differential gravitation of x z and F z, but beyond B E the particles will be pushed upwards as well as forwards, causing the water to be heaped up successively at F H J, &c. thus translating a protuberance above the level of the

stream to those spots by the simple pressure of gravitation; long before the particles x, b, &c. can reach them—(always conditionally that D E, F G, &c. are sufficiently long to float the wave, which contingency will be treated of hereafter.) In other words the particles x, b, move down the river with a speed proportional to the sine of the angle of the inclination of its bed; *minus* friction, and *plus* the wave motion communicated to them; but the wave crest is translated *directly* according to the known ratio of gravitation, *minus* only the retard of friction.

2ndly. That we have evidence that the phenomenon presented all the characteristics of a wave. We are told that in the morning the river at Attock was “unusually low.” This was the preceding hollow,—then that “the river at first came swelling up quite quietly but very rapidly, not less for a little time, than a foot per minute.” This was the rise on the anterior slope,—then “this of course did not last very long, for as the width, the depth and the velocity increased, so did the discharge, &c.” This was the onward motion of the particles at the passage of the crest.—Then we hear of a more gradual fall on the posterior slope of the wave, which seems to have been much flatter than the anterior slope, as is always the case with large waves in shallow water. These facts are apparently in accordance with the wave laws, and inconsistent with any other theory. And it may be replied,

3rdly. That those who doubt may make the matter a direct subject of experiment upon a small scale.

23. From the nature of the phenomenon of the flooding of the Indus; and for the reasons above detailed, I have no hesitation in considering it, when it passed Attock, as an immense wave, the mass of which was very considerable in proportion to the depth of the stream. I consider it therefore analogous to the tidal wave, and it is, on that account, that I have treated so fully of waves of that class. I have little hesitation in ascribing to the Indus wave a length of one hundred miles when it passed Attock, but if it were only five miles or as much as five hundred, the following results would not be materially affected.

24. Where the depth of the stream above Attock was not more than twenty-five feet—the rate of translation of the wave should

theoretically have been about nineteen British miles per hour : and where it equalled fifty feet, the speed should have equalled twenty-six miles per hour : and so on, increasing in direct proportion to the square root of the depth of the river.

25. It is, however, necessary here to observe that the foregoing remarks are only applicable within certain limits ; and that when the depth of the stream is very small, the continuity of the wave motion is lost ; and the crest of the wave topples over in broken water. The limit of depth within which, wave motion is impossible, is perhaps not very closely ascertained ; but if it be assumed at one-half the height of the advancing wave, it will be sufficiently close for the present purpose. It seems that when a wave reaches shallow water, sufficient particles do not exist in advance, to maintain the altitude of the anterior slope.—Its form consequently changes gradually from a slope to a perpendicular, until the particles on the crest still proceeding with the same velocity, find at last no support and topple over by their own momentum in a torrent of foam. The swell upon a coral reef ; the flood bore of the Hooghly ; and the heavy surge upon the Madras coast ; are illustrations of this law respecting large waves in shallow water.

26. It would not have been necessary to dwell upon this fact with relation to the Indus wave of 1858, which certainly was not a broken one ; but, as discredit has been thrown upon the traditions respecting the noise, the foam, and the destruction, &c. of the previous flood of 1841, and the diminution of water previous thereto, together with the greater altitude it attained, because similar phenomena were not present in 1858, I would observe that the very concomitancy of these traditions, leads me to yield a general belief to the whole of them. It is stated that the flood of 1841, culminated at twelve feet higher than that of 1858, and started from a much lower zero. It is, therefore, probable that the positive altitude of the wave was twenty-four feet greater than that of the late flood ; and moreover, that the stream upon which it travelled was twelve feet shallower. It is therefore very probable that the conditional limits within which wave motion is possible, were not present in 1841, though they were in 1858.

27. I regret that so little practical information can be deduced

from the preceding theory, regarding the late flood—much local knowledge would be requisite to obtain any result which would be even generally satisfactory. Moreover, the disturbing effects of friction, through varying depths and breadths, and the influence of tributaries; would perhaps always prevent a close approximation between observed facts and theoretical deductions. Still, however, as correct methods of investigation are only second in importance to accurate observations of phenomena; I trust that the foregoing exposition of what I believe to be the true principles of tidology will not be wholly valueless—which, it will not be, if it only induce those who are better able to deal with the difficulties of the subject, to examine and refute the errors into which I may have fallen.

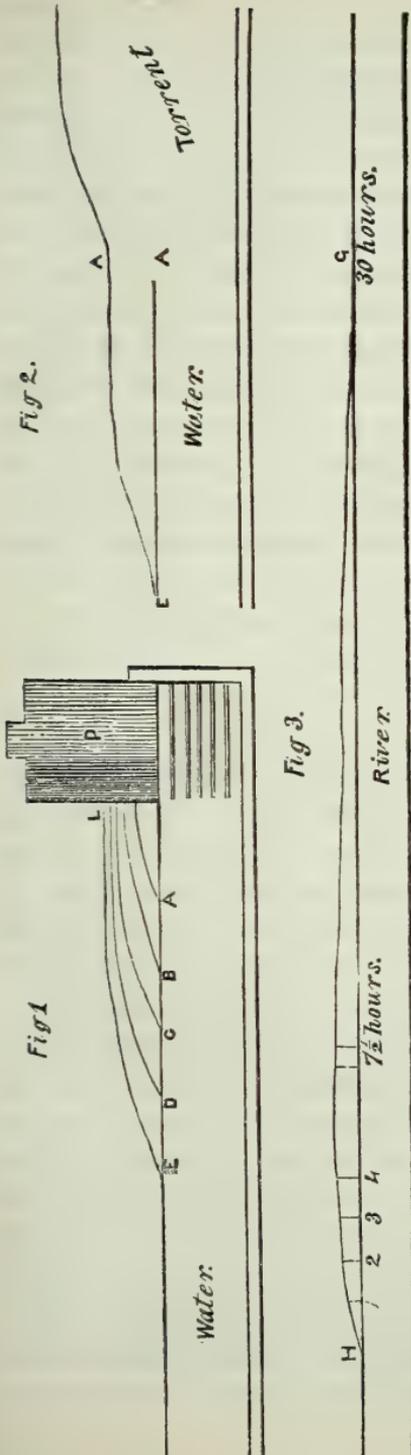
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*On the physical difference between a rush of water like a torrent down a channel and the transmission of a Wave down a river—with reference to the Inundation of the Indus, as observed at Attock, in August, 1858.—By ARCHDEACON J. H. PRATT.*

The following paper is the substance of some remarks I made at the monthly meeting of the Asiatic Society early in September, after the reading of Mr. Obbard's paper published above. That interesting communication was shown to me and to one or two other members when it was first forwarded to the Society, and a discussion which ensued persuaded me that some further explanation of the manner in which a wave may have been generated on the Indus, as supposed by Mr. Obbard, by the bursting of a bund and the precipitation of the pent-up waters, would not be unacceptable.

I do not stand forth precisely as the advocate of the view, that the rise and fall of the water at Attock was produced by the transmission of a wave, rather than by the ordinary rush of water in a swollen river; because there are several facts, which it is necessary to determine before coming to a decision. We ought to know whether there are any great bends and shallows in the river; and the phenomena to be explained ought to be more fully before us. My object is to show the possibility of such an explanation as Mr. Obbard has advanced; and to give my reasons for on the whole inclining to the view that the disturbance at Attock was produced by the passage of a wave.

J. H. P.



1. In fig. 1 suppose that A E is a surface of still-water, in a canal closed at one end and extending indefinitely to the left. P is a gigantic plug, supposed to be thrust down vertically into the water. As the plug descends, pressure will be continually communicated through the water so as to lift up the surface of the water in the canal. As the plug descends successively to a, b, c, d, e (omitted by the engraver) the surface will be raised up into the curves at A, B, C, D, E. The greatest rise at any instant will be close to the plug, where the pressure has been acting longest ; and the elevation of the surface in each curve will be less and less in passing down the canal, because the pressure has been acting for a shorter and shorter time. At the instant the plug reaches the bottom, the surface will have been elevated into half a convex wave L E, its length depending upon the rapidity with which the pressure has been communicated. The amount of water in this elevated half-wave will be equal to the volume of water displaced by the plug. It is evident, that during the formation of this half-wave the several particles of water beneath its surface have received a slight upward and forward mo-

tion of transfer ; this effect being produced by the plug forcing onwards into the canal the water it displaces.

2. If the plug remains motionless after it has reached the bottom, and the half-wave it has forced up is left to itself, the following process will take place. The higher parts of the half-wave will sink by their own weight and press up its less elevated parts ; and these in their turn will by their weight press up the surface of the hitherto still water of the canal beyond the originally formed half-wave. By this process the half-wave L E which was generated by the plug will form itself into a whole-wave of less height and greater length than the half-wave, like G K in fig. 3. This whole-wave will move freely along the canal, elevating the surface of the water at each place as it passes it, and then depressing the surface again to the original level. The slope of the back of this wave will, in general, be longer than the forepart of the wave, because this slope is formed by the sinking of the elevated water merely by its weight ; whereas the forepart of the wave is formed (as above described) by the forced action of the plug, and this force is supposed to be much greater than the mere difference of weight arising from the different elevations of the different parts of the wave. This free whole-wave is represented in fig. 3. The volume of water in this whole-wave, which moves solitarily and freely along the canal, is the same as the volume of water in the forced half-wave from which it grew, and therefore is equal to the volume of water displaced by the plug.

3. The length of the generated half-wave, (and therefore also the length of the free whole-wave which finally moves along the canal,) depends upon the rapidity with which pressure is communicated through water. This rapidity depends upon the exciting cause. A very extreme example of the communication of pressure through water is seen in the velocity of sound through water, which has been found by careful experiments in the Lake of Geneva to be about eight-ninths of a mile in one second, or 3200 miles an hour. At this rate is the pressure communicated, which causes the minute but rapid vibrations of the water which produce the sound. Another example is the velocity of the tidal-wave up the Hooghly, which moves (as Mr. Obbard states) at 24 miles an hour. I have myself made experiments on the great swell-waves at the Equator and found

them to move at 27 miles an hour.\* Waves may be made, as is well known, to move much slower than this, if the pressure producing them is less. The rapidity of the communication of pressure, and therefore the velocity of translation of the wave, depends upon the intensity of the cause producing the pressure.

4. In order to apply these results to the phenomenon in question, I suppose, instead of the plug pressing down the surface, a large body of water to have fallen upon the surface of the Indus by the bursting of the barrier, as represented in fig. 2. According to the force with which this descending mass struck the river, would be the velocity with which the front of the generated half-wave would begin to move down the river. As the cataract poured down from the broken barrier, its successive portions, after causing the pressure by their impact and weight and so aiding in the generation of the half-wave, would become themselves in turn part of the river, and so part of the medium through which the pressure of the next falling portion was transmitted, to continue the generation of the wave.

\* During a voyage from England by the Cape in 1838 I made the following experiment with the assistance of the first and second officers. A day was chosen when the swell was moving from ahead aft, and the ship was making only about three knots. At one end of the log line a large bung was fastened, and 40 fathoms further up another large bung was tied on, the intermediate forty fathoms of line having a number of smaller corks attached to it to make it float. The line thus furnished was thrown into the water astern, and more line allowed to run off the reel till the bungs were well clear of the ship. The second officer, who held the reel, then checked the line from running out further: and the 40 fathoms of line between the two bungs were drawn out straight by the way the ship made. As the wave which was to be observed approached the vessel from ahead, at the word "let go" the line was allowed to run off the reel, and the bungs, with the line between them stretched straight, instantly remained stationary in the sea. The moment the wave lifted the first bung to its highest point was marked by my giving a "now," and the moment the second bung was raised to its highest point by the same wave a second "now." The first officer, who had a chronometer in his hand, marked the interval; it was found to be about 6 seconds. That is, the wave moved over 40 fathoms in 6 seconds, or 1 mile in 132 seconds, or about 27 miles in one hour. Each of us took the several places in turn of reel-holder, time-keeper, and observer; and the results were the same.

The half-wave would be in the process of generation until the pent-up waters were exhausted.

Major Cunningham states in his work on Ladak, that the mass of water which accumulated in 1841 and caused the inundation of the Indus in that year, was estimated at 20,000,000,000 cubic feet. This equals a volume 100 feet deep, 380 feet wide, and 100 miles long! If the flood of 1858 was only half of this or even much less, the reservoir was large enough to generate a half-wave of enormous length, and to produce a final free whole-wave much longer still.

As the Indus varies in width and depth, this wave would undergo various modifications as it passed down, especially as we must combine with it the natural downward current of the river—probably as much as from 7 to 10 miles or more at the season when the flood occurred. Thus at Attock where the river is confined at its usual level to a width of less than 800 feet by rocks there is no difficulty in assuming, that the elevation of the water would be greater than in other parts where the stream was wider.

5. The state of the Indus at Attock in ordinary years is this. The water is lowest in March. By the melting of the snow in May, and by the rains after that, the surface at Attock has risen by August through 50 feet above the lowest or winter level in March. The facts of the phenomenon of 1858, as observed by the late Captain Henderson at Attock (and recorded in the Journal for 1859, p. 199) were these. In August the river was unusually low for that season of the year, being only about 25 feet (instead of the usual 50 feet) above the winter level. On the 10th August at 6 A. M. the water began to rise, and in the first, second, third, and fourth hours rose through 26,12,7,4 feet, and in the next three hours and a half through 6 feet, so as at 1½ P. M. to stand at 80 feet above the winter level. After this, it began very slowly to subside and returned to its usual level in about (say) 22½ hours, making 30 hours for the whole rise and fall of the water at Attock. The rise occupied one-fourth of this time, and the fall three-fourths. This accords with the form of the wave, the slope of which on the back is much longer than the rise on the front, as explained in para. 2, and represented in fig. 3.

6. The difficulties in the way of receiving this explanation arise from the possible shallows and rapids and sudden bends in the river,

and the consequent checks and friction which might materially interfere with the motion and maintenance of the wave. It may be said, however, on the other hand, that the catastrophe occurred at the season of the year when the river is fullest of water; and although in 1858, even in August, the river was as low as to be only 25 feet (instead of 50 feet) above winter level, nevertheless there must have been a considerable amount of water in the river before the flood came, sufficient very likely for the generation and propagation of the wave. Here, however, is a ground of uncertainty. But even if it were admitted that some impediment of the kind existed between the broken barrier and Attock, yet the influx of waters would at length rise over the impediment like an ordinary rush of water on a much swollen river, and commence to generate a wave in the river below the impediment, as the influx of the tidal water at the sandheads produces a tidal wave.

7. We may understand how the water which the wave had raised just above the impediment would get over the impediment into the part of the river below it, ready to produce another wave by its pressure, by observing the breakers of the Bore in the Hooghly. The Bore is simply the flood-tide-wave moving along the river at the springs at which season the influx at the sandheads is greatest. The onward movement of this wave or form at the rate of 24 miles an hour is accompanied (as stated in para. 1) by an upward and onward movement of the parts of the water itself in the front of the wave, though at a much smaller rate than that of the form or wave itself. Conceive this wave coming suddenly from deep water into shallow. What will take place at the boundary line between deep and shallow water? The pressure lifts up the water on the deep side of the boundary line and so forms the front of the great tidal-wave at that spot, and at the same instant gives the water thus lifted up a slight onward motion, which carries it on to the shallow side of the boundary line between the deep and shallow parts. The pressure-action by which the wave should be propagated onwards over the flat is now destroyed; for the upheaved water thus lifted up over the shallow has nothing but the hard bottom to press down upon, and this unyielding bottom will not communicate the pressure onwards (as it would if it had been itself water) to keep up the formation of a wave

ahead. Hence the water, lifted upon the shallow bottom by the action of the wave moving up to the boundary line, will move on over the shallow with its own proper onward motion already acquired, increased by the action of gravity upon the unsupported front of the mass which has found its way, as described, upon the shallow. The water thus heaved up by the wave from the deep side is, so to speak, poured out upon the shallow, and it rushes along over the flat in a running torrent of breakers, till it covers it over with water to the level of the rest of that part of the river now swollen by the flood which is come in.

The violence of this process will depend very much upon the form of the bottom of the river, and the degree of abruptness of the transition from deep water to shallow. If this transition is gradual, the advancing wave will be reduced gradually by the increasing friction of the bottom; and the resisting pressure caused by the bottom (as it inclines up and so faces the wave) will reduce the action, and when the wave does break, if it break at all, it will do so feebly, like ordinary waves on the sea-shore. If, however, the transition be abrupt from deep water into shallow, the action will be as described above in explaining the Bore. This description will show why the phenomenon is so much more sensible when the Hooghly is full of water, in the freshes, than in the dry season. In the dry season the river lies down in the deep channel, and when the accession of water at the spring tides lifts it up, the highest part only of the tidal-wave rises above the flats or shallows, and runs on them, therefore, without violence. But when the river is full, the general level is raised higher than in the dry season and the flood-wave at the springs is bodily raised up above the level of the flats and falls upon them, and rushes over them with a correspondingly greater violence.

This digression about the Bore will serve to illustrate the action of the wave in the Indus when it reaches an impediment stretching across its breadth, such as a fordable shallow, or a rapid caused by broken rocks on a descent. The wave will break, and rush over the impediment (aided in this case by the downward current of the stream) in a torrent of breakers, and the mass of waters, on arriving at the deeper water below the impediment, will again form

a wave by the pressure-action, though not so large as the previous one, because some force will have been destroyed by impact and friction.

8. If the barrier, causing the accumulation of waters, occurred on the main-stream, it might be objected, that, owing to the long stoppage of the supply, there could not have been water enough below the barrier for the descending mass to impinge upon and produce the wave. In this case the mass would rush down the dry or almost dry channel, and as soon as it came to a part of the river where (from its tributaries) the depth of water was sufficient, the sudden influx of the flood would by its weight press downwards and cause the wave to spring up ahead and run down the stream as already described, exactly as the tidal-wave is formed.

9. The reasons which favour the hypothesis of the wave-explanation are these :

(1.) Captain Henderson, who appears to have been the only European who observed the disturbance of the river, inclines to a velocity which accords more with the notion of a wave of water than with that of the water itself rushing down at such a speed : see *Journal*, 1859, p. 207.

(2.) In his account he says (p. 208) “ at first it [the water] came welling up quietly, but very rapidly.” This looks much more like the uplifting of the surface by a pressure from below, than the rush of water down the river.

(3.) He tells us in his account (p. 208) that four hours after the rise began, and three hours and a half before the maximum rise was attained, he crossed the river in a boat. This he hardly could have done had the waters of the swollen river been moving down bodily at the wave’s velocity.

10. Mr. Obbard in his paper attributes the low state of the river at Attock before the flood came, to the hollow which precedes a wave, like the tidal-wave in the Hooghly, and he takes the existence of this depression to be an argument in favour of his explanation. But this would rather appear to have arisen from the stoppage of the full supply of water in consequence of the dam being formed : and it is evident that there was no *cause* producing a hollow in the process explained above by which the wave was generated.

For example, in the illustration I have given above, if the plug began to rise again after it had reached the bottom of the river, a hollow wave *would* be formed by the rushing back of the water to supply the vacuum caused under the plug. The hollow wave thus produced is analogous to the convex wave, and would run along the canal after the convex wave. If the plug were thrust down again and then raised again, another pair of convex and concave waves would be formed. If the rise and fall of the plug occupied six hours each, the action would be like the influx and withdrawal of the tidal mass of water at the Sandheads from the Bay of Bengal, and the convex and concave waves would represent the high and low tides. In this mode of action a concave or hollow always precedes, as well as follows, a convex wave.

But in the case of the Indus there was only the *addition* of a mass of water to the river as it was before the catastrophe took place and the wave was formed, and no subtraction of water. A wave of *elevation only* was, therefore, formed, which ran down the river and passed off into the sea, spending much of its strength no doubt on the way, and in part perhaps restoring the lost level which had arisen from the stoppage of the supply.

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*On the Flat-horned Taurine Cattle of S. E. Asia; with a Note on the Races of Rein Deer, and a Note on Domestic Animals in general.*—By ED. BLYTH.

The species of Bovine animals (so far as known), whether recent or fossil, resolve into three primary groups : viz.

I. *Bisontine*. II. *Taurine*. III. *Bubaline*. Two of these groups being again divisible as follow.

I. *Bisontine* (adapted for a frigid climate). Subdivided into—  
1. OVIBOS (the 'Musk Ox' of the Arctic 'Barren grounds' of America; but which, formerly, during the glacial epoch, was far more extensively diffused, remains of this animal having been met with in

the British islands\*).—2. BOÖTHERIUM; extinct (founded on two specific races, one of which is the *Ovibos Pallantis* of de Blainville, and the other is the *Bos bombifrons* of Harlan).—3. BISON (the well-known broad-fronted and shaggy Bisons of Europe and N. America, and formerly of N. Asia).—4. PÖEPHAGUS (the Yak of high Central Asia). To this *Bisontine* division pertain the only indigenous Bovine quadrupeds of America.

II. *Taurine* (with the exception of the humped cattle suited to a temperate climate and restricted to mountainous countries within or near the tropics). Subdivided into—1. ZEBUS (the Zebu or humped cattle of the hotter regions of Asia and Africa). 2. TAURUS (the humpless cattle with cylindrical horns).—3. GAVÆUS (the humpless cattle with flattened horns, peculiar to S. E. Asia).

III. *Bubaline* (the flat-horned, thinly clad and thick-hided, wallowing† cattle of Asia and Africa). Comprising only—1. BUBALUS (the Buffaloes, including the Anoa of Celebes).

According to the views so very ably expounded by Mr. C. Darwin, all the species of one genus have a common origin in the depths of time, and we may ascend in the generalization to any extent, needing only unlimited lapse of time for the ever accumulating development of small variations in any particular direction, under the unconscious guidance of the law of Natural Selection. *Species*, as he maintains, are only strongly marked *varieties*, and *varieties* he designates as *in-*

\* As also of the Caribou, or present barren-ground race or variety of the Rein Deer; though I am far from being satisfied that this barren-ground race differs in any respect from the *wild* Rein Deer of Lapland, or of the 'tundras' of Arctic Siberia; while I much suspect that the large race or variety of Rein Deer which is ridden by the Tungusi and other Siberian tribes, (and to the backs of which the bales of goods are annually transferred, in Mantchuria, from those of two-humped Camels,) to be similarly identical with the Woodland Caribou of North America. The subject of the races of Rein Deer will be more fully treated of in the sequel.

As the above is passing through the press, I learn, from Lord Wrottesley's Address to the British Association at Oxford (June 27th, 1860), that Dr. H. Falconer, "aided by Col. Wood, of Glamorganshire, has recently extracted from a single cave in the Gower peninsula of South Wales, a vast quantity of the antlers of a Rein Deer (perhaps of two species of Rein Deer), both allied to the living one. These fossils are most of them shed horns; and there have been already no fewer than 1,100 of them dug out of the mud filling one cave."—*Athenæum*, June 30th, 1860, p. 890.

It is remarkable that URSUS ARCTOS of the major continent should, in America, be restricted in its range to the Arctic barren-grounds.

† The true Bisons wallow during the summer.

*cipient species*; and most assuredly the dividing line between what are variously accepted as *species* or as *varieties* cannot oftentimes be traced: nevertheless, it is admitted by Mr. Darwin that the mass of what are generally considered as *species* have acquired a high degree of persistency, and arguments *pro* and *con* are abundantly supplied by the Bovines, as by endless other groups: on the one hand, we have the multitudinous races of cylindrical-horned domestic cattle, whether humped or humpless, which surely no naturalist would go the length of supposing to be so many separate and distinct creations; and, on the other hand, we have the phenomenon of three wild species, or most strongly characterized races (more strongly characterized apart than are any of the domestic races of humped or humpless Taurines respectively), yet exhibiting many peculiarities in common, inhabiting to a great extent the very same region, but maintaining their distinctive characters wherever found, and never (so far as known) hybridizing one with another, though at least two of them have interbred in a state of domestication (and one of them even in the wild state) with the ordinary tame humped cattle of the tropical regions of the major continent.\* All three are *domesticable*, as will be shewn; and as regards the reputed indomitable nature of one of them, the gigantic Gaour (*G. GAURUS*), we have only to reflect on the fact, how very readily the tamest and one of the most thoroughly and completely domesticated of all tame creatures, the humped Ox (*BOS* or *ZEBUS GIBBOSUS*) relapses into a condition of feral wildness, unsurpassed even by the Gaour itself, and assuredly beyond that of the renowned Chillingham cattle of Northumberland, if not also of the feral humpless cattle of S. America and elsewhere.†

\* The *Bos sylhetanus*, F. Cuv., is founded upon a hybrid Gayál (*G. FRONTALIS*) of this kind; and the *B. leucopyrnos*, Quoy and Gaynard, upon a hybrid Banteng (*G. SONDAICUS*). Sir T. Stamford Raffles remarks, in his *History of Java*, that "the degenerate domestic cows [of that island, humped,] are sometimes driven into the forest to couple with the wild Banteng, for the sake of improving the breed." Baron Cuvier supposed that the true Gayál was a hybrid between the humped cattle and the Buffalo; but he seems to have known only the hybrid animal, from the description and figures sent by M. Duvaucel and published by his brother in the *Mamm. Lithog.*

† How readily European cattle resume the wild habit, is shewn by the following passage in Mr. S. Sydney's excellent work, 'The Three Colonies of Australia' (1852), p. 314. "The cattle in bush re-acquire in many respects the habits of their wild progenitors; such is the habit of camping, and such, too, the manner in which, like the wild [feral] cattle of Chillingham park in Northumber-

The humped cattle are unknown in an aboriginally wild state; and I am strongly of opinion that they will prove to be of African rather than of Asiatic origin, however ancient their introduction into India; for no fossil or semi-fossil remains of this very distinct type have as yet been discovered in any part of Asia, where the only established fossil *Taurine* is the *BOS NAMADICUS* of the Nerbudda deposits, which is barely (if at all satisfactorily) distinguishable from the European *B. PRIMOGENIUS* (or true *Urus* of Cæsar).\* It

land, they march in single file to water, the bulls leading; so, too, when threatened, they take advantage of the inequalities of the ground and steal off in their hollows unperceived, the bulls, if attacked by dogs, bringing up the rear."

In the Swan River colony, both horses and horned cattle have gone completely wild, and Buffaloes in the vicinity of Port Essington. *Vide* Leichardt, in *Journ. Roy. Geogr. Soc.* XVI, 237.

(What are the wild cattle of Albania noticed by Count Karact in *Journ. Roy. Geogr. Soc.* XII, 57? Also, what were those hunted by the ancient monarchs of Assyria, as represented in the Nineveh sculptures? What, indeed, were the *Uri Sylvestres* which haunted the great forests that surrounded London in the time of Fitzstephen, *i. e.* about 1150 *A. D.*? The late Jonathan Couch remarked, in his '*Cornish Fauna*' (1838), that—"The ancient breed in the west of England was called 'black cattle,' from the very dark appearance of its coat, almost like velvet: circumstances in which it seems to have differed from the races of the north of England, which were white)."

\* I refer more especially to the later or post-pliocene (*pleistocene*, or even recent) type, the remains of which are found in almost modern lacustrine deposits, where likewise occur those of *BISON EUROPEUS* of the existing type, as distinguished from the wide-horned *PRISCUS* type. This later form of *PRIMOGENIUS* (which is that originally so named by Bojanus) absolutely resembles the most finely developed examples of certain (*unimproved*) domestic races of large and very-long-horned cattle, except that the size is fully one-third larger, as remarked by Professor Nilsson. In like manner, Mr. Hodgson notices, of the Indian Buffalo, that—"The wild animals are fully a third larger than the largest tame breeds [in India], and measure from snout to vent 10½ ft. and 6 to 6½ ft. high at the shoulder." (*J. A. S.* XVI, 710). The older type of *PRIMOGENIUS* occurs in the pliocene drift, together with *BISON PRISCUS*; and (so far as I have seen) the size of the skull is smaller than in the other, but the horns are still larger, and curve round more towards each other at the tips; moreover (if I mistake not), they are both thicker and longer in the bull than in the cow, whereas in the more modern type (as in domestic cylindrical-horned cattle, whether humped or humpless,) they are thicker but shorter in the bull, longer and more slender in the ox and cow. With the exception of the Indian Buffalo to some extent, I know of no other true bovine in which the horns are not both thicker and longer in the bull! In the old type of *PRIMOGENIUS*, the horn-cores are sometimes enormous. I have measured a pair which were 3 ft. long and 19 in. round at base. Another of the same linear dimensions, but 18 in. in circumference at base, is noticed in the *Ann. Mag. N. H.* Vol. II (1838), p. 163. I have drawings of a fine frontlet of perhaps a cow of this race, which was found in the gravel when digging the foundations of the houses of parliament. Of the later race, compare the noble Swedish bull-skull figured in *Ann. Mag. N. H.*, 2nd series, IV, 257, 259, with the superb Scottish cow-skull in the British

need hardly be remarked that the humped type of domestic cattle is generally diffused over the hotter parts of Africa, from east to west or ocean to ocean, and on the eastern side as far south as Natál, and throughout Madagascar; the same being the only Taurine type known in Arabia,\* though, curiously, in the essentially Arabian island of

Museum, figured in Prof. Owen's 'British Fossil Mammals and Birds,' 498, 507. The latter measures just  $2\frac{1}{2}$  ft. from vertex to tips of intermaxillaries. Compare also Prof. Owen's figure of BISON PRISCUS with Prof. Nilsson's figure of the modern type of European Bison from the Swedish peat (p. 490 and p. 415 of the same Vols. respectively). Whether the *latter* has occurred in the British Islands I am unaware; but suspect that it does not, or at least that it has not been recognised hitherto.

*Perhaps* the latest (though vague) notice of the Urus, as an existing animal, occurs in Bell's 'Travels in Tartary,' Vol. I, Ch. III, p. 223: "Journey from Tomsky to Elimsky, in the country of the Tsuliam Tartars." It seems to me to refer more probably to the wild *taurine* Urus than to the Bison; but in either case the notice is sufficiently remarkable. "On the hills, and in the woods near this place, are many sorts of wild beasts; particularly the Urus, or Uhr-ox, one of the fiercest animals the world produces. Their force is such, that neither the Wolf, Bear, nor Tiger, dares to engage with them. In the same woods," Bell continues, "is found another species of Oxen, called *Bubul* by the Tartars. It is not so large as the Urus; its body and limbs are very handsome: it has a high shoulder and flowing with long hair growing from the rump to its extremity, like that of a Horse. Those which I saw were tame, and as tractable as other cattle." Certainly a remarkable notice of the Yak, both wild and tame (as it would seem), in a region where that animal is at present unknown. The word *Bubul* has probably its connexion with *Bubulus*.

The difference in the development of the wild and tame Buffalo of India is equally observable where the two frequent the same pastures and commonly interbreed; and I believe the main reason of it to be, that the tame calves are deprived of their due supply of milk. The importance of an ample supply of nourishment in early life, as bearing on the future development of any animal, cannot be over-estimated. A friend remarked to me that he had no idea of what a fine Buffalo was, till he saw those of Burmá. They are there, he states, much larger than in Bengal, with splendid horns, and altogether a vastly superior animal. The Burmese *never milk them*; having the same strange prejudice against milk which the Chinese have, though otherwise both people are nearly omnivorous. There is a corresponding difference of development in the wild and tame races of Yak, and of Rein Deer in Lapland,—doubtless for the same reason.

\* The humped cattle of Arabia generally are "of a very small and poor race, and are never, but with the greatest reluctance, killed for food." (Wallin, in *Journ. Roy. Geogr. Soc.*, Vol. XXIV, 148.) Chesney remarks of them, that "bulls and cows take the next place to the Buffalo, and, like those of India, they bear a hump, and are of small size; some bullocks purchased at Suweideyah, produced, each, only about 224 lbs. of meat." Again, in his Appendix (Vol. I, 279), he enumerates, among the domestic animals of Arabia and *Mesopotamia*, "both the common bull and cow, and the bull and cow with hunch." In the province of Kerman, in Persia, Mr. Keith C. Abbot remarks that "the oxen of this part of the country are of a small humped kind, and are commonly used as beasts of burthen; people also ride on them, seated on a soft pad, and a rope is passed through the nostril, by which they are guided." (*Journ. Roy. Geogr. Soc.*, Vol. XXV, 43.)

Socotra, the cattle are of the humpless European or N. Asiatic type.\* Both humped and humpless cattle are represented in the old Egyptian paintings; and the humpless reappear in S. Africa, in the remarkable indigenous (so far as known) Caffre cattle, and I have seen fossil remains of the same cylindrical-horned humpless type from the banks of a tributary of the Gariep river.† In Madagascar, also, where the tame cattle

\* *Vide* Wellsted, in *Journ. Roy. Geogr. Soc.* V, 200. On the confines of India, this European and also Tartar type of humpless cattle comes round, evidently from the eastward, into Butan. But the Chinese Taurines (so far as I can learn) are mostly hybrid, being variously intermediate to the humped and humpless species: except, however, towards the north; and huge herds of splendid Tartar cattle are pastured beyond the great wall of China,—many of these, with vast troops of horses, &c., being the property of the emperor. (*Vide* Timkowski and others.) According to Major R. C. Tytler, a white breed of humpless (?) cattle is reared and highly prized by the natives of Dacca, who never turn them out to pasture. It has “little or no symptoms of a hump.” *Ann. M. N. H.* 2nd series, XIV (1854), 177.

† *Vide Proc. Geol. Soc.* 1840, p. 152. Capt. Speke observed some very fine humpless cattle on the N. W. shore of the Tanganyika lake, near the equator. “Very large cattle, bearing horns of stupendous size. They are of an uniform red colour, like our Devonshire breed, but attain a much greater height and size.” Northward, again, on the shore of his grand Victoria Nyanza lake, he remarks that—“The cows, unlike the Tanganyika ones, are small and short-horned, and are of a variety of colours. They carry a hump, like the Brahmini bull, but give very little milk.” *Vide* ‘Blackwood’s Edinburgh Magazine,’ No. DXXVIII (October, 1859), pp. 392, 398. A little further northward, in the Bari country on the shores of the White Nile, between 4° and 5° N. lat., M. Ferdinand Werne tells us—“We remark, as usual among the light-coloured cows, many quite white, and few black or dapple. The bulls have the customary high and thick humps; the cows, on the contrary, have exactly the appearance of those at Emmerich on the Rhine [?]; their horns are twisted in a surprisingly handsome form, and set off with flaky hair, as well as the ears. They carry the latter erect, by which means the head, and the lively eye, acquire a brisk and intelligent expression.” (Werne’s *Narrative of Expedition to discover the Sources of the White Nile, in the years 1840, 1841*, O’Reilly’s translation, II, 94.) It is not likely that the cows referred to should be entirely humpless; and the large lustrous eye is everywhere one of the many characteristics of the humped species, as is the lanceolate form of ear (which I suppose is referred to), as contrasted with the broad round ears of the humpless kind; and in hybrids of different degrees of admixture the proportion is more readily seen in the shape of the ear than in aught else. Moreover, it seems that, as in India, white or greyish-white humped cattle predominate; but the black tail-tuft is constant, except in the rare case of an albino. Between 6° and 7° N. lat., among the Kek or Kiak nation, we learn, from the same authority, that—“The cattle are generally of a light colour, of moderate size, and have long beautifully twisted horns, some of which are turned backwards [as also in India]. The bulls have large speckled humps, such as are seen in the hieroglyphics; the cows, on the contrary, only a little elevation on the shoulders.” (*Ibid.* I, 175.) As with the humped cow elsewhere; and when Col. Sykes mentions that this species of cattle, “when early trained to labour or to carriage, is nearly destitute of the hump” (*Proc. Zool. Soc.* 1831, p. 105), he refers to cows and oxen only; for the labouring bull has always a well developed hump, especially if well fed, and this has much to do with the filling out of the hump in oxen and

are all of the humped kind, a humpless wild race, not yet scientifically described, was long ago indicated by Flacourt, and since by the missionary Ellis; stated to resemble European cattle except in having longer limbs.\* But to return to the humped cattle. These are now the ordinary Taurines of tropical and subtropical Asia, and according to Kæmpfer extend on to Japan. Though unknown in an aboriginally wild state, the species has relapsed into wildness in various parts of India, as especially in Oudh and Rohilkund, in Sháhábád, in Mysore, and even in Ceylon; a fact the more interesting, as proving (what had been doubted) that these humped cattle can maintain themselves, unaided by man, in regions inhabited by the Tiger. The origin and history of the wild herds of the Sháhábád jungles, which still exist, are given by Dr. F. Buchanan Hamilton,† who remarks that—"In the woods of Jagadisipur and Damraong are some wild cattle of the common breed: they resemble entirely in form and in variety of colours‡ those bred about the villages of this district,

cows: the fundamental structure is there invariably, and capable of development. The huge-horned Bornouese and Galla races of cattle are of the humped species, —unlike the fine Tanganyika race "with stupendous horns." Indeed, cattle exceedingly like the African Galla race of Bruce and Salt are by no means very rare in India.

It is remarkable that the singular *strepsicerine* or Cretan breed of Sheep exists in the country drained by the White Nile; modified, however, in its fleece by the locality. Thus, Werne tells us (II, 18), that—"I purchased for a couple of miserable beads a little Sheep, covered partly with wool and partly with hair, as the Sheep here generally are, with a long mane under the throat, and horns twisted back. Selim Capitan says that a similar species [race] is found in Crete." Elsewhere (p. 97), he remarks "Rams with horns twisted back and manes,"—the latter, of course, *under* the throat, as mentioned in the preceding notice.

\* "Horned cattle are numerous, both tame and wild; many of the latter resemble, in shape and size, the cattle of Europe." (Ellis's *History of Madagascar*.) These wild cattle abound in the province of Mena-bé, which occupies much of the western portion of the island. In Mr. J. A. Lloyd's *Memoir on Madagascar*, published in the 20th Vol. of the *Royal Geographical Society's Journal*, we read (p. 63) that "the northern part of Mena-bé contains great numbers of wild cattle; Radáma and his officers, in one of their warlike expeditions amongst the Sakalami, passing through this country, killed upwards of 340 [wild?] oxen in one day for the use of his army, and two days afterwards 431 more were killed by the soldiers."

† Montgomery Martin's compilation from the Buchanan Hamilton MSS., Vol. I, 504.

‡ Major W. S. Sherwill, who has often shot over the now famous "Jugdespur jungle," by permission of the late Kumár (or Kooer) Singha, who allowed him to shoot what he pleased so long as he spared the wild cattle, informs me that, while, of course, respecting the Rája's injunction, he was curious about these cattle, and had opportunities of watching them somewhat closely. All he saw were rather of small size and of an earthy-brown colour, with shortish horns,

but are more active, and very shy. The Rájá of Bhojpur, and his kinsman Sáhebzádeh Singha [as of late Kumár Singha, the notable rebel], carefully preserve them from injury; and say, that owing to the encroachments of agriculture the number is rapidly diminishing. Many of their neighbours, however, alleged that the devastation committed by these sacred herds was very ruinous, and every year occasioned more and more land to be deserted. The origin of these herds is well known. When the Ujayáni Rájputs incurred the displeasure of Kásim Ali, and for some years were compelled to abandon their habitations, some cattle were left in the woods without keepers; and on their owner's return had acquired the wild habits, which their offspring retain. Several calves had been caught; but it has been found impossible to rear them, their shyness and regret for the loss of liberty having always proved fatal. This shows what difficulties mankind must have encountered in first taming this most useful animal," &c. &c. The extreme wildness of the feral cattle of Oudh is noticed by Capt. (now Col. Sir T. Proby) Cautley, in *J. A. S.* IX, 623. "In the districts of Akharpur and Doolpur, in the province of Oudh," he remarks, "large herds of black oxen are, or were, to be found in the wild uncultivated tracts, a fact to which I can bear testimony from my own personal observation, having, in 1820, come in contact with a very large herd of these beasts, of which we were only fortunate enough to kill one; their excessive shyness and wildness preventing us from a near approach at any second opportunity." Another writer notices herds of these feral humped cattle on the road from Agra to Bareilly; and, from all recent accounts, they seem to be on the increase rather than on the decrease.\*

and he thinks without the *Nil-gai* markings on the feet (which are often seen in domestic humped cattle). Whether the Oudh herds tend to uniformity of colouring I am unaware. The feral herds of humpless cattle in S. America are, I believe, of various colours, like their domestic Spanish progenitors.

\* In an article "On the Future of Oudh" (published in the *Morning Chronicle* for May 17th, 1859), it is remarked that "The forests, and notably among them that of the Tarai, towards Nipal, serve as a shelter for innumerable wild cattle, which are admirably suited for artillery bullocks and other laborious purposes, besides affording excellent fire-wood and pasture for cattle, and also hunting-ground for the sportsman. In these forests, and in the extensive jungles, are to be found the hides and horns of thousands of wild cattle, rotting, as it were, for want of hands to turn them to account, and which alone would prove a most remunerative branch of commerce, to judge from the success which the very few who

With this fact, therefore, to bear in mind, the excessive shyness and wildness of the feral herds known to be descended from domestic humped cattle, and also the fact (which I and others know from experience) of the extreme difficulty there is in subduing the wild propensities of the common Bengal Jungle-fowl (*GALLUS FERRUGINEUS* v. *bankivus*), from which wild species all the races of domestic poultry are as clearly derived as are those of tame Ducks from the Mallard, we are quite justified, I think, in withholding assent to the current opinion that the Gaour (*BOS GAURUS*), or any kindred species, is incapable of domestication.

have attempted to realize this branch of commerce, have met with. From the same source tallow might be obtained in abundance, were there only a few speculators to inaugurate the trade, and to direct it into the natural channels for its development."

The making over of a considerable portion of the Tarai region to a Hindu Prince (Jung Bahádur) will, of course, tend to a further preservation of these feral cattle. Another and more remarkable locality where many beasts of the sort (and of various colours) are little molested, is the *churr* or alluvial island known as the Siddi *churr*, lying S. E. of Noacolly in the eastern Sundarbáns. On this *churr* there is no high tree-jungle, and scarcely brushwood enough to afford cover for Tigers, which do not occur on the island.

It is probable that such feral herds occur also in Africa. Thus, in some "Notes on an Expedition down the Western Coast of Africa to 'the Bijuga Islands,' and the recently discovered river Kiddafing," by Col. L. Smyth O'Connor, C. B., F. R. G. S., communicated by the Colonial office to the Royal Geographical Society, and published in its Journal for 1859, p. 384, it appears that in the island of Ovanga "the finest Oxen are wild in innumerable herds." In general, however, the notices of wild cattle in Africa refer either to—1. *Bubaline* species,—2. Gnus (*CATOBLEPAS*), or 'wilde beasts' of the Dutch colonists,—3. Species of the Hartebeest group, as especially *ACRONOTUS BUBALIS* in N. Africa,—4. Even the *Leucoryx* and kindred Antelopes. As an illustration of this vague application of names, Capt. Lyon mentions a chain of mountains to the south of Fezzan, named *Wadan*, "on account of the immense number of Buffaloes to be found there, and which are of three species, viz. the *Wadan* [*OVIS TRAGELAPHUS*!], an animal of the size of an Ass, having very large (or, as is elsewhere stated, very long, heavy) horns, and large bunches of hair hanging from the shoulder, to the length of 18 in. or 2 ft.; they have very large heads, and are very fierce. The *Bogua-el-Weish* [*ACRONOTUS BUBALIS*?], which is a kind of Buffalo, slow in its motion, having very large horns, and being of the size of an ordinary cow; and the White Buffalo [*ORYX LEUCORYX*!], of a lighter and more active make, very shy and swift, and not easily procured. The calving-time of these animals is in April or May." (*Travels in N. Africa*, pp. 76, 271.) Dr. Barth notices the *OVIS TRAGELAPHUS* by the name *Wadan*. "Wild Oxen" of some sort are stated to inhabit the country bordering on the river Koanza. (*Journ. Roy. Geog. Soc.* XXIV, 272.) Capt. Burton, also, in his recently published work, 'The Lake Regions of Central Africa,' notices that—"The park-lands of Duthumi, the jungles and forests of Ugogi and Mgunda Mk'hali, the barrens of Usukuma, and the tangled thickets of Ujiji, are full of noble game—Lions and Leopards, Elephants and Rhinoceroses, wild cattle (Buffaloes?), Giraffes, Gnus, Zebras, Quaggas, and Ostriches." Gnus, at least, being here discriminated.

From accounts of the savage nature of the wild Yak, the same might have been inferred of that species, which we know to be extensively domesticated; or, if we were only acquainted with the wild Rein Deer as it exists in arctic America, the varied applicability of the domestic herds of the corresponding regions of the major continent would scarcely have been predicated. So with the African Elephant in modern times, as compared with the Asiatic Elephant!\* Civilized man, as a rule, exterminates but does not domesticate—has not hitherto done so at least, whatever efforts may of late have been made (with but moderate result hitherto) by the Acclimation and different Zoological Societies. A cultivated country, however, is ill adapted for such experiments. Wild animals are rather to be won over, by degrees, in their indigenous haunts, where their habits of life are little changed by domestication, and their food continues to be that to which the race is accustomed: their subjugation being accordingly effected by human tenants of the same haunts, who can hardly have emerged from savagery, but are practically familiar with the habits of the creatures they seek to subdue. It is thus that the three species of known wild Asiatic Taurines with flattened horns have (each of them) been domesticated, to a greater or less extent, in their own wildernesses. A few calves may have originally been caught and tamed, and some stock established; but how entire herds of full-grown wild animals may be won over and gradually domesticated, is thus told by Mr. McRae in *Lin. Tr.* VII, 303 *et seq.* The Gayál or *Mit'hun* (*GAVEUS FRONTALIS*) being the species referred to.

“The Kukis have a very simple method of training the wild Gayáls.

\* In a letter just received from Sir J. Emerson Tennent, I learn that the Elephant of Ceylon is considered to be identical with that of Sumatra (!), which is adjudged to be a peculiar species (intermediate to the existing African and Indian Elephants) by Prof. Schlegel and the late Prof. Temminck, as also by the late Prince of Canino. At all events the Sumatran Elephant is described by three or four authors, to whom I have had access, to bear generally fine tusks (*i. e.* the males), whereas a fine tusker is exceptional in the instance of the Elephant of Ceylon. Sir J. E. Tennent's elaborate and most interesting series of chapters on the great proboscidian discloses certain facts, on the *family resemblances* of particular herds of Elephants, which will not fail to interest the disciples of Mr. C. Darwin. How about the Elephants of the Malayan peninsula; if not also of the Indo-Chinese countries, as far at least as Cochin-China? I am trying to obtain grinders, *i. e.* molar teeth, in the hope of coming soon to some understanding in the matter.

It is as follows :—On discovering a herd of wild Gayáls in the jungles, they prepare a number of balls, of the size of a man's head, composed of a particular kind of earth, salt, and cotton; they then drive their tame Gayáls towards the wild ones, when the two soon meet and assimilate into one herd, the males of the one attaching themselves to the females of the other, and *vice versa*. The Kukis now scatter their balls over such parts of the jungle as they think the herd most likely to pass, and watch its motions. The Gayáls, on meeting these balls as they go along, are attracted by their appearance and smell, and begin to lick them with their tongues; and relishing the taste of the salt, and the particular earth composing them, they never quit the place until all the balls are destroyed. The Kukis having observed the Gayáls to have once tasted their balls, prepare what they consider a sufficient supply of them to answer the intended purpose, and as the Gayáls lick them up they throw down more; and to prevent their being so readily destroyed, they mix the cotton with the earth and salt. This process generally goes on for three changes of the moon, or for a month and a half; during which time the tame and wild Gayáls are always together, licking the decoy balls; and the Kuki, after the first day or two of their being so, makes his appearance at such a distance as not to alarm the wild ones. By degrees he approaches nearer and nearer, until at length the sight of him has become so familiar that he can advance to stroke his tame Gayáls on the back and neck without frightening away the wild ones. He next extends his hand to them, and caresses them also, at the same time giving them plenty of his decoy balls to lick; and thus, in the short space of time mentioned, he is able to drive them along with his tame ones to his parrah or village, without the least exertion of force or compulsion; and so attached do the Gayáls become to the parrah, that when the Kukis migrate from one place to another they always find it necessary to set fire to the huts they are about to abandon, lest the Gayáls should return to them from the new grounds, were they left standing. Experience has taught the Kuki the necessity of thus destroying his huts."

In at least some of the hill-ranges bordering the Brámaputra valley on its left, where Gayáls are extensively domesticated by the

mountaineers, they have been so far influenced as to vary considerably in colour, whatever may be the cause of such variation. Thus, amongst the Meris, Lieut. Dalton tells us that—"The *Mit'hun* (or Gayál) is the only species of horned cattle possessed by the Meris. It is rather a clumsy-looking animal in make; but a group of *Mit'huns* grazing on the steep rocky declivities they seem to love, would be a noble study for Landseer: some are milk-white, some nearly black, some black and white, and some red and white."\* Elsewhere, the herds of tame Gayáls shew generally a few individuals a little pied or splashed with white, with not uncommonly a white tail-tuft; and they cannot be expected to vary much further than this, unless subjected to new influences, and above all to that of selection in breeding under human superintendence. In the Mishmi hills wild Gayáls are still numerous;† but we know little of this species excepting on the outskirts of its range, where its native hills impinge on British territory.‡

The Rev. J. Barbe, R. C. M., who seems to have penetrated further into the interior of the Tipperá and Chátgaon (or 'Chittagong') hills than any other European, even to the present time, remarks, in an account of his tour into the latter territory in 1844-45,§ that—"the Gayál, *Bos frontalis*, is found amongst the hills, particularly to the south of Sitacra: there are two species, differing in size and [a] little in colour: the large one is of a dark brown, and the male

\* *J. A. S.* XIV, 265.

† *Ibid.* XIV, 495.

‡ The *Gayál* of Bishop Heber's Journal, which that much respected prelate saw in Barrackpore park, was of course the *GAVÆUS FRONTALIS*. But the figure and description given are monstrous, and were obviously got up from extremely vague recollection: the horns turn down instead of up, the space between them is narrow instead of being very broad, the heavy dewlap is not given, nor the white stockings; the tail is figured and described as "bushy," and as extending below the hocks; and the outline of the spinal ridge is utterly unlike what it should be. He says—"It is very much larger than the largest Indian cattle [he could not then have seen an ordnance bullock], but hardly, I think, equal to an English bull [!]: its tail is bushy [!], and its horns form almost a mass of white and solid bone to the centre of its forehead [!]" He could only have viewed the animal from a distance, and have mistaken the pale colour of the forehead for a continuation of the bases of the horns. Neither is it, as he remarks, "a native of Tibet and Nipal," nor even of Butan (*vide* Turner's Embassy). The second figure in the distance is meant, we can only suppose, to represent a large humped Ox; but here, again, the animal is furnished with a Horse's tail, and is like nothing in nature! Our utmost respect for the reverend Bishop can scarcely pardon him such outrageous caricatures, both of figure and description. *Vide* Heber's Journal, I, 31.

§ *J. A. S.* XIV, 386.

is nearly as high as a female Elephant : the small one is of a reddish-brown ; it is the Tenasserim 'Bison,' and the Arakanese call them by the same name as the Burmese do. These Gayáls are perfectly distinct from the *Shio* of the Kookies, which are smaller, have a projecting skin to their neck, and differ also by the form and direction of their horns." Now the *Shio* or *Shiál* of the Mughls is, for certain, the true Gayál (*G. FRONTALIS*),\* as indeed indicated by the "projecting skin to their neck;" this species having the dewlap much more developed than in the Gaour (*G. GAURUS*) and Banteng or *Tsoing* (*G. SONDAICUS*), which last I believe to be M. Barbe's smaller species "of a reddish-brown," as I have ascertained his larger species to be the Gaour (which has hardly even a trace of dewlap). But the Gaour and not the Banteng is the 'Bison' of Anglo-Indian sportsmen on both sides of the Bay of Bengal; † the Banteng being currently known as the 'wild Ox' of the Indo-Chinese countries. M. Barbe has therefore erroneously identified his *smaller* kind with the Tenasserim 'Bison,' and is also wrong in applying the name *Bos frontalis* to either of his species, as obviously so to both of them.

Soon after the publication of the foregoing notice, I had some conversation on the subject with M. Barbe, and have fortunately preserved a written memorandum of that conversation, intended for publication at the time, though it has not hitherto appeared in print. I did not then recognise the *third* species ; indeed, at that time, I had much less knowledge of the Banteng than I have at present : but I now give the memo. as originally written :—

"M. Barbe had informed me, that, besides the common Gayál (*Bos frontalis*), the Kukis of the interior of the Chittagong hills had a very different species of *Bos* in a state of complete domestication, the exact species of which I could not satisfactorily make out from his description ; when, luckily, he remembered that he possessed a horn of one of those tame animals, and, to my very considerable surprise, it proved to be that of a Gaour, or (so-called) 'Bison' of Anglo-Indian sportsmen, an animal which is commonly reputed to be untameable. The huge beasts are, however, stated to be most

\* *Vide As. Res.* VIII, 488.

† In Orissa, the Gaour is known to sportsmen and others as the 'Gayál ;' although the natives of the province style and pronounce it *Goor*. The names, of course, being branches or *ramifications* of the same root.

perfectly gentle and quiet; and they habitually pass the night and great part of the day beneath the raised habitations of their owners: and M. Barbe further mentions that he was greatly astonished at the facility with which these enormous cattle ascended and descended heights so steep and precipitous, that, had he not witnessed the feat, he would scarcely have been inclined to credit it." The last observation points rather to the Gayál than to the Gaour!

As a rule, the proper *habitat* of the Gaour is an undulating grassy table-land intermixed with forest; the heavy and Buffalo-shaped Gayál being habitually much more of a climber, and also more exclusively affecting the dense craggy forest, where it browses in preference to grazing; the Gaour being much more of a grazer. Having possessed both species alive, I can testify to this difference in their feeding. The Gaour appears to be diffused throughout the Indo-Chinese countries, and all down the Malayan peninsula to the extreme south; but has not been observed on any of the great islands of the archipelago. I have lately seen the skull with horns of an old bull from the mainland near Singapore; and in 1858 I purchased a live Gaour-calf that was brought from Singapore to Calcutta, together with a Malayan Tapir. This calf was in high health when I shipped him for England, and as tame and tractable as any domestic animal, yet full of life and frolic; but he was suddenly taken ill when nearing the Cape, and died on the following or next day. He was very impatient of the sun, even at the height of the cold weather (so called) in Calcutta; which rendered it difficult to secure a photograph of the animal, but a good one was taken, and copied in the 'Illustrated London News;' only the artist must needs improve upon nature by lengthening the tail beyond the hocks, which detracts from the *vraisemblance* of the wood-cut. The Gaour is the only species of the group which inhabits *cis*-Bráhmáputran India, in all suitable districts; extending formerly to Ceylon, where we recognise it as the *Guavera* of Knox; and in Johnson's 'Indian Field Sports,' it is familiarly referred to as "the *Gour* (a kind of wild bullock)" inhabiting, in about 1796, the hill-country bordering on the Dámudá, through which the Grand Trunk Road now runs from Ránigánj to Shergátti,—a district from which it has been long since extirpated, or has retired some hundreds of miles further west. It is still

numerous in various localities, and not always particularly shy where little persecuted: for instance, my late friend Capt. Crump (a distinguished sportsman, who fell most gallantly taking possession of a gun at Láknao,) found them so little shy towards the sources of the Nerbudda, that, on one occasion, a couple of young bulls came trotting fearlessly out of the forest, within easy gunshot of himself and companion on horseback, and continued for some time to trot alongside of them at that distance, till my friend's *sporting* (or destructive) propensities could brook it no longer. Others would have felt much greater pleasure in observing the noble animals thus fearlessly at liberty, and would have been loth to abuse their confidence.

In the catalogue of the specimens of mammalia in the India-house museum, published by the late veteran zoologist, Dr. Horsfield, in 1851, a *Bos asseel* is described as a new species, founded on a preserved head, with the skin on, in that collection. I have drawings of the identical specimen, which I pronounce, with confidence (as I did formerly in *J. A. S.* XI, 445), to be that of a cow Gaour, with horns more slender and turning back more towards the tips than usual; but I have seen others like them, and of all intermediate grades between them and the ordinary type of female Gaour-horns, resembling those of the bull but more slender, and with always a greater amount of inclination backwards at the tips. The specimen in question is figured by Gen. Hardwicke in the 'Zoological Journal,' III, pl. 7; together with a frontlet of a bull Gaour: and the two being by him also supposed to be distinct species.

Of the Banteng (*G. SONDAICUS*), or *Tsoing* of the Burmese, (who designate the Gaour as the *Pyoung*,) we possess two frontlets from Java—one of them particularly fine,—also an imperfect skull with horns from Pegu, and a single horn from the Arakan side of the mountain range which separates that province from Pegu,—both presented by Col. Phayre;—together with a flat skin of a calf from Mergui, resembling in colour the Javanese calf figured by Dr. Salomon Müller, who has given four excellent coloured representations of this animal, of different sexes and ages, and profusely illustrated the skulls and horns. For this calf-skin, the Society is indebted to the late Major Berdmore. The species was long ago indicated in Penant's 'Hindustán,' as a kind of wild Ox "with white horns" inha-

biting the Indo-Chinese countries; and our Peguan specimen has remarkably *albescens* horns, while the single horn from Arakan is darker, and resembles the Javanese examples in our museum. The next and more detailed notice which we can now refer, without hesitation, to this species, occurs in Herbert's 'Gleanings in Science,' III, 61. It would appear that a skull and horns of this animal were presented to the Society at its Meeting of February 2nd, 1831;\* "with a descriptive notice by Mr. Maingy; by which it appears, that, when full grown, it is about thirteen hands high, and of a most beautiful red colour, except under the belly which is white. It has no hump, like the cow of India. Altogether, it resembles the red cow of England, but is a much handsomer animal. The bull is a large and fine animal, and, with the exception of having a white forehead, resembles the cow. Mr. Maingy has seen twenty or more of these animals in a herd, but it is a very difficult thing to get a shot at them, as they have a most acute sense of hearing and smelling; one or two appear to act as sentinels, while the others graze or drink. If, in snuffing the air, they find it tainted, off they fly in a moment, with a speed almost inconceivable, considering the form and bulk of the animal."

In the foregoing descriptions, the invariable great white patch on each buttock (whence the name *leucoprymnos* bestowed on the *hybrid* by M.M. Quoy and Gaymard) is unnoticed, as also the dark colour of the old bull: but the alleged "white forehead" of the bull refers doubtlessly to the mass of thickened corneous substance between the horns, which, in our larger Javanese frontlet, is thick and solid enough to turn a musket-ball.† (*Vide* S. Müller's figure of the mature bull.) But, in a notice of "the Burmese wild Cow, or 'Sine Bar,' which appeared in the 'Bengal Sporting Maga-

\* These were not in the museum when I took charge of it in 1841; but only two frontlets from Java, presented by Prince William Henry of the Netherlands (*J. A. S.* VI, 987), one of which has since been forwarded to the India-house museum.

† In our smaller Javanese frontlet (figured *J. A. S.* XI, 490), a portion of this enormously thickened *epidermis* remains attached to the base of each horn, which led Mr. Hodgson to remark, when looking at these specimens as they hung up, that the horns were less approximated at base in the Peguan specimen. However, on close examination, the true base of the horn is seen to be well defined, and the supposed distinction disappears.

zine' for 1841, p. 444, we are informed that "herds of thirty and forty frequent the open forest jungles [of the Tenasserim provinces]. They are noble-looking animals, with short curved horns, that admit of a beautiful polish. The cows are red and white, and the bulls of a bluish colour. They are very timid, and not dangerous to approach. Their flesh is excellent. They are the only cows indigenous to the provinces:"—yet the preceding paragraph mentions "the Bison" or Gaour as "attaining a great size in the East."

Here the difference of colouring of the sexes observable in the Banteng (analogous to what is seen in the Nil-gai and Indian Antelope, and to a less extent in the Gayál,) is noticed; and Sir T. Stamford Raffles mentions, that (as also in the Nil-gai,) "a remarkable change takes place in the appearance of this animal after castration, the colour in a few months becoming invariably red;"\* *i. e.* reverting to the hue of the cow and immature bull. The horns cannot justly be termed *short* in an old bull; but it is worthy of remark that, when full grown, they are flattened only towards the base, considerably less so than in the Gaour and Gayál, wherefore, when but half-grown, only the cylindrical portion of them appears, which has given rise to the reports of wild cattle with cylindrical horns inhabiting the Indo-Chinese territories. As shewn by Prof. S. Müller's figures, the Banteng—though still very Gayál-like in general aspect—approximates more nearly in contour to the cylindrical-horned humpless cattle of Europe and N. Asia, than is the case with its immediate congeners, the Gaour and Gayál; and the increased amount of cylindricality of its horns adds to the resemblance. With much of the general aspect of the Gayál, it has longer limbs, and is less heavy and *Bubaline* in its proportions. There is nothing exaggerated about its figure; the spinal ridge is not more elevated than in *B. TAURUS*, and the tail-tuft descends considerably below the hock-joint. Indeed, this animal has been compared to a Devonshire Ox; but it has nevertheless all the general features of the present group, and is true to the particular colouring, shewing the white *stockings* (like the Gaour and the Gayál, and also not a few Indian Buffaloes). The shoulder is a little high, with some appearance of the dorsal ridge behind the scapulæ, but this slopes off and gra-

\* *History of Java*, I, 111.

dually disappears behind. The rump also is nearly as much squared as in European cattle. Dewlap moderate, with a different outline from that of the Gayál, more as in the *B. TAURUS*. Colour of the calf bright chesnut, with a black tail-tuft, and also a black dorsal line commencing from where the ridge should terminate behind;\* the white stockings having much rufous intermixture at this age. The cows are deeper-coloured, being of a rich light bay; and the old bulls are blackish,—both however relieved by the white on the legs, buttocks, lips, and hair lining the ears, which last are scarcely so large as in the Gaour and Gayál, but of similar shape. The description here given is drawn up from Dr. S. Müller's elaborately careful coloured figures.

The Banteng inhabits Borneo, Jáva, and Báli, and I strongly incline to the opinion that the Gaour, Gayál, and Banteng alike inhabit the Malayan peninsula and Tenasserim provinces; the Gayál, probably, being confined to a certain altitude upon the mountains. Capt. (since General) Low distinctly indicates three species in the Malayan peninsula, besides the Buffalo, in *As. Res.* XVIII, 159. He mentions—"The Bison [Gaour], which is found of a very large size in Thedda, the head [forehead] being of a fawn colour: the wild Ox [Gayál?] of the size of a large Buffalo; and also a species [Banteng?] resembling in every respect the domestic Ox." There is, indeed, the skull of a bull Banteng divested of its horns, labelled "from the Keddah coast," in the London United Service Museum;† and the considerable resemblance of this animal to the humpless domestic cattle of Europe has been mentioned repeatedly. Thus the late Major Berdmore, writing of it from the valley of the Sitang river, remarks—"They are by no means so common here as they are to the south. I have often been in the midst of very large herds of them, and they appeared to me to be very like red domesticated cows." Helfer (no great authority, yet) notices three species of wild cattle, besides the Buffalo, in the Tenasserim provinces. He tells us that—"The great *Bos gaurus* is rather rare, but *Bison quodus* [evidently a misprint for *gavæus*,‡ *i. e.* *Bos gavæus* of

\* This black list is also conspicuous in the calves of both the Gaour and the Gayál, extending both over the dorsal ridge and behind it.

† Figured in *J. A. S.* XI, 470, figs. 1, 2, and 3.

‡ The words may be *written* to look very much alike.

Colebrooke, or the Gayál,] very common; besides another small kind of Cow, called by the Burmese *Fhain*, of which I saw footprints, but never the living animal.”\* He does not mention the Gayál as *domesticated* in the provinces; and I am not aware that any other writer has there noticed it at all. Still, I consider it highly probable that the Gayál, in addition to the Gaour and Banteng for certain, extends to the more elevated regions of the Malayan peninsula.†

The Banteng is the only species of the three which has been observed in certain of the great islands of the archipelago. The existence of a “wild Ox” in Borneo was long ago noticed by Beckman, as cited by Pennant, who also recorded the occurrence of such an animal in Java, and had likewise (as we have seen) obtained intelligence of one “with white horns” in the Indo-Chinese countries. In Java, according to Raffles, “it is found chiefly in the forests eastward of Pásuran, and in Báli, though it also occurs in other parts of Java.” Dr. S. Müller remarks that the Banteng is found in Java in territories which are seldom visited by man, as well in the forests of the plains and of the coast, as in those of the mountains up to 4,000 ft., where it is tolerably common. “We have likewise seen traces of it,” he adds, “in Borneo, and have even received a calf from the Dyáks about a month old. According to Raffles, it is also found in Báli, but in Sumátra it does not appear to exist.” In the N. E. peninsula of Borneo it would seem to be numerous. Thus, in a ‘Sketch of Borneo,’ published in Moor’s *Notes of the Indian Archipelago*, the writer remarks—“During the wet season, the rivers swell and overflow their adjacent shores, and run down with such continued rapidity, that the water may be tasted fresh at sea at a distance of six or seven miles from their mouths. \* \* \* In the dry season the coast, from these overflowings, presents to the eye the richest enamelled fields of full grown grass for miles around. It is at this season that whole herds of wild cattle range down from the mountains of the interior to fatten on the plains, but during the

\* *J. A. S.* VIII, 860.

† The two species of Malayan wild cattle noticed as the *Sapi* and the *Sapan-dang*, in the ‘Journal of the Indian Archipelago’ IV, 354 (as cited in *J. A. S.* XXI, 433), refer, as I am now satisfied, to the Gaour and the wild Buffalo. Dr. Cantor describes the Gaour to be “numerous in the Malayan peninsula,” where known as the *Sapi utan* (literally ‘wild Cow’), *J. A. S.* XV, 273. But he enumerates neither the Gayál nor Banteng in the peninsular fauna.

wet season they ascend to the hills." Hence we gather that the Banteng is essentially a grazer, like the Gaour, instead of being chiefly a browser like the Gayál, which never descends from its mountain forests.

Another writer in the same work states that, in Báli, "the breed of cattle is extremely fine, almost every one of these beasts being fat, plump, and good-looking; you seldom, if ever, see a poor cow in Báli: it is a breed of a much larger size than the common run of [humped] cattle in Jáva, and is obtained from a cross with the wild cow [bull?] with the same animal. They are generally of a red colour, and all of them are white between the hind-legs and about the rump, so that I do not remember seeing one that was not white-breached. The people have no land expressly devoted to grazing; but let their cattle eat their old stubble or fresh grass of the rice-fields, after the crops have been taken off; and while the rice is growing, they let the cattle stray into the commons or woods, and pick up what they can get by the road-side. The rude plough is drawn by two abreast, which the plougher drives with one hand while he guides the plough with the other." This account pretty clearly indicates domesticated Bantengs; intermingled in blood, perhaps, more or less, with the humped cattle; though there is nought to certify such intermixture in the notice quoted, but rather that—as in the case of the Gayál—both wild and tame exist and interbreed occasionally. However, we have the authority of Professor Van der Hoëven that the *Bos leucoprymnos* of Quoy and Gaynard is a hybrid Banteng; and there is a figure of a cow of this mixed race among the Hardwicke drawings in the British Museum, which—as also in the instance of a hybrid Gayál that I saw alive—partook much more of the general aspect of what may be termed the jungle parent. These hybrid Bantengs are known as 'Báli cattle' at Singapore.

The Rev. F. Mason, in his 'Notes on the Fauna, Flora, &c., of the Tenasserim Provinces' (1852), remarks that "a small Ox from the Shan country is brought down sometimes in considerable numbers, which resembles in its form the English rather than the Indian Ox, but is probably derived from the wild race. Occasionally a young wild Ox is domesticated, and brought under the yoke." This notice should have been more explicit. Crawford remarks—"The Ox is

found wild in the Siamese forests, and exists very generally in the domestic state, particularly in the Southern provinces. Those we saw about the capital were short-limbed, compactly made, and often without horns, being never of the white or grey colour so prevalent among the cattle of Hindustân. They also want the hump on the shoulders which characterises the latter. They are used only in agricultural labour, and the slaughter of them, publicly at least, is forbidden even to strangers. Hence, during our stay, our servants were obliged to go three or four miles out of town, and to slaughter the animals at night. The wild cattle, for the protection of religion does not extend to them, are shot by professed hunters, on account of their hides, horns, bones, and flesh, which last, converted into jerked beef, forms an article of commerce with China.”\* Are domesticated Bantengs here intended? The existence of hornless individuals is

\* ‘Mission to Siam and Cochin China,’ p. 430.

The people of Laos “have a great many cattle, very small, which yield scarcely any milk, and which they never think of using. When we told them that in our country the milk of the cow was much esteemed, and that it formed a savoury food, they laughed, and only held our countrymen in contempt.” (Grandjean, in the Chinese Repository, as quoted by Sir J. Bowring). This prejudice against the milk of the cow seems to be common to all the Indo-Chinese nations, and prevails also in China, whilst the Mantchurian Tartars are great consumers of milk. Even the savages of the Nâga hills, bordering on Asâm, reject milk as food, in the belief that it is of excrementitious nature.

In Earl’s ‘Voyage to the Molucca Islands and New Guinea’ (p. 361), we are informed that “Wild cattle are numerous in Timor Laut, of a brown colour, and size about the same as that of two-year old cattle in Holland. The natives catch them with rattan, and also shoot them with arrows.”

The *Tamarao* of the island of Mindoro (one of the Philippines), as I was informed by Mr. Hugh Cuming, is a small bovine species, but fierce and dangerous to attack, of a dark colour, with horns rising at an angle of about 45° from the forehead.” The nearly similar name *Tambadao* is applied in Borneo to the Banteng.

These various wild races and humpless tame races of S. E. Asia and its archipelago demand investigation; and though I have before published in the Society’s Journal several of the notices here cited, it is convenient to bring them together, to save trouble in reference. What animal the following passage refers to, in Mrs. Graham’s work in Ceylon, I am unable even to conjecture; and certainly do not credit the existence of such a creature. At the Governor’s house, this lady “saw, feeding by himself, an animal no less beautiful than terrible,—the wild bull, whose milk-white hide is adorned with a black flowing mane!” The description is explicit enough, so far as it goes, but most assuredly no such animal is known to naturalists; and with the example before us, of what a writer of Bishop Heber’s stamp can make of the Gayál, we may cease to wonder at any amount of vagary of the kind on the part of unscientific observers; though why people of education, who undertake to describe or notice an animal, however cursorily, should make such sorry use of their eyes is difficult to comprehend.

not more remarkable than that of hornless Buffaloes and other domestic cattle; unless in the instance of a race little altered from the wild type. Thus the Italian race of Buffaloes, in which hornless individuals sometimes occur, (*vide* figure of the skull of one in Cuvier's *Ossemens Fossiles*.) is considerably more removed from the aboriginally wild type of the species, than are the domestic Buffaloes of India, among which I am not aware that hornless individuals ever occur. But I have read of hornless Yaks; and instances have been known of hornless individuals of different species occurring even in the wild state: a tame Springbok of this description was long in the possession of the Empress Josephine. By specially breeding from such animals, a race of them could be readily established.

In Sumátra, as in Jáva, the ordinary domestic Taurine cattle are humped, small and of inferior quality: but, according to Sir T. Stamford Raffles,—“There is a very fine breed of cattle peculiar to Sumátra, of which,” he remarks, “I saw abundance at Menang Kabu, when I visited the capital of that country in 1818. They are short, compact, well made animals, without a hump, and almost without exception of a light fawn colour, relieved with white. The eyes are large and fringed with long white lashes. The legs are delicate and well shaped. Among all that I saw I did not observe any that were not in excellent condition, in which respect they formed a striking contrast to the cattle generally met with in India [*i. e.* S. E. Asia and its archipelago. India *proper* is styled “Western India” by Crawford]. They are universally used in agriculture, and are perfectly domesticated. This breed appears to be quite distinct from the Banteng of Jáva and the more eastern islands.”\* What, then, is it? The remark that these beasts are “perfectly domesticated” would hardly have been made of any race appertaining to the humped or to the ordinary humpless type, but seems to imply that the writer regarded it as a peculiar species, as does also his statement of its distinctness from the Banteng.

In the ‘Journal of the Indian Archipelago,’ II, 831, is a notice of the existence of wild cattle in Celebes; but I suspect that the small *Anoa* Buffalo (*BUBALUS DEPRESSICORNIS*) is intended. In an account of the province of Minahassa, it is there stated that—“wild Cows

\* *Lin. Trans.* XIII, 267.

ere also found here, principally in the higher parts of the mountains ; but they bear little resemblance to the Banteng of Jáva ; are below the middle size, yet possess, notwithstanding, an incredible strength." Just possibly an undescribed Taurine may be here indicated.

While illustrating the domesticability of all the flat-horned Taurine cattle indigenous to S. E. Asia, it is not disputed that some species of animals are more easily tameable than others ; for instance, the American as compared with the European Bison (by all accounts), or even the domestic humped bull as compared with the domestic European bull. It may be from more thorough association with mankind, from its youth continuously, but it rather seems from constitutional difference (still the result, perhaps, of countless ages of such complete domestication), but the fact is undeniable that the humped bull is far more gentle and tractable than his European compeer ; being much more completely in subjection, and hardly (if at all) influenced by those paroxysms of sexual excitement which seem to be as irrepressible as ineradicable in the entire males of most other ruminants. It must be conceded, however, that the European bull is rarely subjected to like conditions,—so much inured to constant handling, and governed by a cord passed through his *septum narium*. But the fact remains (as attested by daily observation) that, under existent respective conditions, the humped bull is—as a general rule—by far the more gentle, tractable, and inoffensive animal of the two.

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Since writing the above, I have seen Professor Isidore Geoffroy St. Hilaire's essay ' Sur les Origines des Animaux Domestiques,' 2nd fragment, published in the "*Bulletin Mensual de la Société Imperiale Zoologique d'Acclimation*," III, 496. Of the Zebu, or humped Ox, he remarks, that in ancient times it was doubtlessly much less diffused over the *East* than at present. " Herodote qui avait voyage en Orient, Aristote qui connaissait si bien l'Egypte, la Perse et l'Inde, parlent à plusieurs reprises des Bœufs de l'Orient et des particularités de leur organization, jamais de leur bosse. Pour Herodote, voy. surtout liv. II, III, et V. Je ne trouve pas davantage le Zebu dans 'Ælien and dans Athenée. Ou contraire, Pline (liv. VIII, LXX,) mentionne son existence en Syrie et en Carie. \* \* \* Aristote dit d'ailleurs formellement,

dans un autre passage (liv. II, 1),—“ Une chose qui n'appartient qu'au Chameau, *entre tous les quadrupeds*, c'est qu'il a une bosse sur le dos.” (Trad. déjà citée de Camus, p. 59.) Donc Aristote ne connaissait pas le Zébu.”—The frequent representation of the humped bull on Indo-Bactrian coins at once recurs to mind: but I have been favoured with the following note respecting the antiquity of the humped bull in India, by our joint-secretary Mr. E. B. Cowell.—“ In reply to your query,” he remarks, “ I find that a humped bull is expressly mentioned in the tenth book of the Rig Veda. This is generally considered to be a later book than the other nine,—but it is certainly much older than the Bactrian kingdom, not later, at least, than *B. C.* 900 or 1000. The passage occurs in the 10th Mandala, 8th Anuváka, 2nd Súkta;—I am sorry to say we have no commentary in the Society's library, and the printed edition has only completed the former half, so that I cannot exactly determine the entire sense of the passage, but part of it is clear enough—that the god of fire is described as rushing along in his course roaring like a humped bull. The words *vrishabhah kakudmán* (here used) are the common terms, which of course occur frequently enough in the later Sanskrit authors. The comparison of Agni (the god of fire) to a bull occurs very often in the earlier books of the Rig Veda, but I don't remember any mention of the hump.”

It is remarkable that the humped cattle were common enough in ancient Egypt, though unknown in the valley of the lower Nile, or even northward of Abyssinia at the present time. According to Sir J. Gardner Wilkinson, the cattle of the ancient Egyptians “ were of different kinds, of which three principal distinctions are most deserving of notice; the short, the long-horned cattle, and the Indian or humped ox; and the two last, though no longer natives of Egypt, are common to this day in Abyssinia and Upper Ethiopia.” *Domestic Manners of the Ancient Egyptians*. III, 33. For an unmistakable figure of the humped species, vide p. 19, f. 5; though the European type is more commonly represented in Wilkinson's copies, and often the calf frisking about beside its dam, as in 1, 48. Even here the difference of the two species is characteristic; for the humped cattle, when at play, recurve the tail over the back in a remarkable manner; instead of its being held straight out, or assuming the Bisontine bend,

straight for the basal half and then downward, as shewn in the figure cited. Any one accustomed only to the sight of European or humpless calves at play, cannot but feel some surprise, at first, on witnessing the mode in which the humped species carries its tail; and the propensity of a humped calf to run thus before or beside a horse in harness, and to accompany it for a considerable distance along the road, is a fact of daily observation in this country.

*(To be continued.)*

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*Literary Intelligence.*

The Aynuhi 'Bukht' *بکھت* is a work which is not, at all events under this title, mentioned in Elliott's *Historians*. Mr. E. C. Bayley has sent us a copy of the Preface and conclusion of a MS. of it, which has come into his possession. Its author is Bukhtawur Khan, and its date of composition A. H. 1127. The writer brings down the history of the Moghul dynasty from Baber to Aurungzeeb, but we have not yet ascertained from what materials he has drawn his narrative—nor indeed who he was. A copy of the work is being made for the Society's Library.

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The following extract from a letter from Lucknow promises information of great interest from perhaps the most classical spot in India.

"Rajah Man Singh has drawn up an account of the divisions of ancient Ajoodhia which I have asked him to give to the Society. He says there were three, viz. "Poorub Rasht," "Puchim Rasht" and "Uttur KOSALA!" The latter being the modern *Gonda Boraitch*.

He declares also that there were eventually two Buddhist kingdoms which sprang up on the decline of the Ajoodhia Raj—one of

these was at "Sahet Mahet," where he says there are a tope and ruins between Ekowna and Bulrampore. The other kingdom was at Benares—they sprang he declares from the Mourya line of Palibothra.

The most celebrated king of the Sahet Mahet race was "Sohil Deo" slain by Syud Salar, the celebrated general of Mahmood of Ghuzni. The last was "Ram Deo" who fell in battle with Mahomed Ghori three generations later.

He has too given me a hint. He says the copper coins with Lion reverses belong to *Ajoodhia*, the bull and cock coins to Sahet Mahet (king's titles "Mittra and Deo" both) and the Benares kings he says had a trisul as their symbol.

He has given me also an account of a tope near Sultanpore.

Further more he says that in building Sañkatá Ghat at Benares a "lath" larger than that at Allahabad was dug up, but that the barbarians chipped off the letters, and built it into the foundations where it still exists and is visible.

He promises to send me two inscriptions or rather manuscripts in modern Sanscrit, and I have ordered for him a transcript in large letters of Thomas' comparative table of the Devanagari."

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We are glad to find that there is a prospect of Dr. Sprenger's carrying out his project of publishing Maqdisiy in the Bibliotheca Indica. It will be remembered that he proposed this undertaking when in Syria in 1854, (See Journal, Vol. XXIV. p. 47,) and that the Society closed with the offer at its meeting in May, 1855, but that on Dr. S.'s return to Indian he found the Oriental Fund so reduced in resources as to render it unadvisable to proceed with the publication. The subject dropped, and in the following year Dr. S. left the country. He now renews his offer from Berne, and we earnestly hope that the arrangements now being made to give effect to it will be successful.

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The following is extracted from a letter from Professor Wright of Dublin to Dr. W. N. Lees, dated March 19th, 1860.

Just now the Government and the mass of the people (led by Trevelyan, Monier Williams, &c.) are possessed with a rage for Romanizing the Oriental characters, and anglicizing the Hindu races, and what not, the result of which, so far as I can see, is, that Oriental learning will sink among us still lower than it is, that we shall have lots of bad Hindustani translations of English books, and that the native literature, which is really useful in a *historical* point of view at least, will be utterly neglected. Your Asiatic Society must bestir itself and try to save what it can. For myself, I am working at the 2nd vol. of the Arabic Grammar, and after that, I shall probably edit a reading book with a complete glossary. Besides, I have on hand, an English Hindustani Dictionary, which I am compiling from my own reading and the best published sources I can get. Have you seen Ahlwardt's onslaught on the fame of Von Hammer, entitled "Chalefelahmar's Qasside von W. Ahlwardt, Greifswald, 1859"—a good book, as is also his edition of an historical work with the title "El Fachri, Geschichte der islamischen Reiche...von Ibn Etthiqthaqa...von W. Ahlwardt, Gotha, 1860." Further there is the 9th fasciculus of Juynboll's *مراصد الاطلاع* containing the introduction and the notes to the first 2 fasciculi (588 pp. and cviii. pp.)...Vüller's Persian Lexicon goes on slowly,—I have seen 6 fasciculi in 8 parts as far as *قيوند*...Possibly you may not have seen Chwolson "uber die Ueberreste der altbabylonischen Literatur in Arabischen Uebersetzungen," a most extraordinary work and very interesting, if one could only believe it all. Yet Chwolson is a good and cautious scholar (as his "Ssabier in d. Ssabismus" shows), and has studied this particular branch of the Arabian literature more than any man alive. The chief work is the *Agricultura Nabathæorum* (الفلاحة النبطية) along with the translations by *ابن وحشية*.

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A letter from Dr. Sprenger dated last October, an extract from which is published in the last No. of the Zeitschrift, announces the result of his examination of the MS. of Wákidy's Mugháziy in the British Museum. Though an imperfect one, this MS. contains a third more of matter than the text published in our Bibliotheca by

M. Von Kremer. It is to be hoped that Dr. Sprenger, who has for the furtherance of his own Biography made a copy of the additional matter, will enable our Philological Committee to bring out a 4th or Supplementary Fasciculus of M. Von Kremer's edition.

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Extract from a letter from Professor Holmboe, Christiania, to Baboo Rajendralal Mittra.

“Dans la dernière mémoire,\* j' ai démontré que deux médailles d' or qui ont été découvertes dans deux tombeaux payens en Norvège, ont des types et des légendes, qui sont des imitations de médailles Ariennes. J'y ai encore prouvé, qu' un grand nombre de bractéats (lames avec empreintes à l'un des côtés) d' or ont emprunté leurs types de représentations de Siva ou de Dourgâ de la mythologie Indienne. Comparez par exemple la position du bœuf sur le bracteat scandinave No. 7 de ma planche I. avec le bœuf des sculptures de Mandore et de Java sur ma pl. II. Et les croix mystiques qu' on voit si souvent au commencement ou à la fin des inscriptions anciennes de l' Inde se présentent sur une vingtaine des bractéats surnommés. A la page 201 j' ai encore comparé d' autres symboles, qui se voient moins souvent sur nos bractéats, et qui se trouvent également sur des médailles de l' Afghanistan et de l' Inde.”

\* In the last No. of the Transactions of the Christiania Society.

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PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR JULY, 1860.

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The Monthly General Meeting of the Asiatic Society was held on the 4th Instant.

A. Grote, Esq., President, in the chair.

The proceedings of the last Meeting were read and confirmed.

Presentations were received—

From the Madras Government, Selections from its Records No. 64 (containing Report on the Agricultural Exhibitions in the provinces in 1859).

2. From the Government of India, Home Department, a copy of a work containing No. 27 of the Appendix of the Bombay Government record.

3. From the Municipal Commissioners, a copy of their report for 1859.

4. From His Royal Highness the Prince Consort, through Alexander Murray, Esq., of Edinburgh, a remarkably fine stuffed head, with horns, of the Scottish Red Deer with the 'cup' of 'royal crown' to the horns and the tines complete. "This animal was killed by his Royal Highness, the Prince Consort upon Locknagaar on the 8th September, 1859. Weight after being cleaned out 16st. 12lbs." Some further particulars about the specimen are given in the Curator's report.

On the motion of the President, a vote of thanks was unanimously accorded to His Royal Highness for this valuable addition to the Society's collections.

5. From J. F. Galiffe, Esq., two living specimens of the large Gecko Lizard, *Tokki or Toktu*, (*Platydaitylas Gecko*) captured at Russa near Calcutta.

6. From Baboo S. S. Ghose a large Medusa cast ashore at Diamond Harbour apparently of the genus *Cephia* of person, but the appendages mutilated of all but their peduncles.

7. From Baboo Rajendra Mallik various eggs laid in his aviaries; also, for exhibition to the Meeting, a stuffed specimen of a newly discovered species of Cassowarry, at present unique; five species of this remarkable genus being now recognised, of which two have been first brought to notice within the present year.

The following gentlemen, duly proposed at the last Meeting, were balloted for, and elected ordinary members.

Rajah Bunsput Singha.

A. B. Sampson, Esq.

W. Grey, Esq.

J. P. Grant, Esq. Jr.

Dr. B. Simpson.

G. H. M. Batten, Esq., B. C. S.

E. G. Mann, Esq.

L. F. Byrne, Esq., C. E.

George Shelverton, Esq., and

Syud Ahmed Khan.

The following gentlemen were named for ballot as ordinary members at the next Meeting.

Dr. A. J. Payne, Superintendent of the Insane Hospital; proposed by Mr. F. L. Beaufort, seconded by Major Thuillier.

Captain C. M. FitzGerald, Deputy Commissary General; proposed by Major F. D. Atkinson, seconded by Mr. Atkinson.

T. E. B. Judge, Esq., proposed by Mr. Atkinson, seconded by the President.

The Council reported that they had added Col. Baird Smith and Dr. H. Halleur to the Committee of Meteorology and Physical Science.

The President proposed the following resolution:—

Resolved that the Meeting desires to record its sense of the heavy loss which the cause of Oriental literature has sustained by the death

of Professor H. H. Wilson, and to express at the same time the sincere and affectionate regrets with which this Society finds itself deprived of the advice and assistance of its oldest and most distinguished member.

In moving this resolution, the President spoke as follows:—"I need scarcely remind the Meeting that since we last met the mail has brought us the announcement of the death of a very old, indeed our oldest Member. Horace Hayman Wilson, late Boden Professor at Oxford, died in London on the 18th May at the advanced age of 73 after a connexion with our Society of more than half a century; for he joined us immediately on arriving in this country in 1808, a period at which we had only just established ourselves in the building in which we now sit. Colebrooke was then our President, and Hunter had been our Secretary with a short interval from 1798, so that by his succession to Hunter as Secretary, in 1810, Wilson has a title to be ranked among our earliest office-bearers. He filled the Secretaryship for 22 years; in fact until his retirement from India in 1833; and during this long period he devoted himself almost exclusively to the study of the Sanscrit classics. His first work was the translation of the *Megha Duta*, and in 1819 he brought out the first edition of the first Sanscrit and English Dictionary which had been compiled. He then published his *Selections from the Hindoo Drama* and the catalogue of the *Mackenzie MSS.*, and was, when he left this country, engaged on his analysis of the *Purans*, four of which he completed before his departure, and the original MSS. of which are all in our Library. These works, however, were by no means all his contributions to Oriental literature. One of the most important papers which has appeared in our *Researches* was written by him in 1825; I allude to his *Essay on the Hindoo History of Cashmere*, which, with other papers, helps to make Vol. XV. of our *Researches* the most interesting, perhaps, of the series.

The address which was presented to Wilson by our President, Sir E. Ryan, and his Vice-Presidents, Drs. Mill and Tytler in December 1832, shows how fully our Society then appreciated the loss which it was about to sustain of his eminent services, while his answer evinced the unabated interest in our Society's proceedings which he was carrying away with him.

At our request he kindly consented to act, as Colebrooke had for some years acted, as our London agent, and it was in this capacity that he so successfully pleaded our cause with the late Court of Directors and obtained for us the monthly grant which now forms our Oriental Fund. The correspondence which we had with Government and with Wilson himself in 1856 is a sufficient proof that he wished still to take a part in our deliberations for appropriating this grant; and it must be a source of gratification to us now to feel that in bringing out the Persian historical texts which we have lately resolved on undertaking, we shall be working more than we were a few years back in the special direction in which he wished to lead us.

What Wilson had been to our Society during his stay in this country he has since his return to England been to the Royal Asiatic Society which Colebrooke had founded ten years previously. Whether as President or Director, he has been its moving spirit at least on all occasions on which Indian subjects were to be dealt with. Besides his contributions to the transactions and Journal of that Society he found time to bring out a further edition of his Sanscrit Dictionary, "Ariana Antiqua," a work of the greatest archæological and historical value, a Glossary of Indian terms, and a continuation of Mill's History of India up to Lord William Bentick's administration. His introduction to the Sanscrit Grammar is known to every student of the language, and his edition of his old fellow-passenger, Moorcroft's Travels in the Himalyan provinces, to every geographer. The last work on which he was engaged was the translation of the "Rig Veda," and his determination himself to effect its completion is strikingly shown by the way in which he has anticipated Müller's edition of the Text. Wilson died a few days only before the 37th Anniversary Meeting of the Royal Asiatic Society. He had when vacating the Presidentship of that Society in 1858, and acknowledging the usual resolution of thanks which Mr. Marshman had moved, and in which a hope was expressed that he would soon re-occupy his proper post, made a touching allusion to the improbability of his surviving the interval which must by the Rules of the Society precede his re-election.

What little I have said does not profess to approach to an ade-

quate notice of so indefatigable a man and so complete a scholar. It is intended only to preface the Resolution which I hold in my hand, and to which I am going to ask the assent of this Meeting.

Communications were received—

From J. Obbard, Esq., a paper on the “Translation of waves of water with relation to the great flood of the Indus in 1858.”

2. From T. Oldham, Esq., extracts of letters from J. L. Stewart, Esq., M. D., 14th Punjaub Infantry employed with the expedition to the Wuzeeree country :—

“I generally pick up a bit of stone here and there, but as I have made no arrangements for the carriage of such heavy goods, I am obliged to be contented with very ‘wee bits’ which I suspect would be much too minute to be of use to you. Next time, if I have another chance, I purpose making better arrangements in this respect. Near where we have been encamped recently, blocks big and little were abundant (I nowhere have seen it in strata or in situ) of a calcareous rock crammed with corals, echinide mata (?) and shells of various species, some not uncommon, but I have not seen a trace of vegetables or of higher animals. This doubtless partly depends on my want of practice. Almost all these are, however, too bulky for my means of stowage.

“The expedition started from Ták (to the N. W. of Dera Ismael Khan) and hitherto we have been advancing up the bed of a small stream called the Zam. We have only come 24 miles from Ták, but will go on to the central city of the Wuzeerees (Kanee-gorn) some 25 miles apparently, to the west, on a mountain which ought to be near the watershed of what here represents the “Suliman” range. The mountain has been calculated from a distance as upwards of 11,000 feet, but as yet although we rise very considerably with the slope of the bed of the Zam, we have gained no great elevation. The stream cuts through the ridges crossing them, and gives numerous sections, as do the innumerable ravines and gullies.

“For the first ten to twelve miles from the plains the rocks were all soft standstones and conglomerates alternating, at first dipping to the west mostly at a low angle, and presenting a steep escarpment towards the plains of Ták on the east, latterly dipping to the east and contorted variously at varying angles. We then came on cal-

careous strata and for the last five or six miles the rocks are mostly of rapidly disintegrating strata, red, greenish, and with salt efflorescing on the surface. Amongst these, which on the surface become earthy masses, are some nummulitic beds alternating with non-fossiliferous grey limestone and strata of sandstone and grit, often vitrified and darker coloured externally. All these dip to the east at all angles varying from  $1^{\circ}$  to  $90^{\circ}$ , but mostly from  $15^{\circ}$  to  $45^{\circ}$ , roughly speaking, amongst them are a few thin beds of flint. The masses with corals lie about on the surface and in drift masses, in something like a line parallel to these strata.

“Upon the lower parts of these inclined strata in many places are plateaux of gravel having amongst it large vitrified-looking blocks. These plateaux are of several acres in extent, and from 50 to 100 feet above the bed of the stream. Occasionally below that, and a few feet above the stream, are patches of alluvial soil cultivated by the inhabitants, apparently very fertile.

“The day following we made a march of  $4\frac{1}{2}$  miles up the Zam ravine, till we came to a *tangai* (a ‘tightness’ as they call their passes in Pushtu) beyond which the General considered it advisable not to go that day. The strata composing the hills on either side, so far as they were not obscured by the horizontal shingle beds, appeared to consist mostly of a brownish limestone alternating with beds of the coloured disintegrating shales, the latter far exceeding the former in quantity, all dipping to south-east at moderate angles.

“In front of us, the stream came through a narrow gorge between a height of perhaps 200 to 250 feet, composed of a light coloured limestone with numerous veins of calcareous spar running in all directions through it. Its strata considerably waved, and with a low dip to the north-west. The strata of these heights seemed at the point of junction to overlie the coloured strata, but I had not an opportunity of getting close to the point.

“The 4th was rather a momentous day, and I had not much time for dawdling and looking about, as some five miles up, the Wuzerees stood, and *the* fight of the expedition came off.

“After we passed through the *tangai* the strata were mostly of greyish non-fossiliferous limestone overlying unconformably beds of the coloured shales. The uppermost beds of the limestone here had a

character, which I had occasionally remarked before, of 'tessellation,' that is, were divided into little quadrilateral blocks, the upper edges of which were rounded.

"Beyond the Barrarra pass, where the fight took place, the lower strata visible were the coloured disintegrating beds, generally at a high angle with dip to south-west; the higher hills of the waved limestone dipping to S. W. at a *low* angle.

"On the 5th, we made a march of 15 miles, notwithstanding our many wounded, to Kaneegorm, and the flora was so new, that I had not much leisure for looking at the rocks. Our camp at Kaneegorm was trigonometrically 6,700 feet above the sea level, and we probably rose more than 2,500 feet in that march.

"We gradually appeared to leave the limestone rocks, although (occasionally) the coloured rocks were seen overlaid by limestone, and got among hills composed of slate in very thin beds, mostly and frequently with markings of angle (?) over their surface. These slate strata were frequently contorted and wavy.

"For the last two days the quantity of granitic stones among the gravel, was very much on the increase. About and below Palasin; (the place whence I wrote my last letter,) hardly a bit of granite was to be seen; here the shingle is almost entirely granitic.

"6th halt.—7th.—I went with the survey party to the top of a hill to the S. S. W. some six miles off, and 1600 feet higher than the Kaneegorm camp. The strata on the way appeared mostly of what looks like a thin bedded sandstone (?) generally dipping to N. W. at pretty high angles.

"Our road up to Kaneegorm had lain still in the bed of the Zam ravine, and latterly in that of one of its tributaries. As we got near the centre of the range here the streams became quite small.

"On the 8th, we marched eight miles down the stream on the same road by which we had come, and then I had more opportunity of noticing that in a general way the ranges run north and south, and that the strata, although occasionally horizontal and often contorted, are generally at an angle of about 45°, with the dip to the west (W. N. W). The beds are mostly thickish and of slaty rock, with occasional strata of bluish disintegrating schistose structure.

"There were, however, but few sections to be seen on account of

frequent masses of horizontally deposited shingle, mostly granitic, or of the above rocks. Further down, the upper strata appear generally the grey contorted and waved slaty, overlying and hardly conformable with the thinner bedded blue slaty rocks.

“10th.—We left the road by which we came up, and diverged to the northward some five miles. The strata mostly of the thick bedded grey slaty rocks, contorted, and at varying angles, and dip generally not far from horizontal.

“Here we were within a mile of another central cluster of their villages called Makin and the nearest point to which we got to the central mass of this range of hills called Pirghar or Ghal, points of which towered some 2000 to 4000 feet above us. Where the stratification can be seen, as in the nearer masses, it appears nearly vertical and bent.

“On the 11th with one of the covering parties of a burning expedition to these villages, I got on a ridge somewhat nearer to Pirghar. The surface of this ridge is mostly composed of shingle, granitic, and very rarely slaty grey rock visible *in situ* nearly vertical.

“On the 12th a march of eight miles, still northerly, up a bank bed, and camp at about 7300 feet; the highest camp we had. Just on reaching camp passed a number of strata of the algæ, marked, thin, bluish, hard, shaly strata overlying beds of the thick, vitrified looking rock. I mentioned before, both at a high angle dipping to the west. The general disposition of the grey slaty rock we saw is, however, nearly horizontal, with a slight dip to east. Most of the valley in which we progressed was a mile wide, and occasionally more, filled up by horizontally disposed shingle beds, our road being up the bed which the stream has cut through these.

“14th.—Marched five miles still to northward. For  $1\frac{1}{2}$  miles we rise, then down a steep rocky ravine; rocks mostly shaly, and the vitrified looking varieties generally at high angles, dip to east; some of the strata occasionally much contorted.

“For days, evidences of the Iron manufacture for which Kanegorm has long been famous had been visible, such as furnaces and slag, &c., with occasionally, in villages, stores of iron stone. None of the latter, however, did I happen to see. Here I thought we

must be near the ore, and made some efforts to get at some place whence they dig it, but am sorry to say, failed.

“15th.—We went more to eastward descending towards Bunnoo in the ravine of the Khyssor stream. The rocks mostly slaty, and the ‘vitrified’ at high angle dip to the west, and often covered by horizontal shingle beds to 50 or 60 feet, which obscure matters greatly, so that sometimes for a mile or two no rock *in situ* could be seen. The lower beds of this shingle are here occasionally consolidated into conglomerate.

“16th.—The strata, mostly of the dark “vitrified” surfaced rock, generally at about 45° dip to west. Then a grey rock with white streaks (limestone) nearly horizontal and contorted, then with a strong dip to west and still contorted; occasional shaly beds.

“17th.—Halt. Here we were in a region of plateaux of the horizontally laid gravel with, a mile or two to south, the western termination of a flat sloping hill with the strata dipping slightly to the east.

“18th.—A mile or two on we pass through the gorge formed by the stream crossing through the end of the above hill, which is of non-fossiliferous limestone. This appears to be near the geological ‘level’ of Palasin; for here, also, there are numerous heaps of the black decomposed rock we had there, with other particoloured debris: vertical strata of the white non-fossiliferous limestone. Numerous blocks of the coralline (?) rock seen lying about, but I could not get near any of them. Nummulitic blocks and pebbles numerous among the shingle. Then after about a mile of these heaps of coloured debris we go through a gorge formed by nearly vertical ridges of dark coloured hard sandstone, followed by sandstone strata also at a high angle (dipping to east) with one or two strata of conglomerate. Blocks of the dark superficially vitrified stone profusely strewn over all the heights.

“On the 19th a mile and a half carried us from among these low ridges into the Bunnoo plain, here stony, mostly uncultivated, and sloping from the hills.”

In forwarding these extracts, Mr. Oldham writes as follow:—

*Nainital, June 9th, 1860.*

MY DEAR GROTE,—I enclose you a brief extract from a note received from Dr. Stewart of the 14th Punjab Infantry, who is at present with

Chamberlain's expedition against the Wuzerees. Dr. Stewart is devoting his leisure moments, principally to botanizing, I believe, but he has in his note given some geological details which are of great interest. It has hitherto been supposed that the rocks representing the Siwalik group extended very much further to the west from the plains of upper India, even beyond the Ghilza range, but this note shews the occurrence of nummulitic beds within a very few miles of Ták.

The soft sandstones and conglomerates are, I think, clearly the Siwalik group, and probably the upper portion of this enormously thick series. The physical structure of the hills there, also, appears to correspond with that of the Siwalik hills here. They run to the N. W. presenting a scarp to the plains of beds dipping sharply into the hills. The calcareous beds associated with red, greenish, and white shaly beds rapidly disintegrating into earthy masses seem to represent the lower part of the nummulitic series; at least this is the general character of that part of the group in these hills. The layers of *chert* or flint are frequent here as there. If this conjecture be correct, it must follow that there, as here, a great fault separates these two series.

The remarkable fact of the streams cutting across the ridges of the outer or Siwalik rocks is abundantly paralleled here too, and nothing is more striking on passing up the river gorges here than the marked plateaux or terraces of gravelly detritus which occur at various levels, such as are noticed in Dr. Stewart's note.

I sincerely hope to have further information from the writer of the interesting note regarding a country of which we know so little.

Yours sincerely,

(Signed) T. OLDHAM.

Since forwarding the above notes, specimens of the iron stone used on these hills has been received from the Government of the Punjab, and submitted to assay in the Geological Survey Office, Calcutta. The results are as follow.

The specimens consist of samples of a rock which is itself composed of iron ore in two distinct conditions.

(a) One portion is a common hydrous peroxide of iron containing 40.4 per cent. of iron.

(b) The other is a similar mineral mechanically mixed with carbonate of lime, in small quantities, the mass containing 31.8 per cent. of iron.

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LIBRARY.

The following books have been added to the Library since June last.

*Presented.*

General Report of the Municipal Commissioners of Calcutta for 1859.—  
BY THE COMMISSIONERS.

Selections from the Public Correspondence of the Punjab Government, vol. IV. Nos. 4 and 5.—BY THE GOVERNMENT.

Selections from the Records of Travancore. Part I. (containing Memoir of Travancore).—BY THE MADRAS GOVERNMENT.

The Oriental Christian Spectator for May.—BY THE EDITOR.

Bibidharta Sangraha for the month of Kartick.—BY THE EDITOR.

Selections from the Records of the Madras Government, No. 64, (containing Report on the Agricultural Exhibitions in the Provinces in 1859).—  
BY THE MADRAS GOVERNMENT.

Proceedings of the Academy of Natural Sciences of Philadelphia from October, 1859, to February, 1860.—BY THE ACADEMY.

Proceedings of the Royal Society of London, Vol. X. No. 38.—BY THE SOCIETY.

Description of a deformed fragmentary human skull, found in an ancient Quarry cave at Jerusalem.—BY J. Aitken Meigs, M. D.—BY THE AUTHOR.

*Exchanged.*

The Athenæum for April, 1860.

Journal of the Academy of Natural Sciences of Philadelphia. New series, Vol. IV. Part 3.—BY THE ACADEMY.

Zeitschrift der Deutschen Morgenländischen Gesellschaft. Band, XIV. Heft I. and II.—BY THE SOCIETY.

The Philosophical Magazine for May, 1860.—BY THE EDITORS.

*Purchased.*

The Literary Gazette, Nos. 95, 96, 97 and 98.

Comptes Rendus, Nos. 15, 16, 17 and 18 of Tome L.

Revue des Deux Mondes, Tomes 26 and 27.

Annales des Sciences Naturelles, Tome XII. No. 2.

Journal des Savants for April, 1860.

The Natural History Review, No. 26.

The Annals and Magazine of Natural History, Vol. V. No. 29.

Die Leider des Hafis, Vol. II. Part 4.

Vendidad Sadé, VI. Livarison.

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FOR AUGUST, 1860.

At a meeting of the Society held on the 1st instant, A. Grote, Esq., President, in the Chair.

The proceedings of the last meeting were read and confirmed.

Presentations were received—

1. From C. Hobhouse, Esq., C. S., nine silver coins found in May last year, in throwing down one of the old Embankments on the right bank of the river Damoodah in Pergunnah Hubilee of the district Hoogly. These coins are of the last century, from the Moorshedabad mint.

2. From Michael M. S. Dutt, Esq., a copy of his work named "The Birth of *Tillottoma*," being the first epic poem in blank verse in the Bengali language.

3. From the British Indian Association, a copy of their Report for June last.

4. From C. J. Evans, Esq., Calcutta, frontal portion of skull of an African baboon, probably *Cynocephalus hamadryas*, found by himself in the dry well of the pyramid of Cheops. The specimen is quite recent.

5. From the Rev. H. Baker, Junior, of Mandakyam, Alipee, S. Malabar, skins of *Sorex marinus* and *Sciurus trilineatus*.

The following gentlemen, duly proposed at the last meeting, were ballotted for and elected ordinary members :—

Dr. A. J. Payne; Capt. C. M. Fitzgerald, and T. E. B. Judge, Esq.

The following gentlemen were named for ballot at the next meeting.

W. Forbes Goss, Esq., proposed by Mr. Medlicott, and seconded by Mr. W. Blandford.

Major T. James, Bengal Army, proposed by Dr. Crozier, seconded by Mr. W. S. Atkinson.

The Council reported that they had nominated Major H. L. Thuillier a member of their body and also a Vice-President of the Society in the room of Col. Strachey, who has left India.

Communications were received—

1. From Lieut. Col. A. Phayre, Commissioner of Pegu, a paper entitled "Remarks upon an ancient Buddhist Monastery at Pu-gân on the Irrawaddy."

2. From Dr. J. L. Stewart, 14th Punjaub Infantry, a Journal of a Botanical Tour in Hazara and Kháján in April and May, 1859.

Extracts from this paper were read to the meeting by Dr. Thomson.

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JOURNAL  
OF THE  
ASIATIC SOCIETY.

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No. IV. 1860.  
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*Is the Pushto a Semitic Language?—By the Rev. ISIDOR  
LOEWENTHAL, Peshawur.*

Error is immortal. The old fable concerning Hercules and the Hydra has doubtlessly a typical reference to the quixotic bouts men sometimes undertake against error; only seven heads is too small a number to typify the vitality of a good blunder, the longevity of a plain definite mistake. The fable, too, makes Hercules victorious; but who has ever seen the successful gardener that has really extirpated a weed which once has taken root in his grounds? This ineradicability may be predicated of any error, but necessarily most so of such as appear to rest on the authority of a great name, and are brought forward now and then by those who have in some way or another acquired the reputation of being authorities. This is very provoking. Is it really so that men love darkness rather than light?

More than seventy years ago the first President of the Asiatic Society of Bengal happened to state that the Pushto language had a manifest resemblance to the Chaldaic. There is evidence in the earlier volumes of the "Asiatic Researches" that some attention was paid in Calcutta to the Pushto language in those days, but, it appears, more for literary than philological purposes. At all events the statement of Sir William Jones remained uncontradicted and unchallenged for many years. In Germany even the opinion gained currency through Kleuker (the earliest German translator of the Zend Avesta)

who published (Riga 1795) many of the articles of the "Asiatic Researches" in a German translation.

Klaproth, however, the distinguished traveller and orientalist, as early as 1810 vigorously attacked this opinion in the first volume of the Archives for Asiatic Literature, and dated his conviction that the Pushto is an Indo-Germanic language. In 1826, when he published his *Tableaux Historiques de l'Asie*, he held the same view.\*

In 1814, Elphinstone, in his "Account of the Kingdom of Cabul" also dissented from the opinion of Sir William Jones, and stated positively that of 218 words of those in common use which he had examined, not one had "the smallest appearance of being deducible from the Hebrew or Chaldaic."

In 1829, Dorn, professor of Oriental languages at the University of Charkow, then young, but already distinguished for his attainments in Eastern Literature, in his translation of Neamet Ullah, maintained that there was not the least resemblance between Pushto and Hebrew or Chaldee. He adduces three words that had been referred to as proving a connection between them:

ابا *father*, compared with the Chaldee st. emph. אבא

اخستل *to take*, with the Hebrew אָחַסְתָּ

ارخ *the side*, with the Hebrew אָרַח

He simply says that these prove nothing. And he is correct; but it may be added that the word *abá*, *abbá*, or *apá* means "father" in considerably more than thirty distinct languages (v. Buschmann, *Ueber den Naturlaut*, p. 16, which list is very far from being complete), so that such a word would have to be entirely excluded from any evidence; that the Infinitive اخستل (*ákhistal*) is deceptive, the root being اخل (*ákhāl*), bearing the same relation to the Infinitive that the Persian گسل does to its Infinitive گستن, and that it is most probably connected with the old Persian آختن "to draw out," "take away;" whilst ارخ (*arḥ*) is undoubtedly the Sanskrit उरस् (*uras*) "breast;" the slight shifting of the signification finds its exact counterpart in the Sanskrit पार्श्व "the side" as compared with the Polish *piers'* "breast;" the pronunciation of the Polish *s'* is precisely

\* Does Captain Raverty mean any pleasantry, when, in his *Pushtoo Grammar*, he "hopes the Professor will change his opinion now" twenty-five years after his death?

that of the Sanskrit अ. The change of the Sanskrit स into خ is exemplified in various languages: compare the French *savon* with Spanish *jabone* (soap); Hebrew חוּג (*khúg*) and סוּג (*súg*) "to encircle;" חָקָה (*kháká*) and סָקָה (*sáká*) "to look;" Greek αστηρ with Persian اختر "a star;" Hindustani سسر with Persian خسر "socer;" Sanskrit *svap* with Persian خواب "sleep," etc.

Taking his materials solely from Klaproth and Elphinstone, Pott, than whom, with all his audacity, no greater etymologist has arisen, does not hesitate a moment in assigning the Pushto its place as one of the Indo-European languages. He divides the latter into five families in his *Etymologische Forschungen* (1833), and places the Persian and Pushto together into the second family, precisely as he puts the German and the Dutch together in the fourth.

In 1839, Ewald the greatest Hebraist of the present century, gave a careful examination of what materials of the language were accessible to him, and, of course, could not give the slightest support to the opinion that Pushto had any connection with a Semitic language.

The same view was clearly elucidated by Dorn again, in the transactions of the St. Petersburg Academy of Sciences at various times from 1840 to 1845. In his *Pushto Chrestomathy* (St. Petersburg, 1847), he designates the Pushto as a branch of the Indo-Persian languages.

"The Bible of Every Land," a work published by Bagster in 1848, which exhibits in its notices great accuracy and completeness of information, says of the Pushto language, "It exhibits none of the peculiarities of the Semitic dialects, but, on the contrary, forms an important link in the great Indo-European languages."

The latest edition of Brockhaus' *Conversations-Lexikon* also correctly calls the language a sister of the Persian.

And as if to clinch the matter, *Max Müller*, whose authority in such things is simply indisputable, without the shadow of a doubt ranges the Pushto among those scions of the Arian stock which struck root in the soil of Asia, before the Arian reached the shores of Europe. (*Languages of the Seat of War*, London, 1855.)

To these we may add minor lights to show at least the general consent of intelligent philologists, such as *Schleicher* (*Zur Vergleichenden Sprachgeschichte*, Bonn, 1848, p. 67,) and (*Die Sprachen*

Europas, Bonn, 1850, p. 130); *De Vere* (Comparative Philology, New York, 1853, p. 299); *Rapp* (Grundriss der Grammatik, Stuttgart, 1855), and others.

One might have thought the truth pretty well established by this time, were it not for the feline vitality of error, which in this instance was aided by the fact that the pure linguistic question had been mixed up with an obscure ethnological problem, which some people moreover are inclined to make somewhat of a religious question. The allusion is to the alleged claim of the Afghans to be considered children of Israel. It is not intended here to enter upon this matter. The question now is simply whether the Pushto is an Indo-European, or a Semitic language. But when Ewald, and Dorn, and Pott, and Müller have pronounced, is there any one yet who can doubt? It is mortifying to be obliged to say that there is.

When the founder of the Asiatic Society pronounced his opinion, perhaps hastily, and certainly on an imperfect inspection of scanty and perhaps faulty materials, one willingly forgets it.

*Indignor, quandoque bonus dormitat Homerus!*

But people must necessarily dig up old bones, *Sir George Rose* published a somewhat wild pamphlet on "The Kings of the East," in which he revives the opinion of *Sir William Jones*, maintains that the Pushto language does contain Hebraic elements, and blames *Dr. Wolff* for not finding more than one word which countenances that view.

*Sir George Rose* claimed neither a position as a philologist, nor an acquaintance with Pushto; hence his assertions, however strenuously made, might be allowed to rest on their own merits. But now a professed philologist enters the lists, namely, the *Rev. Charles Foster*, one of the six preachers of the Cathedral of Canterbury, Rector of Stisted, Honorary Member of the Literary Society, author of "Mahomedanism Unveiled," and of "The Historical Geography of Arabia." These facts are taken from the title page of a work designated briefly as follows: "The one primeval language traced experimentally through ancient inscriptions in alphabetic characters of lost powers from the four continents. Including the voice of Israel from the rocks of Sinai: and the vestiges of Patriarchal tradition from the monuments of Egypt, Etruria, and Southern Arabia." In

this book, as is well known, the author runs a violent tilt against men like Grotefend, Beer, Lassen, Rawlinson, St. Martin, and upsets them all to his own complete satisfaction and the reader's infinite amusement. The third volume of this work is filled up by "A New Key for the Recovery of the Lost Ten Tribes," which recovery, we are informed—and the information is at least new—is "the most interesting problem in the history of the world." It is in this that Dr. Forster reprints Jones' note from the second volume of the "Researches," and reasserts the Semitic origin of the Pushto language. In proof of this assertion he produces three words, which are to establish his position.

(1). He quotes from Wolff "אור (*or*) light, is the only Hebrew word I found in the Afghan tongue."—On this it may be observed that *or* اور in Pushto does not mean "light," but "fire," and that the word is plainly connected with the Arian tongues. In the language still called Zend "fire" is *atar*, Persian اذر; the connection of اور (*or*) with these is precisely analogous to that of the

Pushto مور (*mor*) *mother* with Persian مادر, Sanskrit *matar*.

|   |                      |                     |   |       |                          |
|---|----------------------|---------------------|---|-------|--------------------------|
| „ | ورور ( <i>wror</i> ) | <i>brother</i> with | „ | برادر | Zend <i>bratar</i> .     |
| „ | لور ( <i>lor</i> )   | <i>sickle</i> with  | „ |       | Sanskrit <i>dātra</i> .* |
| „ | نور ( <i>nor</i> )   | <i>other</i> with   | „ |       | Zend (à) <i>ntar</i> .   |

It may be observed that in Irish *ur* is "fire," but the connection of the latter is more likely with the Latin *uro* which of course (*us-si, us-tum*) must be referred to the root *ush*; and, as Pictet observes, (Les noms celtiques du soleil), la ressemblance avec l'hébreu *or, ur, lumière, semble donc purement fortuite*.

(2). Dr. Forster continues, "I have no Afghans to confer with on the matter, but I possess Elphinstone's Cabul; and will undertake, in the second word of his "Pushtoo Vocabulary," to find a second Hebrew word: viz. שמים, *Samim*, with the article prefixed, השמים, *hesamin*, 'The heavens,' of which the Pushtoo, 'Asman, Heaven,' is clearly only a dialectic variation. I notice this merely as a specimen of Dr. Wolff's carelessness and hastiness of examination."—This, the readers of the Journal need not be told, would prove too much, and hence nothing; inasmuch as آسمان is also pure Persian; *asman* also occurs in Zend and the

\* On the change of *d* into *l* see below.

cuneiform inscriptions in the same sense; and the Sanskrit *açma* is "a cloud." There may possibly be a general connection between this thoroughly Arian word, and the Semitic, not peculiarly Hebrew, root *سما*, but that is all.

(3). "A third Hebrew term in the Pushtoo language, not in Mr. Elphinstone's catalogue, *viz.* נהר, *nahar*, a river, has been elsewhere noticed in the Pushtoo term *Ning-nehar*, the nine rivers."—Nor will this corroborate Mr. Forster's position materially. *Ning-nehar* (the name of a locality beyond the Peshawur Frontier) is far more frequently written and called ننگرهار (ningrahar), or ننگهار (ningahár), so that the *nahar* necessary for the proof entirely disappears. Were there a *nahar* in the word, the derivation given could not be relied on, as it is given by Afghan etymologists, who are almost as wild as Mr. Forster himself. In this case they are themselves not agreed as to the derivation; for some say the name is نیم نهر (*ním-nahar*) "half-hungry," and that the region is called so from the frequent scarcity of bread there; others say the name is really نیک انهار (*nekanhár*) "the good or pure streams; *anhár* is a pure Arabic plural—the Hebrew plural would be quite different. And lastly, نهر is not a Pushto word at all, is known only in the book language, and not among the people; and even if the latter were the case, it would prove nothing; for if a connection between the Hebrew and the Pushto is to be proved, all such words must be excluded from the evidence as are common to the Arabic and Hebrew; for everybody is aware that all Mahomedan nations use Arabic terms very largely, whatever their language be.

If such sporadic resemblances as the Philo-Semitics have hitherto searched for, helped the matter at all, one might be ready to suggest to them to compare the Hebrew קח (*kheq*) with the Pushto غیر (*ghej*)\* "embrace," which is pronounced by the Khalíl, Momund, and

\* This article does not adopt, in its spelling, either of the two standard alphabets that have been proposed; the reader will have no difficulty, it is apprehended, in making out the words. The vowels have the continental sounds, as proposed by Sir William Jones: the consonants their general English value; *kh* = خ; *gh* = غ; *j* the Pushto ج which answers most completely to the Polish *z*; *zh* = the Persian ژ which in the same manner is pronounced precisely like the Polish *z* (*s* in "pleasure" is between these two sounds); *ç* = Sanskrit ञ.

Yúsufzai “gheg.” But careful investigation will at once prove that “ghej” is the proper pronunciation, and that it has the same parentage with the Persian *آغوش*; *آ* is the inseparable particle, common to the Sanskrit, Zend, Parsi, and Persian, as in *آشنا آشام آشوب آمدن*, etc. etc. The final *ش*, in Persian, often becomes *پ* in Pushto, as *گوش* = *غوپ*; *خوش* = *خوپ*; the substitution of the vowel *e* for *o* is a mere dialectic variation; the Banúchís, for instance, constantly say *mír*, *kír*, *lír*, *kim*, for *mor*, *kor*, *lúr*, *kum*, etc.

The Pushto *لوبه* (*loba*) “play” might be imagined to be connected with the Hebrew *לַעֲבֹד*; only it is much easier and far more correct to derive this Pushto word directly from the Arabic *لعبه*, of the same signification, by the analogy of scores of similar instances, the Afghans pronouncing *ع* generally like *o*,—an incidental proof this that their own original speech has not this Semitic guttural.

Or the Semitic advocates might be told that *da* is used in Pushto to form the Genitive, whilst *די* (*dí*) or *ד* (*de*) in Chaldee is constantly used to form a relation very much like that expressed by the Genitive; and it is not unlikely that this constant recurrence of *da* in both Pushto and Chaldee may have imposed on Sir William Jones. It must be considered, however, that *da* also forms the Genitive in Panjábí, but as a postposition, like *ka* in Hindustani; it is more likely that the Pushto *da* is connected with the Latin *de*, which again reverts, in the Romanic languages, to form the Genitive. In Polish, the Latin *de* is most frequently translated by *od*, which is beyond a doubt the Sanskrit *adhas*; whether *de* is for *ade* = *adhas*, as Benfey suggests, is another question.

*Dá* also is the demonstrative pronoun both in Pushto and Chaldee; only it is so in Zend also, and though the Afghans would like to make out their relationship to the Israelites, their language prefers to be considered an ancient relict of Zend.

But, at all events, sound philologists have long since abandoned and reprobated the plan of establishing the affinity of languages on sporadic resemblances traced in their vocabularies. Organic identity in grammatical structure, added to a large community in certain household words, is necessary definitely to determine such questions.

However, the learned decypherer of the pictured rocks seems himself not quite firmly convinced of the Hebrew origin of Pushto, as,

a few pages on, he catches at a statement of Ibn Haukal's that Pushto is a Tatar dialect (he says, "Tartar"), and makes many apologies on behalf of the Afghans for having exchanged Hebrew for a Tatar dialect.

In return, one ought to be ready to make every allowance for Mr. Forster. His book was published in 1854; the materials for becoming acquainted with Pushto were then not readily accessible to an English scholar, who probably would care little for Russian publications though they be in the English language; it is not likely that he had seen Captain Vaughan's "Grammar of the Pooshtoo Language" which was published in Calcutta in the same year; and Captain Raverty's Grammar was not published till 1856. It would be impossible now, with an apparatus like that contained in the last mentioned grammar, with its copious paradigms and examples, whatever be the value of the system or the rules,—it would be impossible now to fall into the wretched mistake of calling an Arian language a Semitic one. Alas, for human hopes! What if the guide himself should lead you astray? Not wilfully perhaps, but blindly?

After devoting ten years to the study of Urdu, Persian, Marathí, Guzerathí, Arabic, Pushto, Sindí, Punjabi and Multaní (see the Preface to Capt. Raverty's "Grammar of the Pukhto," p. vi.), and after writing a copious Pushto Grammar with all the grammatical terms in Arabic, Capt. Raverty is inclined to consider the Pushto a Semitic dialect (see the Introduction to the Grammar, p. 36). Nay, he is more than inclined; he produces five arguments in favour of the view:—

(1). The vowels and consonants used in Pushto have the same powers as those of the Arabic, Hebrew and other Semitic dialects.

(2). Like them it has two genders.

(3). In common with the Hebrew, Arabic, and Persian, it has the peculiar separable and inseparable pronouns.

(4). The inflexions of the "Afghánian" verbs are formed according to the Arabic, and Hebrew system, with two original tenses only.

(5). In many respects the Pushto syntax agrees with that of the Hebrew.

Before examining these arguments, it may be worth while to inquire what could have led Captain Raverty so grievously astray

And we shall find the cause to be a very common source of error, namely a pre-conceived theory. Capt. Raverty seems hastily to have taken up the opinion that the Afghans are children of Israel, and so all goes wrong.

Let the reader bear in mind that it is desired to keep the linguistic question quite unencumbered, and that the writer of this notice does not intend to enter upon the ethnological question in this place. But it is difficult to pass over a remarkable phenomenon in the Introduction here spoken of. In p. 30, Capt. Raverty somewhat pertinently observes that had the Afghans "been the aborigines of the country at present known as Afghanistan, we must have heard something of them from ancient writers, for we find that even in the time of Herodotus, Darius had sent an exploring expedition under Scylax of Caryanda and others as far as the Indus." He then goes on to cite two passages from some English translation of Herodotus, in both of which the Afghans are mentioned, but he does not see it. The first passage states that Scylax "set out from the city of Caspatyrus and the country of Paktyica, and sailed down the Indus." The second says, "there are other Indians bordering on the city of Caspatyrus and the country of Paktyica, settled northwards of the other Indians."

Had the Afghans, says Capt. Raverty, been then in these regions, their name must have occurred in these passages. Granted; what name? Not *Afghan*, for that is a modern name, given them by the Persians, not acknowledged by themselves, and certainly not occurring before the time of Abu Said, who ruled in Khorasan during the fifteenth century. Their own name in the country near the Indus, to which the citations refer, is *Pakhtu* (n); how would a Greek have spelled this? Πακτυ, I trow. This word, in the plural number, the reader will find in *Hdt.* VII. 67, where the different nationalities are enumerated that constituted Xerxes' army. The Πάκτυες (*Pakhtus*) are described as wearing *posteens*, and carrying native bows and knives, not a bad description of Afghans at any time; and they are duly mentioned after the Bactrians, Parthians, Khwarismians, Sogdians, and Gandarii (Kandaharis?)—Even the peculiar form of the name *Paktuika* as the name of their nation or their country finds its explanation in the fact that the Afghans call themselves collec-

tively *Pakhtuñkha*. Very few native names suffer so little on the part of Englishmen, as these names have suffered at the hands of the Greeks. Capt. Raverty says that the country referred to under the name of Paktuika is Puklí; this also is a mistake, for the Greeks called the latter, which moreover is not near any navigable portion of the Indus, plainly and correctly *Πεύκελα*; the name occurs a number of times in Arrian.

As for Capt. Raverty's arguments in favour of the view that Pushto is of the Semitic family, Argument No. 5 says that in many respects the Pushto syntax agrees with that of the Hebrew. This argument would be valid, if the grammarian had pointed out some *peculiarities* in the syntax of the one language which agree with peculiarities in that of the other. For the good of his argument, it must be regretted that he has not done so, and the proposition as it stands may be predicated of any two languages whatsoever. No. 2, also proves too much; for French, Spanish, Italian, Portuguese, Gaelic, Danish, Livonian, etc., or, what is more to the point, and might have led a candid inquirer into the right track, the Indian languages, such as Hindi and Panjabi, have also but two genders.

What the force of Argument No. 1 is, that "the vowels and consonants used in Pushto have the same powers as those of the Arabic, Hebrew, and other Semitic dialects," is difficult to tell. If the author has reference to the *spoken* vowels and consonants, that is to their sounds, it is sufficient to observe that of articulate sounds there is only an extremely limited number, in consequence of which the great bulk of the vowels and consonants of all languages are the same. He cannot mean that *all* the Pushto sounds are found in the Semitic languages, for he has just laboured for some pages to prove that both there are many of the Arabic sounds which are not found in Pushto, and that there are a number of Pushto sounds not to be found in the Semitic languages, though his statements are by no means complete, or correct as far as they go. If he refers to the *written* character, Semitic scholars will be surprised to hear that there are letters in the Syro-Arabian languages to express vowels at all. And as regards the consonants, every one knows that when Bayazíd, or whoever may have better claims to the distinction, wrote Pushto first, he made use of the Arabic character, and that not the pure

character, but as he knew it from Persian writing, with the addition of all the three pointed letters, and that even then he had to modify half a score of letters besides to express all the Pushto sounds, in which he succeeded only partially. He would have reduced his difficulties very materially, had he used the Devanagari alphabet, in which the Sanskrit and Prakrit languages can be written with greatest ease ; and that Pushto is one of the latter, this matter of the letters alone would be sufficient to establish.

The validity of Argument No. 3,—“ in common with the Hebrew, Arabic and Persian, it has the peculiar separable\* and inseparable pronouns, the latter being invariably attached to some preceding word”—is very much impaired by the author’s adding Persian to the other two languages. Is Persian also a Semitic language ?

It is not at all necessary to be acquainted with Pushto to suspect this argument ; for to compare the graceful freedom of the Persian inseparable pronouns م—, ت—, ش—with the rigid compulsoriness of those of the Semitic languages is the same as to say, “There is a river in Macedon ; and there is also moreover a river at Monmouth.” But the oddity goes much further. Any one acquainted with Pushto would rack his brains to discover what the author could mean ; he would probably conclude that he must refer to combinations like زونم *corda nobis*, which might seem to bear some similarity to دلم, but which occur so excessively rarely that not only could they not be adduced as a characteristic of the language, but any Grammarian would be excused for not noticing them at all in his grammar. Nor does Captain Raverty. What he means by the inseparable pronouns, are the common terminations of the verb : laudo, —as, —at, —amus, —atis, —ant. These terminations Capt. Raverty calls “affixed personal pronouns.” The comparative philologist will probably say, so they are. True ; only Capt. Raverty has no inkling of the truth, for he calls them *zamdirī mutasila*, which are quite different things.

\* What part of speech either in Pushto or Hebrew or Arabic or Persian could possibly be called a “separable pronoun,” is quite beyond divining skill. It is most probable that the grammarian means “separate” pronouns ; but as there is nothing peculiar in the existence of separate pronouns in any language or number of languages, the examination of the argument confines itself to the inseparables.

This grammatical term has been introduced into the Persian Grammar also by ignorant native compilers in India, but quite improperly. It is a pity that Capt. Raverty has thought fit to encumber his otherwise not very clear or correct or practical grammar with the inept terminology of Arabic grammarians. There can be no stronger proof of the Arian nature of the Pushto than that which Capt. R. calls "affixed personal pronouns."

Argument No. 4, states that the inflexions of the "Afghanian" verbs are formed according to the Arabic and Hebrew system, with two original tenses only.

Unless it be admitted that such a statement can originate only in the sheerest ignorance of the nature of the Semitic verb, it is difficult to disentangle the manifold confusions implied in it. It compares incommensurables; it says that an ounce is as long as an inch. How utterly alien and foreign the tenses of the Semitic verb are to Occidental, that is Arian, modes of thought and expression, becomes glaringly apparent, for instance, in the voluminous investigations of their nature, say, in the Hebrew. Hardly two grammars of the language have the same nomenclature for them. With some they are the past and the future, with others the definite and indefinite, with others the perfect and imperfect, with some even the anterior and posterior; Donaldson (*Comparative Grammar of the Hebrew Language*) shrewdly does not call them anything but Primary and Secondary, which terms have reference merely to their form, and only ventures to say that the former expresses single or transitory acts, and the latter represents repeated or continuous action. A perusal of a few sentences of the Hebrew Bible is sufficient to convince any one that the mere precession of the particle "and" is sufficient to make the form that otherwise expresses the future, denote past action, and vice versâ. How utterly different is this from the Grammar of the Indo-European languages. Indeed, the manner in which time is expressed in the Semitic tongues, cannot be understood, unless, as Nordheimer, the profoundest of Jewish Grammarians, somewhere observes, We occidentals discard the notions we have acquired as to the proper function of the tenses. This is not the place to discuss the nature of the Semitic tenses, but it is distressing to see that which peculiarly characterizes the modern Arian languages mistaken for marks of identity with ancient Semitic peculiarities.

By "original tenses," Captain Raverty means those that are not formed with the auxiliary *to be*. If we consult his grammar for further light on this subject, we shall find him giving page after page, not two, but *four* such "original tenses." He calls these, present, aorist, imperfect, and past. On further examination, we shall find that what he calls the aorist, is no tense at all, as is proved by the very quotations that he constantly gives, but is the subjunctive mood. Then we are struck by the fact that the past of regular verbs differs from the imperfect only by an augment. We have then the clue to the grammarian's statement. His two "original" tenses are the present and the past imperfect tenses which the Semitic languages have not at all. But a candid comparison would at once have shown that those languages which have these only as simple tenses, such as Parsi, Persian, Russian, Polish, Swedish, Danish, German, English, and others, are all Arian languages.

Compare these two tenses in Pushto : *wah-am, wah-alam*, (=Latin *caedo, caedebar*,) with the corresponding ones in Polish, for instance : *gr-am, gr-alem*. They differ in meaning in this, that the past tense of the Polish is active, and that of the Pushto has a passive sense. How thoroughly the latter is characteristic of the Sanskrit and many other Indian languages, few readers of the Journal will need to have pointed out to them. It is curious that the European languages, even the ancient ones, seem to have lost this preference of the passive construction in the past tenses to the active, though it may still very distinctly be traced, in Latin, in the favourite gerundive construction, in the form in which the ablative absolute most frequently appears, and in the peculiar conception that must exist in the mind of the speaker or writer who can form a passive voice of verbs like "to go" and "to come."

Such astonishing confusion having been introduced into what is really a very simple question, it is worth while to inquire what are the essential features that distinguish the Semitic from the Arian stock of languages. Contradiction need not be feared, if they are stated to be the following :—

1. The Semitic languages, in historical times, consist of trilateral and hence polysyllabic roots, the three letters being all consonants.
2. The roots express the *ideas*, whilst *relations* are denoted by an

internal modification of these roots, effected by vowels, aided by certain letters termed *servile*.

3. Such modification alone produces from the simple root the differences between verb and noun, adjective and substantive, gender, number, and tense.

4. In addition to the distinctions of gender known in the Arian languages, the Semitic languages also distinguish gender in the pronoun of the *second* person, and in the *second* and *third* person of the verb.

5. Tense-formation is undeveloped.

6. Composition, with immaterial exceptions, is unknown.

These features will in vain be searched for in the Pushto language.

Pushto will attract few students by its literature; excepting those who pay attention to it for practical purposes, it is of interest only to comparative philology and its cultivators; and to them, it would be interesting mainly on account of its antique look. There is no doubt that it has preserved many forms, either altogether, or in more original shapes than are to be found in most of the other Arian languages; that is, in its vocabulary, not in its grammar, which is on a par with most of the descendants of Prakrit.

What grieves and perplexes etymologists so often, is the existence of orphans in the various branches of the great Arian family, stray little things that have lost all love and likeness to their reputed parents, or whose parents have been so long dead that nobody can remember who they were. The entrance upon a comparatively new field sometimes discovers twin-brothers of such orphans, which discovery relieves the anomaly at least in some measure. Let a few examples from the Pushto suffice.

The Greek *ταράνη* is a *rope-basket*, a net-work made of rope, *πλέγμα τι ἐκ σχοιῖου*, says Suidas. Benfey (*Griech. Wurzel Wörterbuch*, I. p. 670) is quite perplexed as to its derivation, and Semitic roots which have been compared by some are of little advantage. The Pushto has *ټراڼه* (*tragañ*), Panjabi *tangar* for those rope-baskets the Afghans so universally use to carry their loads and burdens in. It is not a little interesting that the Apostle Paul uses this word

(2 Cor. xi. 35\*) in describing his escape from Damascus, whilst it is a well known practice among the Afghan thieves to use this very means for letting their accomplices down walls and windows.

The Latin *tussis* (cough) has as yet not been traced; Pott suggests, though but timidly, that it might be connected with *tundo*; the Pushto for "cough" is *tushe*. The Greek εἶδω, "I sleep," "lie down" appears to be as yet without an authentic genealogy; the Pushto اوده (*údō*) is "asleep, lying down;" αυλή, the court-yard, cattle-yard, etc. is a difficult word; the Pushto غولي (*ghole*) precisely answers it. Pushto کاني (*kañre*) "a stone" is difficult to affiliate either in the Sanskrit or Persian, but it seems to have two equally lonely brothers in the Gælic *carn* "a cairn," and the Greek κραναός "stony."

The English *ant* and the Persian *mor* مور, of the same signification, seem wide apart, yet by the aid of the Pushto we are able to point out a very probable connection between them; *ant* is for *amt*, contracted from *emmet*, from the Gothic *amaitō* according to Grimm; from this the German *a-meise*; the Pushto is ميږه (*meje*), also pronounced *mege*, which connects with the second syllable of the Greek μυρμηκ—whose first syllable agrees not only with the Persian *mor*, but with thirteen other languages (cited by Grimm in the Deut. Wörterbuch) whose word for *ant* is similar to *mor* or *μυρ*; from which the conclusion may be drawn that the Greek is nearest the original word whatever that was, and that the descendants have divided the inheritance, some taking the first, others taking the second syllable. Such a division of inheritance is by no means unexampled; for instance the German *ente* (Lat. *anat*) and the English *drake* meet in the Old High German *anetrekho*; the Irish *gall* (swan) and the Slavic *labud* (of the same signification), philologists find united in the Sanskrit *jálapád*, though neither of these cases is quite parallel to that of *μυρμηκ*.

The Greek ὄν and the English *egg*—are, as is well known, closely related: ὄν, Latin *ovum*, Irish *ugh*, Saxon *æg*, English *egg*; the change of *v* into *g* is one of such frequent occurrence as hardly to need an

\* It appears there in the dialectic variation *σαργάνη*; the change of *τ* into *σ* being like Ionic *ἄνησος* for Doric *ἄνητος*, *σύ*, *σέ*, *σημερον* for Doric *τύ*, *τέ*, *τήμερον*, *ναυσία* = Attic *ναυτία*, etc.

exemplification; but compare Sanskrit *vrka* with the Persian گرگ (wolf); Latin *vespa* (wasp) with the French *guépe*; Persian گرم (warm) with German *warm*; *vesper* = Welsh *gospër*; and all the Spanish names beginning with *guada* from the Arabic وادي "a river." —But it is curious that both the Greek and the English variations of the same word should have their representatives in Pushto: the Northern dialect has *hagge*, the Southern *oë*. So, in the same manner as the German *weide* is to the English *willow*, so is the Persian بید to Pushto وله (*wüla*). The Pushto is extremely fond of changing *d* into *l*. In the European languages this change of the dental into *l* is not common, if the Spanish perhaps be excepted, which gets, for instance, the *Madril-eños* from *Madrid*, and evidently manufactured the name *Isabel* from *El-izabeth*, not unlikely mistaking the initial *El* for an article. The Latin shews a few words with that tendency; the connection between the English *tear* and the Latin *lacryma* would be difficult to demonstrate but for the Gothic *tagrs* = Greek δάκρυ (δακρυ-μα); the connection between *lingua* and *tongue* can only be through an intermediate *dingua* which is an antique Latin form. So the Sanskrit *madhu* remains in Greek μέθυ, German *meth*, English *mead*, Polish *miód* etc.; but in Latin it is *mel*. In the same way, the Sanskrit *devri* (husband's brother) retains the *d* sound in Greek, Lithuanian, Livonian, Slavonic, Servian, Armenian, and Saxon, but the Latin has *levir*, and the Pushto also *levir* (لیور); the nearest Persian word seems to be لاد which is used for a brother in a wide sense. (Comp. Bopp. Vergl. Gramm. 17).

This change of the dental into *l* is so much the more remarkable as the Zend has no *l*; and it may serve to show the affinities of the Pushto, to those who have no inclination to study the language, to give a few instances of this preference of *l* over *d* or *t*.

|            |        |        |       |                 |
|------------|--------|--------|-------|-----------------|
| Hindustani | دس     | Pushto | لس    | (las) ten.      |
| Persian    | دست    | „      | لاس   | (lás) hand.     |
| „          | دیوانه | „      | لیوڼي | (lewanæ) mad.   |
| „          | پدر    | „      | پلار  | (plár) father.  |
| „          | دام    | „      | لوم   | (lúm) net.      |
| „          | دیدة   | „      | لیده  | (lída) seen.    |
| „          | دامن   | „      | لمن   | (laman) skirt.  |
| „          | دارم   | „      | لارم  | (laram) I have. |

|       |       |         |                                                                 |
|-------|-------|---------|-----------------------------------------------------------------|
| Pers. | سپند  | Pushto. | سپيلني (spelane) rue ; metathesis unavoidable after the change. |
| „     | خود   | „       | خول (khol) helmet.                                              |
| „     | پودنه | „       | ويلني (welane) mint.                                            |

It has already been intimated that the affinities of the language to the Zend are great ; the only two languages that may be thought able to dispute this claim, would be the Sanskrit on the one hand, and the Persian on the other. An examination of the numerals and a few other words may help to clear up this matter and put the reader in a position to judge for himself.

| Sans. eka    | Pers. يك | Zend aeva     | Pushto يو (yau)—    | 1.  |
|--------------|----------|---------------|---------------------|-----|
| „ dvi        | „ دو     | „ dva         | „ دوه (dwa)—        | 2.  |
| „ tri        | „ سه     | „ thri        | „ دري (dre)—        | 3.  |
| „ chatur     | „ چهار   | „ chathru     | „ خټلور (tsalor)*—  | 4.  |
| „ panchan    | „ پنج    | „ panchan     | „ پنځه (pindza)—    | 5.  |
| „ shash      | „ شش     | „ cvas        | „ شپږ (shpaj)†—     | 6.  |
| „ saptan     | „ هفت    | „ haptan      | „ اووه (uwa)‡—      | 7.  |
| „ ashtan     | „ هشت    | „ astan       | „ اته (ata)—        | 8.  |
| „ navan      | „ نه     | „ navan       | „ نه (nö)—          | 9.  |
| „ daçan      | „ ده     | „ daçan       | „ لس (las)—         | 10. |
| „ ekádaça    | „ يازده  | „ aevandaça   | „ يولس (yúlas)—     | 11. |
| „ dvádaça    | „ دوازده | „ dvadaça     | „ دولس (dúlas)—     | 12. |
| „ trayodaça  | „ سيزده  | „ thridaça    | „ ديارلس (dyárlas)— | 13. |
| „ chaturdaça | „ چهارده | „ chathrudaça | „ خورلس (tswarlas)— | 14. |
| „ viñçati    | „ بيست   | „ viçaiti     | „ شل (shil)§—       | 20. |

\* The change of the dental into *l* as above ; the change of *ch* into *ts* is characteristic of the language ; it is really only a change of *sh* into *s*.

† The change of *v* into *p* is exemplified in words like Sanskrit *açva* = Zend *aspa* ; Sanskrit *sventa* = Zend *spenta* ; Sanskrit *vartaka* = Greek  $\pi\epsilon\rho\delta\iota\text{-}\kappa$  ; though the opposite change also occurs, e. g. Latin *sapere* = French, *savoir* ; Latin *intrepido* = Spanish *atrevido* ; Latin *lupa* = Spanish *lova* : Latin *porta* = Russian *vorota* ; Latin *caper* = French *chèvre*, etc.

‡ This change looks severe, but it has been fully recognized by Pott (*Quinare und Vigesimale Zählmethode*, p. 270) ; it really implies nothing more than the change of *p* into *v* or *w*, just noticed, after dropping *t* ; examples of the latter are the second person plural of the verb in Spanish as compared with the Latin *teneis* for *tenetis*, *erai* for *eratis* ; Sk. *patni* = Pol. *pani*, etc.

§ This loses the first syllable (*vi*), drops the last vowel, and changes the dental

|                |            |                 |                      |                |
|----------------|------------|-----------------|----------------------|----------------|
| Sans. trinçat  | Pers. سي   | Zend thriçata   | Pushto دیرش (dersh)* | — 30.          |
| „ chatváriņçat | چهل        | „ chathvareçata | خلوینت (tsalwesht)   | 40.            |
| „ pancháçat    | پنچاه      | „ pancháçata    | پنځوس (pandzos)      | —50.           |
| „ shashti      | شست        | „ esvaçti       | شپيته (shpeta)       | — 60.          |
| „ saptati      | هفتاد      | „ haptáiti      | اویا (awyá)          | — 70.          |
| „ açíti        | هشتاد      | „ açtáiti       | اتیا (atiyá)         | — 80.          |
| „ navati       | نود        | „ navaiti       | نوی (nwí)            | — 90.          |
| „ çata         | صد         | „ çata          | سل (sal)†            | — 100.         |
| „ çvan         | سپاه or سگ | spá             | سپی (spæ)            | dog.           |
| „ aham         | من         | „ azem          | زه (zö)              | I.             |
| „ tárá         | ستاره      | „ stáre         | ستوري (store)        | star.          |
| Prakrit se     | و          | „ hé            | ئی (ye)              | him.           |
| Sans. çushka   | خشک        | „ hushka        | وچ (wuch)            | dry.           |
| „ svap         | خواب       | „ qaf           | خوب (khob)           | sleep.         |
| „ svasá        | خواهر      | „ qaṇha         | خویندی (khwainde)    | sis-           |
|                |            |                 | خور (khor)           | sister. [ters. |
| „ khan         | کن         | „ kan           | کنه (kana)           | dig.           |
| „ sam          | هم         | „ ham           | هم (hum)             | also.          |
| „ sarva        | هر         | „ haurva        | واړه (wára)          | all.           |
| „ dháv         | دو         | „ du            | دو (dau)             | run.           |
| „ hrid-aya     | خرد or دل  | zere-dhaya      | زړه (zřö)            | heart.         |
| „ hir-anya     | زر         | „ zara          | زر (zar)             | gold.          |
| „ jír-na       | زر         | „ zar           | زور (zor)            | old.           |
| „ harit        | زرد        | „ zairita       | زیر (zyar)           | yellow.        |
| „ hima         | زم         | „ zima          | ژمه (zhima)          | winter.        |
| Ved. jma       | زمین       | „ zema (huz-    | زمکه (zmaka)         | earth.         |
|                |            | varesh          | ضامیک                |                |

into *l* as usual; but in the compound numbers, 21, 22, etc. another form much closer to the Zend appears: *دویشټ یویشټ* etc.

\* In the Zend, it is evidently the *çata* which expresses the tens; of this the Pushto retains the first letter alone; in the following number, 40, it curtails the Zend much less; indeed it loses only the unessential termination, and the single letter *r* which is lost by being crowded out. It has already become plain to the reader, that it is long and weighty vowels only that survive in the modern languages; the short ones are soon lost by attrition.

† The dental into *l*.

|                            |                     |                       |                    |                  |
|----------------------------|---------------------|-----------------------|--------------------|------------------|
| Sans. çiras                | Pers. سر            | Zend sara             | Pushto سر (sar)    | head.            |
| „ ? svar                   | „ خور               | „ hvar (e)            | „ نور (nwar)       | sun.             |
| „ vah                      | „ (آوریز) vaz       | „                     | „ باسه (bása)      | carry.           |
| „ upari                    | „ بر                | Parsi, awar           | „ پر (par)         | over.            |
| „ paçu                     | „ سفند (گو)         | Zend pashu            | „ پسه (psa)        | sheep and goats. |
| „ pri                      | „ فروش              | „ pereta              | „ پیروده (píroda)  | bought.          |
| „ jihvá                    | „ زبان              | „ hizva               | „ ژبه (zhaba)      | tongue.          |
| „ sthorin                  | „ ستور              | „ staora              | „ ستور (star)      | steer.           |
| „ kshapá                   | „ شب                | „ esap                | „ شپه (shpa)       | night.           |
| „ mṛ                       | „ میر               | „ mar                 | „ مر (maṛ)         | dead.            |
| „ mása                     | „ ماه (* mah I. C.) | „                     | „ میاشته (myáshta) | month.           |
| „ para                     | „ فرا (frá I. C.)   | „                     | „ پوری (pore)      | beyond, far.     |
| „ madhya                   | „ میان              | Zend maidhya          | „ میندخ (myandz)   | midst.           |
| „ prishtha                 | „ پس                | „ parasta             | „ ورستو (wrusto)   | back.            |
| „ vrish                    | „ بارش              | „ vár                 | „ وریدل (war-edal) | to rain.         |
| „ vana (forest)            | „ نرد               | „ nazdista            | „ ونه (wana)       | tree.            |
| „ nedistha (nearest)       | „ نزد               | „ nazdista            | „ نژدی (nazhde)    | near.            |
| „ hasta                    | „ دست               | „ zaçta               | „ لاس (lás)        | hand.            |
| „ jan                      | „ زا                | „ zan                 | „ زول (zo-wul)     | to be born.      |
| „ pach                     | „ پز                | „ pac                 | „ پوخ (pokh)       | cooked.          |
| „ (çuch, to shine)         | „ سرخ and سور       | „ çukhra (Parsi سوهو) | „ سور (sor)        | red.             |
| „ çarad (autumn)           | „ سرد               | „ çareta              | „ سور (sor)        | cold.            |
| „ ap                       | „ آب                | „ ap                  | „ اوبه (oba)       | water.           |
|                            | „ خور               | „ qar                 | „ خور (khor)       | atè.             |
|                            |                     | „ spar (ré-pandre)    | „ سپری (spare)     | open.            |
| „ vid                      | „                   | „ zda†                | „ زده (zda)        | knowing.         |
| „ chhuri-ká                | „                   | „ suwrá               | „ توره (tura)      | sword.           |
| „ tar (e.g. tiras = trans) | „                   | „ taro‡               | „ تیر (ter)        | passing.         |
| „ giri                     | „                   | „ gairi               | „ غر (ghar)        | mountain.        |
| „ parama (primus)          | „                   | „ frathemo            | „ وړنښې (wṛum-be)§ | first.           |

\* I. C. for Cuneiform Inscriptions.

† In Ahura-ma-zda (Ormuzd) = Lord Multiscient.

‡ Lassen, Anthologia Sanskritica, p. 135.

§ *b* is an inorganic addition, of frequent occurrence in most languages after *m*,

The following also are submitted to the inspection of the learned reader, though I have not met with their Zend equivalents ; literary material is not abundant on the Afghan frontier.

| Sans. púrven (-dyus)   | Pers. پړن     | Pushto پړون (parún) yesterday.          |
|------------------------|---------------|-----------------------------------------|
| svádu                  | خوش           | خړوب ( <i>khwaj</i> ) sweet.            |
| sveda                  | خوى           | خولي ( <i>khwale</i> )* sweat.          |
| hanu                   | زنخ           | زني ( <i>zane</i> ) chin.               |
| khalváta               | كل (bald)     | كلو ( <i>kalawa</i> ) shave.            |
| keça (hair)            | گيسو          | كوسى ( <i>kausai</i> ) ringlets.        |
| laghu ( <i>light</i> ) | لخت (or لخلخ) | لږ ( <i>laj</i> or <i>lag</i> ) little. |
| duh                    | دوش           | لوش ( <i>lwash</i> ) milk thow.         |
| lomaçá                 | روباة         | لونډر ( <i>lombara</i> ) fox.           |
| charman                | چرم           | خړمن ( <i>tsarman</i> ) hide.           |
| makshi-ká              | مگس           | ماشى ( <i>máshe</i> ) midge.            |
|                        |               | مچ ( <i>mach</i> ) fly.                 |
|                        |               | مچى ( <i>muchai</i> ) bee.              |
| músha                  | موش           | مړه ( <i>maja</i> ) mouse.              |
| krid, kruç             | گرته - زار    | ژړا ( <i>zhará</i> ) cry.               |
| ve                     | باف           | وۀ ( <i>wä</i> ) weave.                 |
| sevaní                 | سموزن †       | شتن ( <i>stan</i> ) needle.             |
| bhrú                   | ابرو          | وروخه ( <i>wrúza</i> ) brow.            |
| vríhi                  | برنج          | ورنچى ( <i>wrije</i> ). ‡ rice.         |
| vára                   | بار           | وار ( <i>wár</i> ) Fr. fois.            |
| grí                    | اغار          | نغرى ( <i>nghrí</i> ) he swallows.      |
| pá                     |               | پوول ( <i>po-wul</i> ) to feed.         |
| pay-as                 |               | پى ( <i>pay</i> ) milk.                 |
| túr                    |               | تير ( <i>ter</i> ) swift.               |
| chhid                  |               | چون ( <i>chaud</i> ) split.             |
| chír-na                |               | خىرى ( <i>tsire</i> ) torn.             |

as *dumb, thumb*, for German *dumm, daum* ; or *chambre, hombro, hambre* for *camera, humero, fame* (s).

\* *D* into *l*.

† *Vullers'* derivation from *سوى زن* "latus feriens" does seem to be marvellous nonsense, when the Latin *suo*, Gk. *σω* (in *κασώω*) and the Sanskrit root *siv* (*Westergaard, Radd. Ling. Sans. p. 261*) are considered.

‡ *Lassen* conjectured that the old Persian ought to have been *brízi* ; the Pushto seems to add much force to his inference.

|                                                          |   |                                                |
|----------------------------------------------------------|---|------------------------------------------------|
| Sans. kshur                                              |   | Pushto خريه ( <i>khraya</i> ) shear.           |
| „ stana (breast) (compare رخ p. 3)                       | „ | ستوني ( <i>stúnæ</i> ) throat.                 |
| „ ura                                                    | „ | وري ( <i>warai</i> ) wool.                     |
| „ lap (say)                                              | „ | لوة ( <i>lwa</i> ) read.                       |
| „ lap, (Benfey, Griechisches Wurzellexicon, II. p. 127). |   | لنبه ( <i>lamba</i> ) flame.                   |
| „ masyádhára                                             |   | Pushto مشوانري ( <i>mashwánre</i> ) inkstand   |
| „ mil (societatem inire)                                 | „ | مل ( <i>mal</i> ) companion.                   |
| „ madana                                                 | „ | مينه ( <i>mína</i> )* love. [ <i>vereor.</i> ] |
| „ bhri                                                   | „ | ويړه ( <i>wyara</i> ) fear; cf. Lat.           |
| „ vish                                                   | „ | ويش ( <i>wesh</i> ) division.                  |
| „ vání                                                   | „ | ويڼا ( <i>wená</i> ) speech.                   |

The foregoing list the reader will observe consists only of words whose identity with their equivalents in the sister languages may be recognised at a glance; if it were extended so as to include such as can fairly be proved, by the recognised rules for the shifting of consonants (*Lautverschiebungsgesetze*), to be unmistakably Arian, by far the greater portion of the entire vocabulary would have to be transcribed.

A cursory inspection of this list will convince the reader that it confirms the truth of the philological maxim that comparatively rude dialects preserve old forms better than their more polished relatives; hence for the etymological investigation of the Persian an acquaintance with Pushto would be more than merely useful. Vuller's Lexicon would have been far more satisfactory, or rather far less unsatisfactory, if the author had availed himself, for the etymological portion of his work, of the connecting links the Pushto offers. The length to which this paper has already grown, will admit of but an instance or two of such links as one may expect to find.

\* Compare the German *minne*. The connection with the German will most probably be doubted, at least by Germans, as it is the fashion to connect *minne* with the very opposite of the root of *madana*, which is *mad*. It is possible that the Pushto *mína* is allied to *Venus*, and the Sanskrit root *van*; the change of *v* into *m* is quite common in Pushto: *nvar* (Zend *hvar*) is pronounced *nmar*; *newasi* (Latin *nepos*), *nmasai*; Persian نواز = Pushto نمانز (*nmanz*), etc. analogous to the Latin *mare* for Sanskrit *vári*.

Under ابريشم “silk” Vullers is mute, as alas he is in most places where one would look for information. In Pushto وريشل (*wresh-al*) is “to spin,” which at least shows that the *a* in *abresham* is prosthetic, for euphony, and that the original meaning of the Persian word is “that which is spun” by the silkworm. But at the same time a conjecture may be ventured as to the Greek ἀράχνη “spider” which may reasonably be supposed to be connected with a word for “spinning,” like its equivalent in so many languages; the change of *v* into a vowel before *r* is quite common, e. g. Sanskrit *vrih* = Greek ὄρχ-έω; Pushto وريشي (*wrbushe*) = Greek ὄροβος (German *erbse*). Prof. Max Müller in another conjecture on the same word (*Zeitschrift für Vergleichende Sprachforschung*, 4, 368), makes a suggestion most worthy of consideration. He observes that a specific term in course of time often passes over into a general application, and that a word, for instance, denoting originally some peculiar kind of “making” adopts the sense of “making” generally; he instances τέχνη (*art*) from Sans. *tvaksh* (to work in timber); and Latin *ars* (*art*) from *ar-o* (I plough); and he goes on to say that the Sanskrit *rach* (to make) may originally have meant “to weave.” This I would modify so far as to say that if a root for ἀράχ-νη must be sought for in Sanskrit, it may be *vraj* “to make,”\* which may originally have signified “to spin;” and support the conjecture not only by the Persian ابريشم (which would then be the original form of both وريشم and ابريشم, both forms being due to the same principle of dislike to a double consonant at the beginning of a word), and the Pushto وريشل (*wresh-al*),† but also by the Greek πρᾶγ—(do) and the Polish *praca* (*work*), both of them etymological *cruces* and *nuces*; and would venture to add even the English *work* and German *werk*.

Taking the Persian word شکار “hunting” by itself, it would seem rash to connect it with شکستن “to break,” which has for its Imperative شکن; yet this seems to be the connection on the analogy of the Pushto ماتې (*mâte*) “hunting” especially that of the lion, as

[\* This very rare root (*vrājayati*) is explained by the grammarians “to send,” “to purify,” rather than “to make” (“*Vraja mārganasaukāra-gatyoh.*”) Eds.]

† For the change of the consonant *j* into *sh* (*vrij* = *wresh*) cf. Sanskrit *jiv-āmi* = Old Slavic *shivú*; Sanskrit *jná* = Persian آشنا, and the Highlander’s *shentleman* for *gentleman*.

compared with مات (*mát*) "broken;" which again reminds one strongly of two difficult French words bearing the same relation to one another, viz. *chasser* "to hunt" and *casser* "to break."

Frequently the Pushto preserves the simple form of Persian compounds: فرستادن "to send" is evidently compounded with the Sanskrit ऋ; but the Persian استادن means "to stand" whilst the Pushto *ásta-wul* (*wul* is the Infinitive termination of transitive verbs) is "to send;" افشاندن (compounded with the frequent Sanskrit *abhi* = اف) "to scatter" has no simplex in Persian, but in Pushto "to scatter" is ښندل (*shandal*); نشاختن "to fix in the ground," compounded with the Sanskrit inseparable preposition *ni*, has no simplex in Persian, but in Pushto ښخول (*shakh-awul*) is "to bury."

Such instances might be very largely multiplied, but only a few have been hastily culled, without much order, with a view, not to exhaust the subject, but rather not to weary the reader who may take a greater interest in the general philological question than in the Pushto language particularly; and these instances will at least show that a language cannot be Semitic which is so intimately connected in its lexical store (grammatical forms there is no room in this paper to discuss) with the prominent members of the Indo-European family of languages, and that in words not such as could be *borrowed* from another language, but such necessary every-day terms as form the staple of every language, and such as every tribe and nation, in their separation from the parent stock, take with them as a common inheritance.

*Peshawur, August, 1860.*

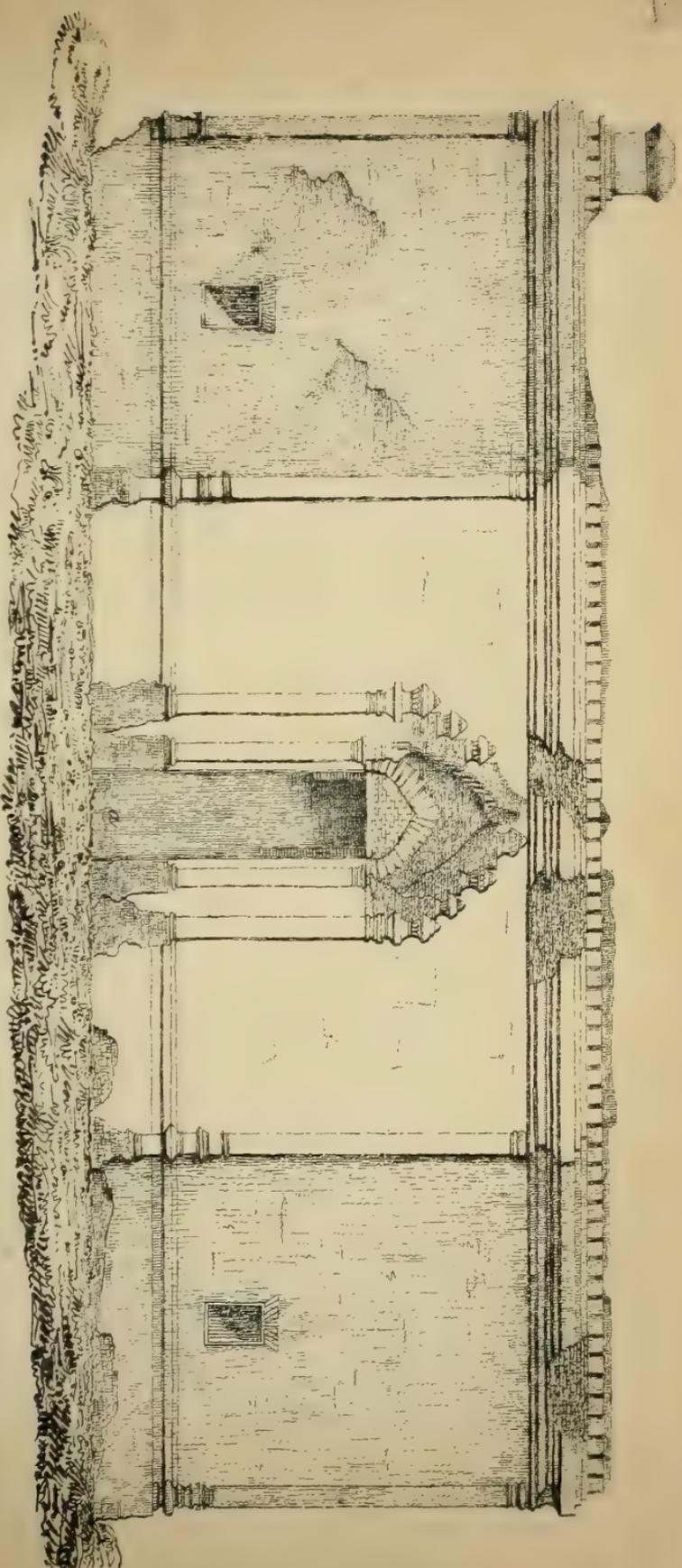
*Remarks upon an ancient Buddhist Monastery at Pu-gân, on the Irrawaddy.—By Lt.-Col. A. PHAYRE, Commissioner of Pegu.*

The ruins of the ancient city of Pu-gân are situated, as is well known, on the left bank of the river Irrawaddy, about three hundred and fifty miles above Rangoon.

In the southern portion of the ruined city, I discovered the remains of an ancient monastery. This was the first building of the kind that I had met with in Burmah, and it is probably in better preservation than any of the ancient Viharas built for Buddhist monks. The nature of the masonry, as compared with that of Pagodas at Pu-gân, the date of building which is known, leads me to believe that the monastery in question was built five or six hundred years ago. The building is constructed entirely of brick.

It is somewhat dilapidated. Still enough remains to show distinctly the nature of the building and its several divisions. The ground plan is shown in the sketch accompanying, and a rough front elevation is added. There was evidently no upper story.

The building consisted of a square of about 80 feet, the outer wall up to the top of its battlemented parapet being about 18 feet above the ground. Each corner had a pilaster supporting a deep cornice which ran all round the outer wall. The outer wall had been plastered, but this protection has now nearly disappeared. The corner pilasters rested on basement mouldings, which appear to have been placed nearly two feet above the ground; the chief entrance was on the eastern face of the building, and here there was a projection of about 15 feet from the main wall, forming a part of the outer room or vestibule. There was a corresponding projection on the opposite face where there was an elevated domed structure, for the reception of an image of Gautama. This was apparently, from what remains, some twelve or fourteen feet higher than the outer wall. Over the entrance door on the eastern side, there had been an ornamental canopy of flamboyant rays in plaster, such as is seen over most of the doors and windows of the temples of Pu-gân. This,



Front Elevation of an ancient **BUDDHIST MONASTERY** at PUGAN.

ON THAKSĪN PAUK AND LITHING BY H. M. SMITH, SURV. GEN'L'S OFFICE, CALCUTTA, OCTOBER, 1860.







East.

References.

- 1 Vestibule.
- 2 Library ?
- 3 Steps to Roof.
- 4 to 13. Cells.
- 14 Open Court.
- 15 Raised image of Buddha with crypt beneath.

however, is now nearly worn away by the weather. Entering this door-way, you pass at once into the vestibule or outer room, which is about 30 by 25 feet. From this you enter the main enclosure or central court of the monastery, more than 40 feet square, and into which open the principal surrounding cells, which were for the use of the monks. At the west end of this court, and directly fronting the main entrance, is an elevated domed tower, once surmounted by a graduated steeple now in ruins. Within the domed tower, at a height of about fifteen feet above the ground, was a *palleng* or raised throne, for an image of Gautama. This must ordinarily have been worshipped from below. There are no existing steps up to the tower, which probably was reached from the hall by a ladder when necessary. Beneath this throne was a vault below the level of the ground. A small opening and descending passage led down to it. In the vault also were places for images. This represented the cave which Buddhists love to construct, to remind them of places for retirement and devotion. The walls for the interior cells or apartments of the monastery are now not more than 10 or 12 feet high, and this appears to have been their original elevation. The interior walls have not been plastered. No portion of a roof anywhere remains. Each cell has a separate entrance door and window about 18 inches square. These are all formed with flat arches and no timber appears in any part of the building. It is not clear how the cells have been roofed or with what material, but probably with planks. Not a vestige of a tile was visible. The outer wall of the building is pierced to receive stone pipes to carry off the rain water from the roof. These are seen obtruding through the top of the outer wall below the parapet. The great centre room or court of the monastery has also been roofed but probably only with boards laid horizontally. The two dotted lines in the plan show where, from marks at the top of the inner walls of the side cells, two beams had probably rested. In a climate where it seldom rains, planks laid on rafters supported by these, would afford sufficient protection from the weather. This apartment was evidently the great hall of the monastery where the religious discourses and instruction would be conducted. The outer room would be that for the reception of strangers and probably for teaching the scholars, who daily attended for that purpose, as is now

customary at existing monasteries in Burmah. At the south-eastern angle of the building was an apartment differing from the others. It had several recesses in the walls and may probably have been the library of the establishment. At its southern end was a staircase which led up to a small turret on the roof. This was probably intended for the inmates to proceed to the roof in the cool of the evening.

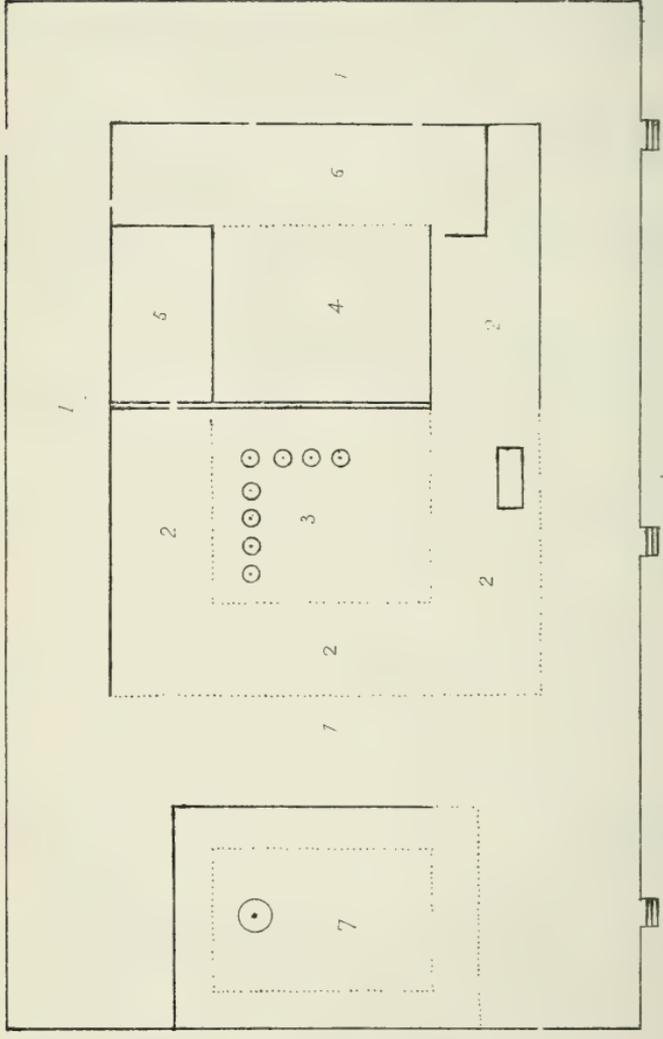
The monastery was surrounded by an enclosure wall (now nearly all in ruins) about nine feet high. Each face was about 200 feet long. There was only the appearance of a gate at the centre of the eastern face. This was constructed with a double arch, indicating that the monastery had been erected by royal bounty.

This building appears to have been constructed solely as a monastery or residence for monks, and with places for images of Buddha, but no other object of worship. I mention this as Mr. James Fergusson in a note on Buddhist structures, appended to Yule's *Narrative of the Mission to the Court of Ava in 1855*, appears to suppose that in Burmese monasteries "a dagoba altar" has been introduced, together with images of Buddha, thus converting the Vihara or monastery into the purposes of a chaitya hall. I am not quite sure that I understand what is meant by a "dagoba altar," to which "the priest turns in prayer." If it be a small model dagoba representing a relic receptacle, I am very certain I never saw one in a modern Burmese kyoung or monastery. In Burmah, Buddhist monks do not conduct worship. They simply preach the law. Each individual makes his own offerings, and utters his own ejaculations. Prayer is scarcely an appropriate term for the devotions of Buddhists. There was no indication in the ancient monastery I have been describing that any such object of worship as a "dagoba altar" was introduced. But in the enclosure wall of the monastery, and entirely detached from the building, are two small chambered or vaulted pagodas, which evidently were intended as oratories, (so to speak,) for the monks. This also would tend to show that no "dagoba" was placed within the walls of the monastery itself.

It may be well to add a few words on modern monasteries in Burmah. They are almost invariably built entirely of teak wood. Indeed Burmese of the present day, clergy and laity, appear to have



PLAN OF A MODERN  
 BUDHIST MONASTERY  
 at PUGAN.



North

SCALE 24' 1 INCH

Feet

0

1

2

3

4

5

6

7

8

9

10

a prejudice against living in brick edifices, whether sacred or profane. Close to the Ananda temple at Pu-gân is a monastery called Ananda monastery. It was, when I visited it in October, 1859, about eight years old. The building, of which a plan is annexed, rests on a platform of teak plank, supported by about two hundred massive teak posts, each not less than eighteen inches in diameter. The floor or platform is raised about eight feet from the ground. The monastery itself is 60 feet long from east to west and 45 feet from north to south. The outer portion of the platform on which the building rests, is left unroofed, being an open space from 14 to 16 feet broad, all round the monastery. A reference to the accompanying ground plan will show, that the arrangement of this modern building bears no resemblance to that of the ancient one. The outer walls of teak plank, are seven feet high. The roof rises with three gradations or tiers. The eaves, gables and ridge ornaments are elaborately and beautifully carved. No gilding appears in the building. The Abbot of this establishment was upwards of eighty years of age. His apartment would properly have been the state room (No. 4) but his great age rendered it irksome to him to move, so he passed his time, during the day, in the long northern apartment, (No. 2) half reclined, leaning against one of the great pillars and enjoying the air. About half of the north side of the outer wall of the building and the whole of the eastern side consisted of shutters working on hinges, which could be raised up and supported on poles, or closed at pleasure, usually only those on the northern side were kept raised during the day. At night the aged Abbot had his bed on the floor, near to where he sat during the day, though there was a handsomely carved bedstead for him close by, had he wished to use it. Near him slept one of the two pazens or deacons, of whom two were attached to the monastery. This arrangement also was with reference to the great age of the Abbot. Under ordinary circumstances, one or both of these pazens would have occupied the room south of the state room (No. 5). The long room called western apartment (No. 6) I found occupied by one of the pazens and the young probationers, of whom there were some half dozen. Usually also this would have been the school room for those boys who attended daily for instruction, but the old Abbot could not bear the noise of these youngsters, and the

schooling went on in another and separate building. In the idol apartment (No. 3), most of the images of Buddha were arranged facing the entrance, that is to the north. Two or three were facing the east. They were placed in wooden models of sacred dwellings, elaborately carved and gorgeously gilded. Worshippers coming to listen to the preaching of the monks, or to make offerings of flowers and food to the images, would kneel below the raised dais, and women probably outside the raised screens on the uncovered platform, so as not to come too near the officiating monk. But they might enter the monastery to deposit their offerings, on a receptacle which is generally placed before the images. No particular room was set apart as a library. Some book-cases were in the idol room, and some books were scattered on bedsteads below the dais on the east side.

In this monastery the discipline was evidently very lax, no doubt arising from the great age of the Abbot, and his inability to move about, and personally exercise authority. The pazens or deacons I found importunate, and the young probationers, notwithstanding their shaven heads and yellow robes, as riotous and wild as school boys. However they all were civil and obliging and willingly showed me over the establishment. Being much interrupted by them in making measurements of the rooms, I left it to be done by a Burmese assistant. He afterwards told me he also had been quite perplexed by the talking, questioning, joking and laughing of these young candidates for monasticism.

On the same platform with the monastery, and at a distance of only 13 feet under a separate roof was what is called a "phra kyoung" or image monastery. In this were images of Buddha placed facing to the north. But as this building is not an essential part of a monastery though in modern times generally added thereto, it need not be described.

#### *References to plan of modern monastery.*

1. Uncovered portion of the platform on which the building rests.
2. Outer hall extending on three sides of the building. The east side and a portion of the north is enclosed by wooden shutters.
3. The principal division of the monastery called "Phra Khan,"

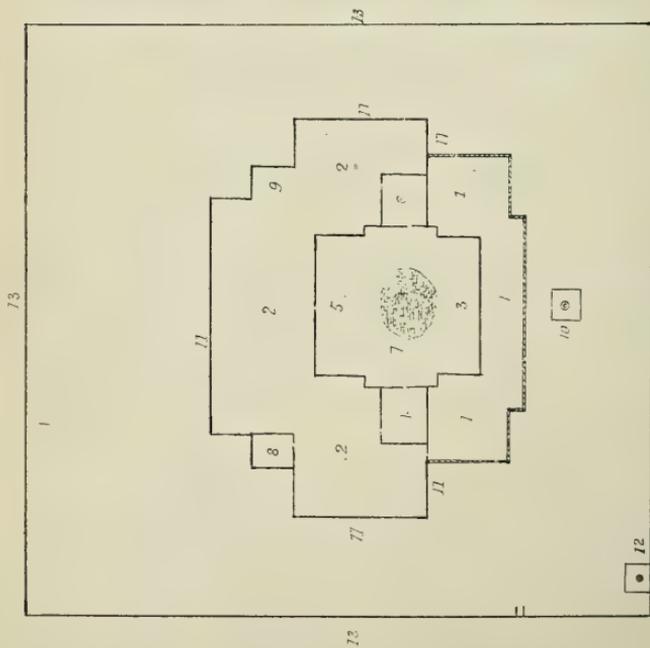


PLAN OF A RUINED

BUDHIST MONASTERY

near the Tsolia Moonee Pagoda,

at PUGÁN.



REFERENCES.

1. Open terrace.
2. Court yard.
- 3, 4, 5, 6. Apartments.
7. Mound of ruins, apparently place for an Image, probably facing to the East.
8. Vaulted Chamber. (Library?)
9. Ruins of a look out tower.
10. Small pagoda.
11. Inner enclosure wall.
12. Small pagoda.
13. Outer wall.

or "Image apartment." The floor is raised about a foot higher than the rest of the floor of the building. The idols are facing the north and east.

4. The state room for the Abbot. This is separated by a richly paneled wall from the "Image apartment."

5. Room for the pazeng or second in rank to the Abbot.

6. The "western apartment," where the young probationers and students sleep and eat. In this apartment, ordinarily the teaching of the day-scholars would be conducted.

7. This is called "the Image monastery." It is not invariably joined to a monastery, but when added it is always on the east side. The principal idol in this building faces the north.

*Note on a ruined monastery near the Tsoola Moonee Pagoda at  
Pu-gân.*

Amidst the extensive ruins of Pugân there are probably many objects of interest yet to be discovered. I met with a second ruined monastery near an ancient temple called the "Tsoola Moonee." A rough ground plan which is annexed, shows the arrangement of the building. The main building, as seen in front facing the east, which included a portion of the interior enclosure wall, was nearly 150 feet long. The principal entrance was on the east. It was gained by ascending a slightly elevated open terrace. In the interior were four apartments, including the vestibule, which were arranged somewhat in the form of a cross, round a central mound, which had probably contained an image of Buddha, within a vaulted chamber. Not far from this monastery was another building, within which I found a stone inscription on which the Burmese date 678 (A. D. 1316) was legible, but I have not been able to decipher the inscription itself.

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*On the rocks of the Damúda group, and their associates in Eastern and Central India, as illustrated by the re-examination of the Rániganj field.—By W. T. BLANFORD, Esq. Geological Survey of India.*

One of the most interesting problems in Indian Geology is the question of the age and mutual relations of the rocks containing coal in Bengal and Orissa. The fossils from the first named locality have long attracted notice in consequence of the great divergence shewn by them from European types of carboniferous vegetation, and of their identity with those from beds, also containing coal, in Australia. But these fossils being entirely vegetable, and fossil plants not having attracted, until very recently, the attention they deserved, except in the case of the true carboniferous flora of Europe and America, very little progress had been made towards ascertaining the geological relations of the Indian coal fields, until the commencement of the work of the Geological Survey of Mr. Williams. They were almost universally massed together as representatives of the carboniferous era, and the details of their geology were utterly unknown. They had not even received the attention which had been devoted to the rocks of Central, Western and Southern India.

Mr. Williams directed his attention rather to the economical than to the scientific questions presented to him, and he appears, in his examination of the Rániganj field, not only to have accepted the idea of the rocks being of true carboniferous age, but to have supposed that he found in the several beds composing them, representatives of the subdivisions recognized in Great Britain. But his observations on the geological relations of the beds among themselves are generally careful and accurate, his map is singularly correct, considering the very grave difficulties under which he worked, and although, partly perhaps owing to the small area which came under his observation, many essential circumstances escaped his notice, his accurate and trustworthy descriptions have since proved most valuable in shewing the relations of the rocks he surveyed to others which have since been examined.

The only other detailed geological observations are contained in

two papers by Mr. J. Homfray, one published in the Asiatic Society's Journal for 1842, the other published in 1847, and reports by Dr. McClelland, on the Kaharwali coal field, and on other portions of the tract of country between the Ganges and the Grand Trunk Road. It is impossible to consider any of these papers as contributions to science, all being extremely inaccurate. Indeed in one case injury has been done, the plates attached to Dr. McClelland's report, not being true delineations of the fossils they are intended to represent (a result perhaps of the difficulty of obtaining competent draughtsmen and lithographers in Calcutta) have caused erroneous opinions to be entertained in Europe, amongst Paleontologists, concerning the affinities of the plants figured.

Very little light came from Australia. The plants there associated with the coal were examined by Messrs. Morris and McCoy, and the rocks themselves by Clarke and Strzelecki. Unfortunately the last observers adopted different and irreconcilable opinions, the first named stating that the coal-bearing rocks were interstratified with others containing marine shells of carboniferous age, the other that they rested upon the marine beds. The relations of the plants were generally considered to be oolitic.

This last opinion was supported by the discovery in India of cycadaceous plants, as *Zamites*, *Pterophyllum*, &c., allied to forms supposed, until recently, to be characteristic of Jurassic and Upper Mesozoic rocks. These Cycads were moreover in places, as in Nagpúr and the Rájmahál hills, found in the neighbourhood of *Vertebraria*, *Glossopteris*, and other genera, peculiar to the coal-bearing rocks, and it was supposed that all were found in the same beds.

The examination of the beds of the Rájmahál hills, of Orissa, and of Central India, by the Geological Survey, together with the valuable observations and collections of the Rev. Mr. Hislop at Nagpúr, have, for some years past, been gradually throwing light upon the true relations of the various beds. The re-examination of the Rániganj or Damúda field during the past two years has supplied several important links in the chain of evidence, and the following is an abstract of the views of the writer upon the classification which may be adopted. The details of the survey of the Rániganj field will be published as usual as the memoirs of the Geological Survey.

The rocks of the Rániganj field and their approximate thickness in feet, are, in descending order,

|                        |   |                         |        |
|------------------------|---|-------------------------|--------|
| 1.—Panchit group,..... | { | Upper Panchits, ... ..  | 500    |
|                        |   | Lower Panchits, ... ..  | 1,500  |
| 2.—Damúda group, ...   | { | Rániganj series, ... .. | 5,000  |
|                        |   | Iron stones, ... ..     | 1,500  |
|                        |   | Lower Damúdas, ... ..   | 2,000  |
| 3.—Talchir group, ...  |   | ... ..                  | 800    |
|                        |   |                         | 11,300 |

Of these beds the Damúda group alone contains coal. This enormous thickness of beds is cut off on the south by a fault, *the downthrow of which cannot be less than 10,000 to 11,000 feet.*

The lowest or Talchir group, first separated in 1856 from observations in Orissa, consists of a series of fine sandstones and mudstones, frequently of a peculiar greenish colour, and becoming coarser towards the top, while towards the base they are commonly composed of the finest silt, in which there occur, in patches, gneiss boulders of enormous size, some having been measured as much as 15 feet in diameter. It is most difficult to account for so anomalous an occurrence as that of these huge blocks in the finest mud, for any current which could roll or even move the former would necessarily sweep away the latter, and although such a phenomenon appears absurd in India, judging from the climate of the present day, the action of ice, probably of the form known as ground ice, appears to be the only geological agent which can account for all the circumstances, by explaining the transport of the boulders.

The Talchir group had not undergone a very great amount of denudation, prior to the deposition of the Damúda rocks. It is, however, completely overlapped in the eastern portion of the Rániganj field, although well developed in the west. Very few fossils have as yet been obtained from these beds, those found are entirely plants, and shew distinctions from Damúda forms.

Beds belonging to the Talchir group have now been discovered in Orissa, in Central India, in Beerbhoom, where they occur in numerous scattered patches, and in one or two places on the west side of the

Rajmahál hills, besides their occurrence in the fields of Rániganj and Rámghar.

The *Damúda* series, thus named from its extensive development on the banks of the river *Damúda*, comprises, with perhaps one exception, all those rocks from which coal has been obtained in Bengal; the coal bearing rocks of the Himalaya, Khasi hills and Burma being, however, distinct. This series is divided in the Rániganj field by a mass of black shales, containing beds of clay ironstone, and attaining a total thickness of about 1,500 feet. There is evidence of unconformity between these shales and the Lower *Damúdas*, but none is clearly made out between them and the upper series or Rániganj beds, with which they are in consequence classed.

The Upper *Damúdas* of Rániganj must be carefully distinguished from those beds in Central India which have been called Upper *Damúdas*,\* *Mem. Geol. Survey of India, Vol II. pp. 176, 312.* The Rániganj beds differ from the Lower *Damúdas* in mineral character, and also slightly, so far as is at present known, in fossil remains. The upper beds consist mainly of very thick false bedded sandstones, with seams of coal frequently continuous over considerable areas. The lower beds are much coarser and more conglomeritic, and are rarely false-bedded; their coal seams are numerous, but very variable in quality, and frequently thin out, or change into shale, or even sandstone, within very short distances.

The most characteristic fossil distinction between the two groups consists in the abundance of a species of plant referred by Mr. Oldham to *Schizonema*, in the upper division, which has not been found in the lower. No animal remains have as yet been discovered in the *Damúda* beds.

The upper or Rániganj series is not known to be represented beyond the *Damúda* field. The lower group is also found in Orissa, and along the Western side of the Rájmahál hills. The superiority of the coal of Rániganj is perhaps partly explained by the circum-

\* This name was given for good geological reasons, as will be seen by reference to Vol. II. of the *Memoirs of the Geological Survey*. It has however proved an unfortunate appellation, as it conveys an incorrect idea of the relations of the beds, which contain a flora completely distinct from that of the true *Damúdas*. see *Mem. Geol. Survey, Vol II. p. 176.*

stance that most of the best seams occur in a group of rocks unrepresented in other fields. It is not known to which group the beds of Palámo Rámghar or\* Central India belong.

Above the Damúda beds, and slightly unconformable upon them, occurs a series of coarse false bedded sandstones, with intercalations of red and grey clays, passing into shale in places. These beds are mainly developed in the Southern portion of the Rániganj field, where they form the mass of the fine hill of Panchit (Pachete), whence the name of Panchit series is suggested for them. The upper part of Panchit Behárináth and Garanji hills are composed of a coarse conglomerate, differing in mineral character from the lower portion of the formation.

This lower portion is of considerable interest, for, besides plants, the first distinct animal remains yet discovered in Bengal have been procured from them. These consist of various biconcave vertebræ and other bones, jaws and teeth, apparently reptilian, and of a small crustacean allied to *Æstheria*. The plants include, besides numerous peculiar forms, the *Schizonema*? so characteristic of the Rániganj series.

The *Æstherias* appear identical with those found by Mr. Hislop in the Mangáli shales of Nagpúr. From these shales was also procured a reptile, *Brachiops laticeps* of Owen, belonging to the same group as the *Labyrinthodon*. It seems probable that the Mangáli shales are the representatives of the Panchits of Bengal. The Upper Damúdas of Jabbalpúr may also be of the same age.

In the Rájmahál hills the Lower Damúdas are unconformably overlaid by a series of grits, conglomerates, and white clays. Above these, also unconformably, occur enormous flows of basaltic trap, with interstratifications of white and black shales, abounding in plants of the genera *Zamites*, *Pterophyllum*, *Pecopteris*, *Tœniopteris*, &c.

\* Beds containing plants of Damúda age occur also at the base of the Himalayas of Sikkim, a circumstance first noted by Dr. Hooker, in his "Himalayan Journals," Vol. I. p. 403, and confirmed by myself in 1856. Nothing however could be made out of the extent of the beds, which are distinct from those containing coal on the Tista river. The only evidence of the existence of Damúdas were specimens of *glossopteris* and *vertebraria* found in loose blocks in a stream below Pankábári.

all quite distinct from Damúda forms. These beds were first accurately described by Professor Oldham in a paper published in the Society's Journal for the year 1853. They have since been named by him the Rájmahál series. It was, however, at first thought that a slight passage existed between the Damúda and Rájmahál groups, a view which Professor Oldham has since announced to be erroneous; the passage, if any exists, occurring in the conglomerates and grits interposed between the two series. *Memoirs of Geological Survey of India, Vol. II. pp. 313, 325.*

The conglomerates and grits of Panchit hill, provisionally termed the Upper Panchits, agree perfectly in mineral characters with those underlying the traps in the Rájmahál hills. As there is every probability that they occupy the same position in the general series, it is not unreasonable to suppose that they are an extension of the same beds.

A still higher group occurs in Orissa and in Central India, to which the name of Máhádeva has been given. No representatives of it are known in Bengal, and it is possibly considerably higher in the series than any of the groups above mentioned.\* It is not by any

\* Professor Oldham has suggested as probable that it is of Nummulitic (Middle Eocene) age. (*Mem. of the Geological Survey of India, Vol. I. p. 171 and Vol. II. p. 210 note*), and there are doubtless arguments in favor of his suggestion. But the Máhádevas are in Central India overlaid unconformably by an intertrappean series abounding in a shell, *Physa Prinsepia*, said to be very closely allied to *Physa Nummulitica* of D'Archiac from the Nummulitic rocks of the Panjáb, if not identical with it. (See Hislop on the Tertiary beds and fossils of Nagpúr, *Quarterly Journal, Geological Society, Vol. XVI. pp. 163, 164*). By D'Orbigny (*Prodrome de Paléontologie, II. 299*) *Physa Prinsepia* was considered identical with *P. Gigantea*, Du Boissy, from beds near Rheims which are of the lowest Eocene age, even below the plastic clay, while Nummulitic rocks are considered by the best authors on the subject, as, at lowest, middle Eocene. There is much general similarity of facies between the fresh water (? land) shells of the Rheims beds (*Mem. de la Société Géologique de France 2e. serie, Tome II. plate 6*) and those of the intertrappeans of Central India. The identifications of the *Physas* are dubious, especially that of D'Orbigny, but the resemblance of the facies is important. So far as this evidence goes, it tends to point out the intertrappean beds as at least as low in the series as the Nummulitics and possibly lower. In this event, from the great break between the intertrappeans and the Máhádevas the latter must, a fortiori, be of pre-Nummulitic date. But all the evidence either way is of an extremely slight description.

means certain that the beds of Orissa and Central India are of the same age.

The age of the rocks associated with the coal of Bengal is still undecided, but it is to be hoped that the examination of the reptilian remains from the Panchit beds may throw some light upon the question. The occurrence of the little *Æstheria*, a crustacean singularly abundant in the Trias of England and Germany, the coal field (Lower Mesozoic and probably Triassic) of Richmond, Virginia, U. S., and in Nagpúr in connexion with a reptile belonging to a group peculiar to the Trassic and Permian periods, (Rupert Jones on *Æstheria Minuta*, Quarterly Journal, Geological Society, XII.) seems to add weight to the gradually accumulating evidence in favor of these beds being classed with the still imperfectly known groups which are considered by European geologists to form the close of the Paleozoic and the commencement of the Mesozoic epochs. (See Professor Oldham's paper on the geological relations and probable geological age of the several systems of rocks in Central India and Bengal. Mem. Geological Survey of India, Vol. II. p. 295.)

There are three localities whence more accurate determination of the age of these rocks may be expected. Of these one is in Australia, the other two in India, on the banks of the Godavery, S. of Nagpur and in Cutch; and the attention of all interested on the Geology of India should be directed to the desirability of obtaining all possible accurate information from these places.

The following diagram represents the views above put forward of the relations of the different series referred to together with their distribution throughout Eastern and Central India.

|    | <i>Rániganj.</i>       | <i>Rájmahál.</i> | <i>Orissa.</i> | <i>Nurbadda valley.</i>        | <i>Nagpúr.</i>      |
|----|------------------------|------------------|----------------|--------------------------------|---------------------|
| 1. | „                      | „                | Máhádevas?     | Máhádevas.                     | Lametas. Máhádevas. |
| 2. | „                      | Rájmaháls.       | „              | „                              | „                   |
| 3. | { Upper Pan-<br>chits. | Conglomerates.   | }              | Upper Damúdas of<br>Jubbulpúr. | Mangáli<br>shales.  |
|    | { Lower do.            |                  |                |                                |                     |
| 4. | { Rániganj<br>series.  | }                | }              | }                              | Damúdas.            |
|    | { Iron stones.         |                  |                |                                |                     |
|    | { Lower Da-<br>múdas.  | Lr. Dms.         | Lr. Dms.       | Lr. Dms.                       |                     |
| 5. | Talchirs.              | Talchirs.        | Talchirs.      | Talchirs.                      | ?                   |

*Report on Geological Specimens from the Persian Gulf, &c., collected by Captain C. G. CONSTABLE, H. M. I. N. Concluding portion by H. J. CARTEB, Esq., F. R. S.*

Since my Report on the Geological specimens brought to me by Captain Constable from the Persian Gulf was published,\* Captain Constable and his assistant Lieutenant Stiffe have been back to the Gulf to finish their survey, and, having again returned to Bombay with the necessary observations for completing their Chart, have, at the same time, brought geological specimens from the islands which they had not before visited.

It will be remembered that the specimens first brought were chiefly from the islands at the entrance and on the Persian side of the Gulf. Those which I have now received are from the islands on the Arabian side, and which, with Captain Constable's account of the Artesian Springs about Bahreyn, and the occurrence of floating tracts of Naphtha a little higher up, will now successively occupy our attention.

After having entered the Persian Gulf and keeping on the Arabian side of the islands of Boo Moosa and Surree,† whose geology has been mentioned in my last "Report," we come, bearing S. S. W., about 45 miles from the latter, to the island of Seir Abonade, rising 240 feet above the level of the sea at its highest point, whose geology is illustrated by volcanic trappean rock and red ferruginous gypsum, similar to that of the nearest island, viz. Surree, which thus connects Seir Abonade with the volcanic formations of the whole of the islands on the Persian side and extends these formations on to the islands on the Arabian coast, with which we are now principally concerned.

Taking thence a W. by S. course and running along the border of the "Great Pearl Bank," which presents nowhere more than ten fathoms of water over it, and shoals off to the Arabian coast, we

\* For the former portion *vide* Bengal Asiatic Journal, No. 97, p. 41. (New Series).

† I must here follow the Orthography of the Charts. "Boo Moosa" and "Surree" would certainly be better spelt "Bu Musa" and "Sarri" for European pronunciation generally.

cross over its seaward margin, and at 70 miles from the last mentioned island, arrive at those of Zirkúh, Daus, and Jirnain, after which, a few miles west, come the islands of Arzenie, Daeny, and Dalmy, which latter lie respectively, N.W. and S. W. of the former.

The island of Zirkúh, which rises 540 feet above the level of the sea, and is by far the highest in the two groups, presents not merely remnants, but an exact geological type of the islands on the Persian side, viz. volcanic rock capped with "Milliolite,"\* together with altered shale and specular iron-ore.

Of the same type, also are Daus and Jirnain, but *without* the Milliolite.

In the next group, the island of Dalmy, which is 244 feet in its highest part, and only 25 miles from the Arabian coast, we find again the same kind of volcanic and marine formations; thus carrying them on to within a few miles of the mainland, on which there are no doubt points, here and there, where they might be equally well verified, and thus completely extended from one side to the other, of the lower part of the Persian Gulf. Some of the specimens of "peacock-iron-ore" from Dalmy are as beautiful as any that I have ever seen from the island of Elba.

The island of Arzenie is also composed of volcanic rock capped with Milliolite, while that of Daeny which is only 9 feet above the water, consists of compact limestone altered by heat and also capped with Milliolite, shewing at once the kind of strata through which the volcanic rock has been thrown up and that which has subsequently been deposited on it.

Lastly the little island of Hawlool, which is outside the "Great Pearl Bank," 180 feet high, and 45 miles north of the last mentioned, is again composed of volcanic rock capped with Milliolite, while the island of Yassart, which lies nearly south of the latter and within ten miles of the Arabian coast, presents the Milliolite alone, and thus, as far as our observations extend, disappears the volcanic rock from the southern-most part of the Persian Gulf.

Doubtless there are points, as before stated, on the mainland, here and there, where the volcanic rock projects above the surface, but

\* For a description of this type and the "Milliolite," see my first "Report" *loc cit.*

with the exception of Jibel Allee lying E. S. E. of Seir Abonade, which is 220 feet high ; the island of Sir Beni Yas, and the headland close to it, which are respectively, 430 and 350 feet high ; Jibel Hadeed, about 85 miles futher west, and about 300 feet high, and a few other mounds much lower still, the whole of this shore is on a level almost with the sea, as far inland as the eye can reach, barren and uninhabited, shewing still further how the Gulf, in its lower half, shoals off through the "Great Pearl Bank" into the interior of the mainland of Arabia.

Leaving this field of volcanic disturbance, in which the outbursts of igneous rocks, here and there, have brought up with them the great field of rock-salt whose culminating point above water is in the island of Hormuz, (for all the others which present volcanic rock are thoroughly sodden with salt), we come, on rounding Ras Rekkan northward, to the island of Bahreyn, which at its northern part, presents an extensive area both above and below the sea, of freshwater springs, the artesian nature of which is at once established, by the rainless locality in the midst of which they are situated, and the approximation of the mountain chain on the opposite side of the Gulf, only 160 miles distant, whose strata raised to upwards of 5000 feet within a few miles of the sea on the Persian side, dip downwards to form the Gulf, and rising again, apparently without much disturbance, at Bahreyn, thus carry their waters with them to issue at a place much lower than that on which they fall. That the presence of these springs at Bahreyn may be thus explained needs only a reference to Captain Constable's beautiful chart, and, for the detail respecting them, here is his own account :—

"The freshwater springs in the sea about Bahreyn and on the island itself," Captain Constable states, "are numerous, and there are some to be found at intervals near the mainland of Arabia in the neighbourhood ; indeed I was informed by the Shekh of Manama that there is a lake of freshwater on the mainland close to the shore nearly opposite Bahreyn. They are to be found at intervals also as far north as the island of Bu Ali, but none beyond, nor are there any others at any other part of the Persian Gulf ; so that they are confined to this part, that is about 90 miles of the coast of Arabia.

"The old travellers who wrote of them, relate how the Arabs dived

down to a fresh spring under the sea in five fathoms of water and filled their jars returning with them to the surface. Such I take to be "travellers' tales." All the springs that I know of, (and between us, Lieuts. Whish, Stiffe, and myself, I think we visited most of them), were situated on the reefs, many of which with the reefs were left dry at low water.

"There is one about 10 miles N. W. of Manama (which is the name of the principal town of Bahreyn), close to which H. M. Schooner, "*Mahi*," anchored, and from it supplied herself with water. They took in 700 gallons of good sweet water from it in one day. The spring is about three feet under the sea, and the way they managed was by putting a tube into it, to which a short piece of hose was joined, and the water rising in the tube, was thus conveyed through the hose directly into the boat which lay along side, where it was received into casks which had been brought for the purpose, without further trouble.

"Again, there is the island of Maharag, close to the N. E. point of Bahreyn, on which is the large town of Maharag with six or seven villages, all of which obtain their freshwater from springs under the sea or nearly so, situated on the great reef which surrounds the island. At low tide the inhabitants walk out to them and fill their vessels. Proceeding round the island northwards, from Maharag, we first come to one of these springs, on a low flat, rocky islet opposite the village of Biseytin, where it is situated in a basin which purifies itself as the tide falls but is over-flown at high water. A mile further on, are three or four others of good sweet water, all of which are also covered at high tide. The inhabitants of the village of El Dír obtain their supply entirely from these. Further round the island still and opposite the village of Gallali are two more springs on the reef; in these we found that the Arabs had placed bamboos, through which the water was bubbling up; there are also the remains of a building here, in the sea, but on the reef close to the springs. Still further round about a mile or two to the south, on the reef, is a slab of rock called "Bú Shahin" where there are more fresh springs. Then a short distance S. E. of the fort of Maharag is another, still under the sea, at least at high water, it is called "Bú Mahah." Beside it is an old tower and it supplies Maharag chiefly. Thus the island on which

Maharag is situated is surrounded by freshwater springs which, as before stated, are over-flown at high-water; and in addition to these there are others which bubble up through the island itself.

“There are also many which issue through the northern part of the island of Bahreyn, but they appear to be confined to this part of the island and are not found southward.

“I regret that I had not an opportunity of getting geological specimens of the island of Bahreyn, the highest point of which is about 400 feet above the level of the sea.

“Reverting to the spring from which the “*Mahi*” was supplied with water, I would add that, besides being 10 miles from Manama, it is 7 miles also from the nearest land which is the N. W. point of the island of Bahreyn. There is a snug anchorage close to it in a bight between reefs; the place is called ‘Khor Fusht,’ and a vessel lying there is sheltered from all winds. It has this convenience, viz. that the water is deep close to the reef, so that a vessel can lie close to the spring. The difficulty, however, is to find the spring, because even at low water, there is from 2 to 3 feet over it.

“Lastly about 30 miles N. W. of Bahreyn, near Al Katif, is a small island called ‘Deman,’ five miles off which, in the sea, is another freshwater spring on a point of the reef called ‘Rasal Khali,’ it has also three feet of sea over it at low tide.”

Having thus added what Captain Constable has kindly given me respecting the “freshwater area” as it may be termed, of the Persian Gulf, let us proceed still northward to the head of the Gulf, keeping on the Arabian side, and the first islands that we pass are those of El Kran, Arabi, Farsi and Hurgooz, which in my last report I have stated to be composed of limestone-gravel milliolite, and still further northward we come to those of Om el Maradim, Garu, and Kubbar, of which the geological specimens now before me give the same composition.

But the point of most interest communicated to me by Captain Constable respecting this part of the Gulf, is that of his having sailed through two floating tracts of Naphtha here at different intervals, respectively close to the two groups of islands last mentioned, making this, as it were, the “Naphtha area” of the Gulf. Of these phenomena Captain Constable states as follows:—

“Near Busra is a place called by the Arabs “Om Gheir” or “the place of bitumen;” and close to the town of Koweyt, at the head of the Persian Gulf, is another on the sea-shore called “Benaïd el Qâr” or “bitumen dyke;” while up at this part of the Gulf I have reason to think that there are also springs of it under the sea, for in August 1843, when in a ship 12 miles N. N. E. of the little island called “Farsi,” we passed through a field of it. The surface of the sea was covered with a glairy, oily looking substance which was accompanied by a strong smell of Naphtha.

“Again in October 1859, while sailing from the little island of Kubbar to another close by called Garu, we experienced a strong smell of Naphtha, and presently passed through large sheets of oily substance floating on the surface of the sea. Our Arab Pilot whom I had engaged at Koweyt said that this appearance was by no means uncommon, and that he was certain there were springs of it near this part, and that he knew where to take his boat to collect it, but he did not know how to collect it or he could make a fortune by it.”

The last addition to our geological information made by Captain Constable is that obtained from his specimens of the Dehmaniyah group of islands which lie close to the shore a few miles west of Muscat, all of which are formed of limestone like that of the eocene strata of the adjacent coast, while a specimen of old diorite from Khor Fakn, 165 miles further up towards the Persian Gulf, is also of the same kind as that of Muscat.

As regards the heights of the mountainous range called Jebal Akdthur whose extreme summit inland, as seen from the sea close to Muscat, I had judged to be about 6,000 feet,\* Captain Constable by triangulation makes this 43 miles inland and 9,900 feet above the level of the sea. The highest point near Ras Mussandum, 6700 feet, and Jebel Bees, a mountain about 25 miles inland on the Mekran coast opposite, stated at a guess in my last “report” to be from 5 to 6,000 feet, is now made by triangulation, to be only 4,600 feet above the sea; but there are points which lie inland to the northward of Bunder Abbas, respectively, 20, and 30, and 45 miles distant, 7,600,

\* Geology of the S. E. coast of Arabia in my “Geological Papers on Western India,” p. 555.—*Ib.* 532.

and 8,500, and 10,660 feet high, all which, from Bunder Abbas belonging to the Imam of Muscat, and the willingness of the Muscat Arabs at this place to accompany travellers to them, according to Captain Constable's account, might be easily visited. The highest point is in  $27^{\circ} 50'$  N. L. inland. At the head of the Persian Gulf, 45 miles N. E. of the village of Delim and 75 miles N. E. of Bushire, are two other points, respectively 10,900 and 10,200 feet above the sea; and between this and the last mentioned mountain at the other end of the Gulf, are points in many places varying from 2,000 to 5,000 feet high, many also of which are almost close to the coast. Thus does the Persian differ from the Arabian side of the Gulf, which latter we have seen to be almost on a level with the sea.

With this, ends all that I have to state from Captain Constable's information and specimens, respecting the geology of the Persian Gulf, which a previous personal knowledge of the coast of Arabia and Capt. Constable's accuracy have enabled me to use as I have done. Captain Constable has now finished his beautiful chart of the Persian Gulf and has handed it in to Government, and with the completion of this work my supply of geological information from this interesting locality ceases; which I regret, as one regrets the cessation of a flow of conversation on a favourite subject from a friend in whose communications one has every reason to place the greatest confidence.

Perhaps there is no part of the world which presents such a succession of striking phenomena as that between Mekran and Mesopotamia inclusive,—beginning with the great area of mud volcanoes in the former, in which the cones range from nothing to upwards of 712 feet high;\* and then going round by the Persian Gulf, at whose entrance is an area of rock-salt culminating in the island of Hormuz; then the sieve-like state of the earth in and about the island of Bahreyn occupying the middle of the Gulf—the “freshwater area;” and lastly the “area of Naphtha springs,” at the head of the Gulf and in the vale of Mesopotamia; all of which are in connection with the great fault and anticlinal axis which bounds on the southwest and south respectively, the highland of Persia, Karmania, and Mekran.

\* See Captain Robertson's interesting and valuable “Memoir”—*Journal of the Bombay Asiatic Society*. Vol III. part 2nd, p. 8, 1850.

*Notes upon some remarkable Waterspouts seen in Bengal between the years 1852 and 1860.*—By MAJOR WALTER STANHOPE SHERWILL.  
—*Boundary Commissioner,—F. G. S. ; F. R. G. S.*

During several years in which I have been engaged in recording remarkable atmospherical phenomena in Bengal, I have witnessed the formation and dispersion of several very remarkable waterspouts in and near Calcutta ; of these natural bodies I have made a memo. that describes the dates, appearance, times of duration, size, and direction of translation of these remarkable natural phenomena, in the hope, that it may assist any future enquiries that may be instituted into the nature of the laws regulating these bodies ; for up to the present time no satisfactory theory has been advanced that serves to connect these phenomena with the general law of physics.

Electricity, doubtless, is the grand mover in the formation, action and dispersion of waterspouts, but its mode of action has not yet been satisfactorily analyzed. These columns are composed of dense masses of vesicular vapours similar to heavy storm, or rain clouds, some portion of the column has generally a violent gyratory motion as well as a motion of translation. Those seen near Calcutta have all been long, slender columns about 1000 feet in length, of a pale blue colour, dark at the edges and pale in the middle ; this appearance indicates them to be solid columns of vapour ; a glass rod held up to the light would present the same appearance, as would also a barometer glass tube filled with water, or a human hair which is a tube filled with liquid, or any similar object that possesses transparency.

In many cases waterspouts are accompanied by thunder and lightning, balls of fire, or great noise, they uproot trees, destroy cultivation, overturn hayricks and houses, exhaust tanks of their water, drawing up the fish at the same time, showering them down upon dry land and on the tops of houses miles away from the spot from whence taken up : but of the waterspouts mentioned in these notes, not one did any harm or the slightest damage, most of them were dissipated into heavy rain, or were absorbed upwards into the clouds without effecting any contact with the ground. Only one, that seen over Howrah, was accompanied with lightning and thunder. No one waterspout

was accompanied with hail, which often does accompany the dispersion of waterspouts; no one drew any water or other substances upwards, as is the case when waterspouts are formed at sea. The general length of the waterspouts seen, were a thousand feet, one however was 400 feet and another 1500, in length.

It will be remarked that those waterspouts seen near Calcutta took place during the later months of the wet or south-west monsoon, August, September, and October.

That electricity is the grand mover of these bodies I think is evidenced by waterspouts being more general in dead calms than in windy weather; the suddenness of their formation; their instantaneous dispersion when once the condensation of their vapour commences, their violent and rapid gyratory motion; their great power of destructiveness although no wind may accompany them, their peculiarity of tearing trees into dry shreds in a precisely similar manner, as a tree struck by lightning is torn and dried by the evaporation of all particles of sap from excessive heat; the violent electrical discharges, balls of fire and hail that oftentimes accompany them; and the fact that their presence in no way affects the barometrical readings of the moment.

The favourite theory regarding the formation of these phenomena is simply, that when the electrical tension of the clouds is very intense, the powerful action that arises from this state of tension causes the cloud to lower itself towards the earth, for the purpose of discharging its electricity; this sudden rush of the cloud and its contained electricity towards the earth together, compose the waterspout: during their descent, from some unknown cause, a violent gyratory motion takes place, light substances are attracted upwards, and those whose weight prevents their leaving the earth, such as trees, houses, haystacks, &c., are torn and shredded to pieces; should the waterspout meet with water, it is immediately entangled in the gyratory motion and drawn upwards, as was the case some years ago at Cuttack, where numbers of small frogs and fish, drawn up with the water from a tank, were precipitated from the clouds and were collected alive from the roofs of the houses in the station.

Man has learnt, in a great measure, to disarm the lightning of its dangerous power; he has learnt how to avoid and not only to avoid,

but he has also learnt how to make use of for his own purposes one of the most fearful and hitherto ungovernable and tremendous natural phenomena, the cyclone: meeting at sea with this violent and formerly much dreaded wind, the intelligent sailor boldly sets his sails to meet it, and by his intelligence and foresight makes what might, in his ignorance, have been his destruction, a fair and a favorable wind to help him on his way to his desired haven; or else, laying to, he bows to the storm and patiently allows it to pass on its way, resuming his journey when it has passed. And so it should be with waterspouts, to thoroughly search out, and to understand the laws that govern these impetuous columns would not only be satisfactory to science, but might be the means of affording some protection to those who are liable to be harmed by them; mankind possessing this knowledge might be able to disarm these columns of their power of uprooting trees, overturning houses, sinking small vessels, disabling others, of demolishing valuable plantations and cultivation, and carrying destruction in their path; but our knowledge concerning waterspouts, as it at present stands, allows these phenomena full power to do as they please.

The formation, action and dispersion of the waterspouts observed, being very similar, I proceed to detail the above appearances in a very grand waterspout that occurred within  $1\frac{1}{4}$  miles of my house, merely observing, that there appear to be only two methods for their dispersion, namely either by precipitation of vapour to the earth as heavy rain; or absorption upwards as vapour into the clouds.

On the 7th October, 1859, a waterspout of colossal dimensions was seen to form and burst at Dum Dum 8 miles north-east of Calcutta. (See plate I. and plate II. fig 3.)

The observations made upon this phenomena at the time are as follows:—

The south-west monsoon had, during the week, received its first check by the north-east monsoon endeavouring to cross the Himalyah Mountains and to drive back the heavy masses of clouds and moisture that had been banked up along their flanks during the whole of the rainy season, or during the prevalence of the south-west monsoon.

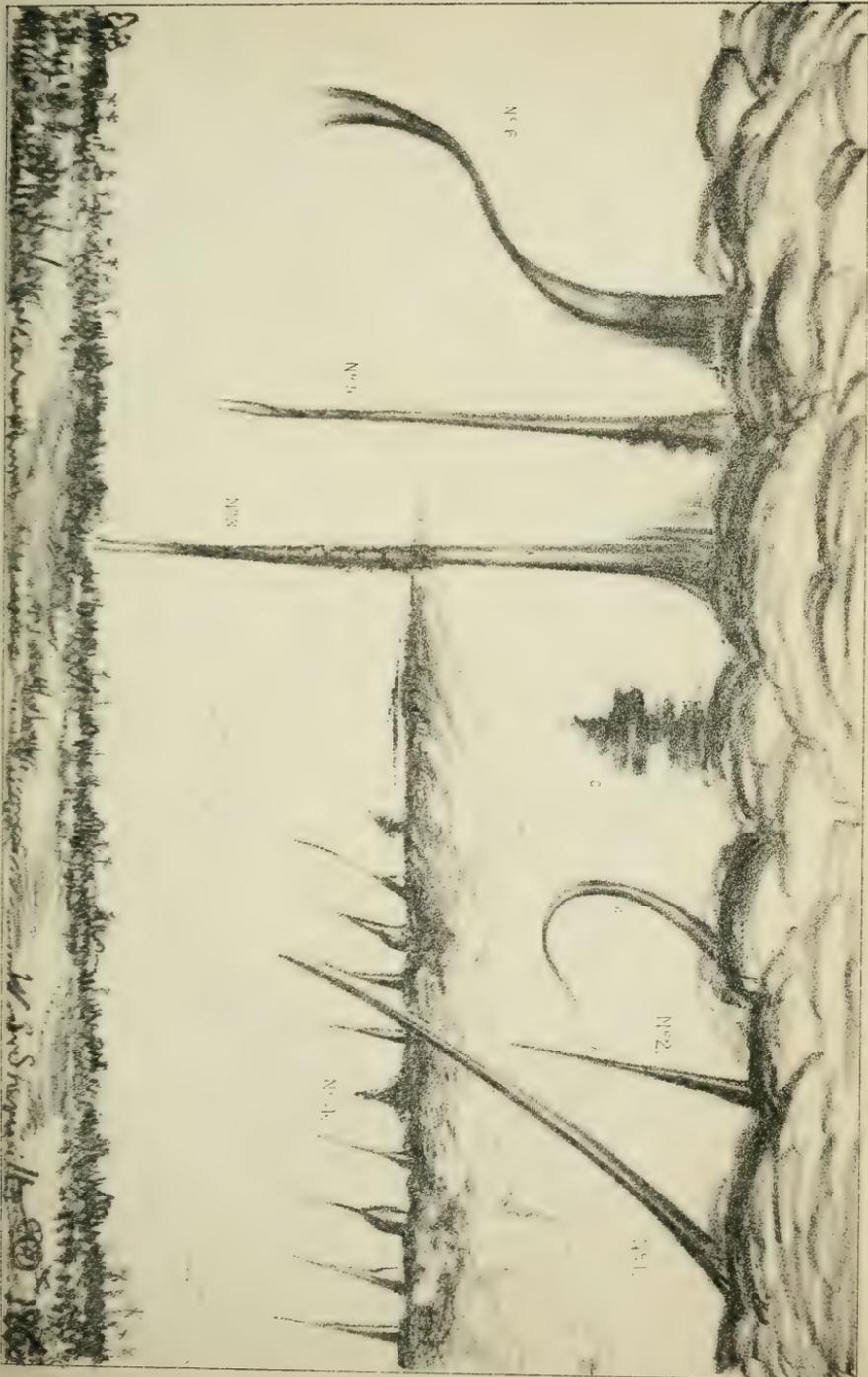
At Dum Dum, the whole visible heavens were occupied by a dense



GREAT WATER SPOUT seen at DUM DUM (BENGAL) 7<sup>TH</sup> OCT: 1859..

ON STONE BY MAJOR W.S. SHERWILL, AND LITH BY H.M. SMITH, SURV<sup>T</sup> GENL<sup>L</sup> OFFICE, CALCUTTA, 1860.



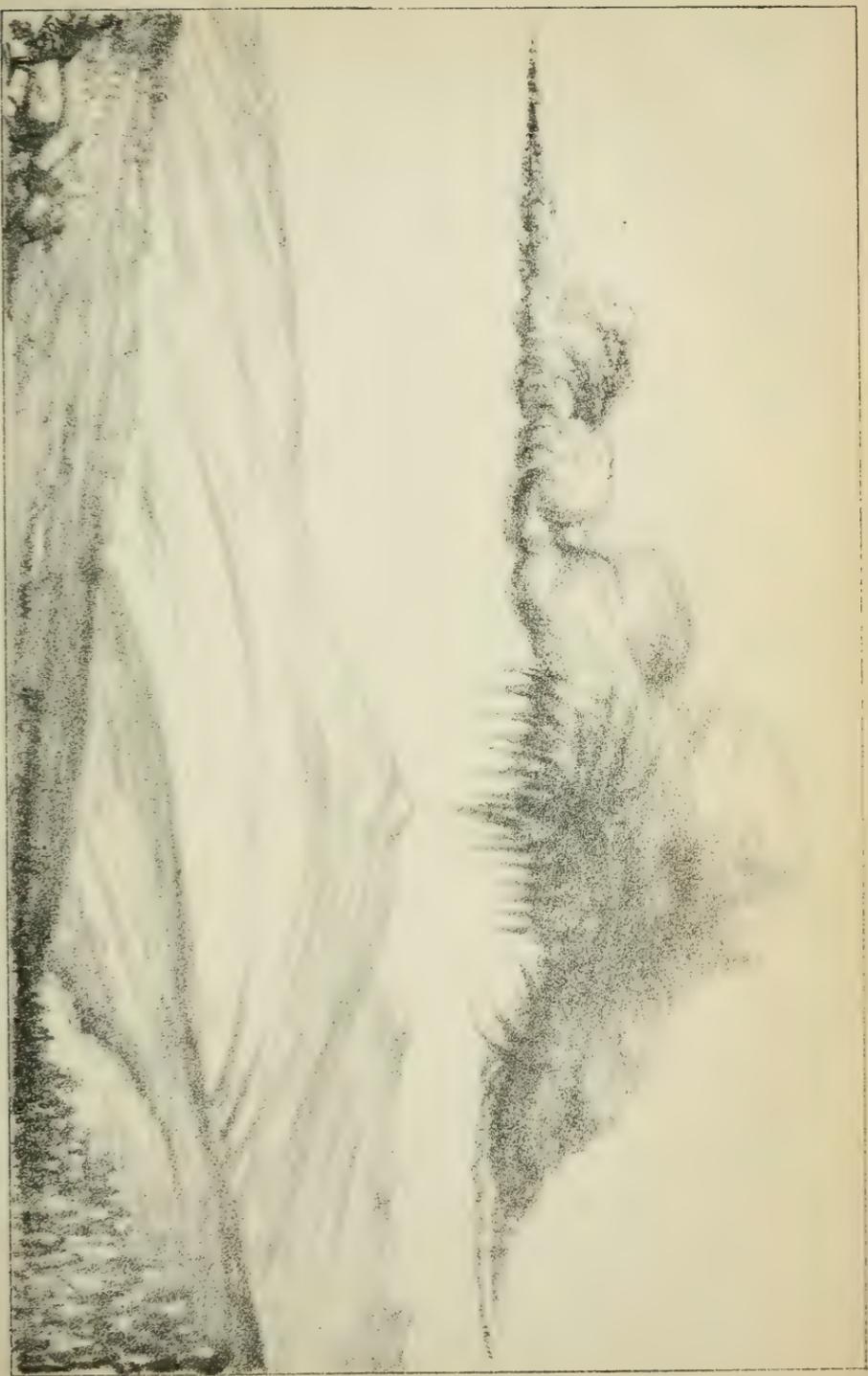


SKETCHES of SIX WATER SPOUTS seen in BENGAL, between the years 1855 and 1860.

Drawn by Major W. G. ... and Lt. ...

W. G. ... Lt. ... 1860

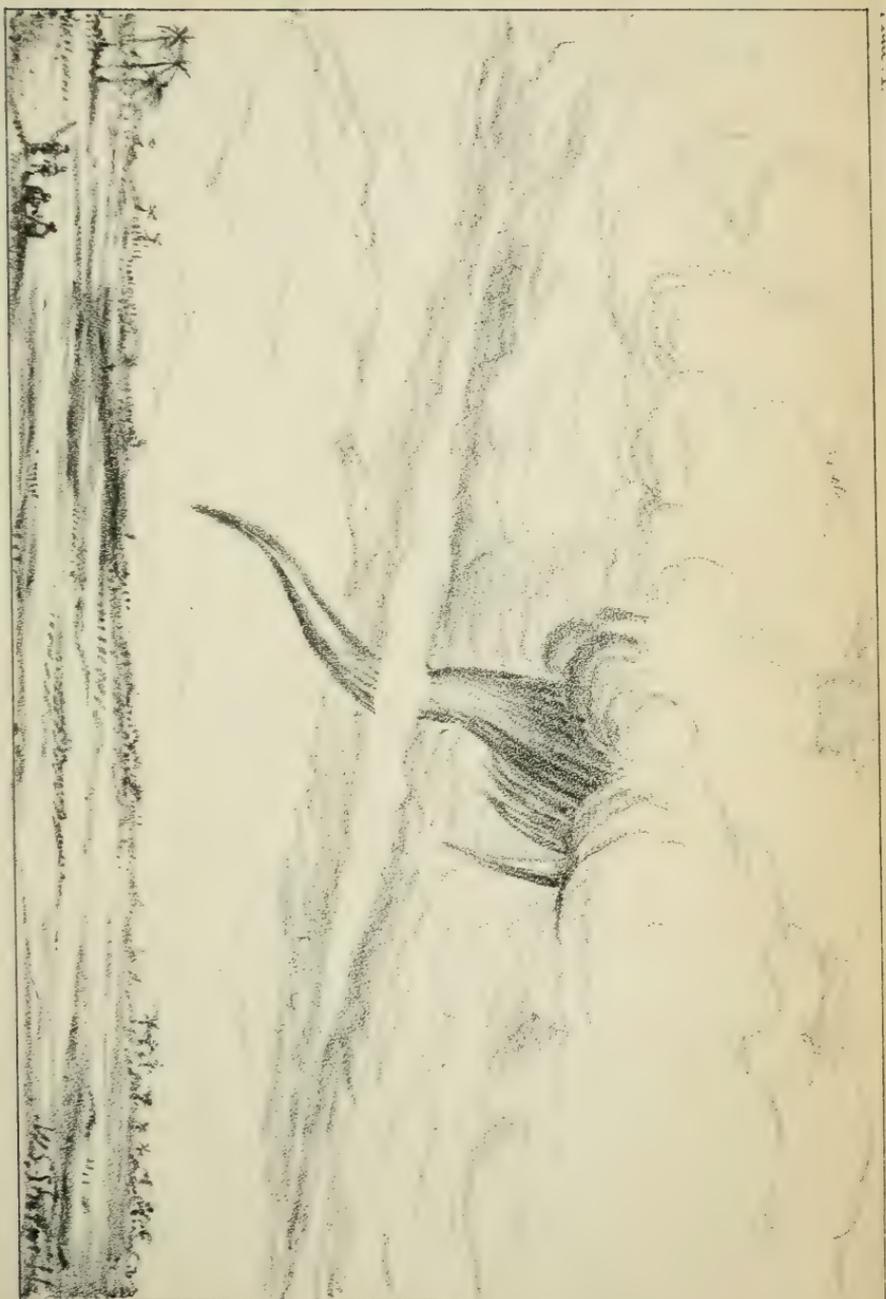




A GROUP OF HIMALAY WATER COURSES, seen in the HIMALAYAN MOUNTAINS, at an elevation of 10,000 feet, 1882

ON GROUND BY MAJOR W.S. GERRILL, AND LITHO BY H.M. SMITH, SURV. GENL.'S OFFICE, CALCUTTA, 1882.





WATER SPOUTS seen at DUM DUM, 28 Sept. 1860

ON STONE BY MAJOR W.S. SHERWILL, R. LITH. BY H.M. SMITH, SURV. GENL.'S OFFICE, CALCUTTA, 1860.



mass of very grandly shaped and massively grouped strata of cumuli, at various elevations, the lowest from actual measurement was 2000 feet above the earth; the highest, probably reaching to 25,000; the whole mass being about 5 miles in vertical thickness.

The aspect of the heavens during the past few days had been most remarkable: presenting a scene of great atmospherical disturbance, the clouds evidently being impelled from the south by the south-west monsoon; but violently checked by the north-east monsoon, giving to the whole mass of clouds extending for as many miles as the eye could reach from north to south, and from east to west, a rotary and at the same time an undulatory motion; in fact causing huge tracts of clouds to revolve rapidly round a centre that appeared from my position to be about 5 miles to the south-east. This rotary motion performed in a very large circle gave the clouds the appearance of moving in two distinct directions, for the clouds nearest to my position appeared to be going to the north, and those furthest removed appeared to be going to the south.

There had been but little rain during the day; in the early portion of the day the wind had been from the south bringing with it a large body of clouds from the sea; at noon it changed to the south-west; and at 2 P. M. to the west and at 4 P. M. to the north.

It was between the hours of 3 and 4 P. M. that the greatest disturbance in the clouds took place; the whole mass revolving and heaving violently; extensive masses of clouds being crushed and driven into others but unattended by any electrical discharges. It now rained heavily to the north and east. It was during this time that more than one waterspout endeavoured to form, but unsuccessfully. It was whilst observing the highly agitated masses of clouds that were revolving and oscillating in a most peculiar manner, that I witnessed the commencement and termination of the remarkable waterspout now under consideration. At 3 P. M. it became suddenly quite calm and during the calm a pale watery-looking but very lofty cumulus, the base of which was a right line, and parallel to the horizon, was seen to bulge out downwards or towards the earth in a long well-defined and light-blue coloured outline; from the centre of this hanging curve a broad column of a pale watery vapour rapidly sank towards the earth, closely resembling a very attenuated cone, dark at the edges and pale blue

in the centre, plainly showing it to be a solid cylinder; as it neared the earth, the lower half of this elegant column commenced to gyrate rapidly, the lower end oscillating violently to the right and to the left; this latter movement I imagine to be a mere optical illusion, caused by the lower end of the column revolving in a circle of large diameter; as the column neared the earth it expanded and contracted in an agitated and rapid manner about the centre into cloud-like protuberances which partook at the same time of the motion of the revolving column.

Upon arriving nearer the earth, the end of the column parted into two slender columns about 150 feet each in length, and in this condition reached the ground.

The shape of the column was now completely and instantaneously altered; for the whole cumulus burst and was seen pouring down to the earth, not as a shower of rain but as a heavy mass of water, resembling a waterfall more than a shower of rain, that completely exhausted and brought the whole cloud to the ground in a few seconds of time.

The estimated height of the cumulus from its summit to its base was 5000 feet, and 3,000 feet in length, the whole of which mass of vapour was precipitated tumultuously and instantaneously to the ground in the shape of water.

The period of duration of the column from its first forming to its bursting, occupied about 25 seconds, and 'offered a very grand and imposing sight.

The mass of water so suddenly precipitated upon a large grassy plain, for the column burst upon the artillery practice ground, was simply to put half a square mile of country under water for about half a foot deep. This water took 14 days to drain off by the usual drainage courses of the country.

That the waterspout was accompanied by a noise I can hardly doubt, judging from the alarm exhibited by the cattle in its neighbourhood who fled in all directions as it descended. No noise was however heard from my position  $1\frac{1}{4}$  mile distant.

By the assistance of a theodolite, a measured base, and observed marks upon the walls of my house, I was enabled to ascertain that the height of the waterspout from its junction with the clouds to its

lowest extreme point, at the moment of bursting was 1,500 perpendicular feet.

Half an hour after this waterspout had disappeared another formed to the east of my position; it was a very attenuated column about 900 or 1000 feet in length, but the cloud from whence it descended being upwards of 2000 feet above the earth, no contact was completed; the column which lasted for half an hour gradually faded away, being absorbed upwards into the cloud from whence it had descended. The cloud and column were moving rather rapidly towards the south, which probably accounts for the column never reaching the ground. The column gyrated and oscillated violently, lengthening and contracting as shown in the diagram, where eleven different positions of the column are given sketched at intervals of from 2 to 5 minutes.

Towards sunset, the clouds began to yield to the north-wind and were gradually driven out to sea, leaving a clear cloudless sky, and at 9 o'clock at night not a cloud was to be seen.

The north-east monsoon had fairly set in.

|                               |     |     |     | inches |
|-------------------------------|-----|-----|-----|--------|
| Barometer at the time 3 P. M. | ... | ... | ... | 29.796 |
| Attached thermometer,         | ... | ... | ... | 85°.8  |
| Dry ditto, ...                | ... | ... | ... | 86°.2  |
| Wet ditto, ...                | ... | ... | ... | 81°.8  |

## List of Waterspouts seen in Calcutta and its vicinity, from the year 1852 to 1860.

| Where seen from.                            | Date.                           | Length of Waterspouts.                 | Direction of movements.       | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------|---------------------------------|----------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.—Sooksagar, 35 miles North of Calcutta.   | 27th Sept., 1855,<br>3.30 P. M. | 1,000 feet not measured. Estimated.    | Moving to the South.          | Depended from a heavy Nimbus at an angle of 45° with the horizon. Upper portion gyrated rapidly, lasted ten minutes, did not burst but was absorbed upwards. (See Plate II. fig 1.)                                                                                                                                                                                                                                    |
| 2.—Howrah (Calcutta.)                       | 24th Sept., 1856,<br>6 P. M.    | 200 feet estimated.                    | Moving to the North.          | Depended from a very heavy and stormy looking Nimbus. Lasted about five minutes, was greatly agitated, throwing its lower end horizontally to the South, then to the North at an angle of 45°; burst into heavy deluging rain. Vivid lightning accompanied the Nimbus. (See Plate II. fig 2, a. b. c.)                                                                                                                 |
| 3.—Dum Dum, 8 miles North-East of Calcutta. | 7th Oct., 1859,<br>3 P. M.      | 1,500 feet measured with a Theodolite. | Moving to S. E.<br>Dead Calm. | Depended from heavy Nimbus, forming the lower end of a massive cumulus 5,000 feet in height; central portion revolving violently with cloud-like protuberances; lower end divided into two tails about 150 or 200 feet in length each. Lasted 25 seconds burst upon contact with the earth into heavy rain. Notes upon this Waterspout were read before the Asiatic Society in September, 1860. (See Plate II. fig 3.) |
| 4.—Dum Dum, 8 miles North-East of Calcutta. | 7th Oct., 1859,<br>3.30 P. M.   | 1,000 feet estimated.                  | Moving rapidly to the South.  | Seen half an hour after the foregoing Waterspout had burst. Depending from a heavy cumulus 2,000 feet above the earth, did not burst. Was absorbed up into the clouds. Lasted half an hour. (See Plate II. fig 4; a group.)                                                                                                                                                                                            |

|                                          |                              |                                                 |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------|------------------------------|-------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.—Dum Dum.                              | 11th Augt., 1860,<br>5 P. M. | 1,000 feet estimated.                           | Moving to the<br>South.      | This was a very perfect and grand Waterspout and was seen from Calcutta; it gyrated rapidly at the top of the column; depended from a heavy Nimbus; burst into heavy rain. Was divided at the lower end into two smaller columns of 50 or 80 feet in length. Lasted about ten minutes. Column dark at the edges and pale blue in the middle; no lightning accompanied it. (See Plate II. fig 5.)                                                                                                                                                                                                                                                                           |
| 6.—Sulkea, Calcutta.                     | 11th Augt., 1860,<br>5 P. M. | 8 or 900 feet estimated.                        | Moving to the<br>North-West. | This Waterspout crossed the Hooghly at Sulkea (Calcutta) agitating the water beneath it. Depended from a heavy Nimbus, burst into heavy rain. Gyrated rapidly at the summit of the column. Was bent by a South wind into an elegant double curve resembling the letter S. Had hanging fringe-clouds, dropping rain, on the South side of the upper part of the column. Lasted about ten minutes. The upper portion of the column was absorbed upwards, the lower part fell in rain. (See Plate II. fig 6.)                                                                                                                                                                 |
| 7.—Darjiling in the Himalayah Mountains. | 29th May, 1852,<br>Noon.     | 20 Waterspouts<br>1,000 feet in length<br>each. | Moving to the<br>South.      | The 29th May, 1852, was a warm, dry summer day, and had been highly favorable to evaporation, and though invisible to the eye, the air was charged with moisture, which suddenly showed itself in an extraordinary manner as a huge cumulus, fifteen miles in length, at an elevation of 11,000 feet, which was rapidly formed by the condensation of the invisible vapour caused by a chilled stream of air descending from the snowy range, distant thirty-five miles; the effect of this cold blast was first shown in the formation of a small cloud, the size of the hand, which rapidly increased until, as before described, it extended to fifteen miles in length |

## List of Waterspouts—(Continued.)

| Where seen from. | Date.            | Length of Waterspouts.                               | Direction of movement. | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------|------------------|------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.—Dum Dum.      | 28th Oct., 1860. | One central 1500 feet; and several small lateral Wa- | Moving to the West.    | <p>and 5,000 feet in vertical thickness. This body of vapour was driven rapidly to the South, and as it approached the Mountain Tongloo, which rises to 10,009 feet above the sea, the lower portion of the cloud which had hitherto been Stratus, or nearly horizontal, began throwing down about twenty Waterspouts, each one thousand feet in length, which gyrated at a rapid pace, increasing in length at the same time, until the whole cloud burst into heavy rain.</p> <p>The distance of the Tongloo Mountain from the spot of observation, at Darjiling, was eleven and a half miles; the gyration of the tails or Waterspouts therefore must have been very rapid, and very extensive, to have enabled me to see it so plainly with the naked eye.</p> <p>The summit of the mountain was evidently a point of attraction for the electricity contained in the cloud, as the Waterspouts one mile North and South of the central group descended towards the mountain at an angle of 45° with the horizon, and all seem striving to reach the very summit of the mountain, and upon reaching it, they all burst into heavy rain. Time of duration fifteen minutes. (See Plate III.)</p> <p>This extraordinary group was seen from Duu-Dum; sketched and described to me by the Rev. R. A. H. Norman. The group was composed of one central and</p> |

Large Waterspout about 1,500 feet in length, flanked to the Eastward by many smaller Waterspouts that were absorbed into the main column as fast as they formed. Between the heavy Nimbus from which the Waterspout depended and the mass of light haze that covered the horizon, a long strip of blue sky was visible, the Waterspout where it crossed this strip was invisible, appearing as if divided into two portions. The whole group lasted 20 minutes and eventually burst into heavy rain.

terspouts 500 feet each.

*Note on the Races of Rein Deer.*—By EDWARD BLYTH.  
(Concluded from page 306.)

In a foot-note to p. 283, I briefly remarked on the races of Rein Deer, and stated that I would recur to the subject in the sequel.

Mr. Andrew Murray of Edinburgh has been engaged in investigating the question, whether the Rein Deer of Lapland differs from the barren-ground race of N. America, and he has figured what he assumes to be characteristic horns of each race, suspecting that the broad vertical plate into which the brow-antler commonly expands in the barren-ground Caribou, to be peculiar to that race (*Edin. New Ph. Journ.*, April, 1858). In a Lapland specimen, however, in the Society's museum, received from that of Christiania (and not probably the head of a wild animal), the horns more nearly resemble the American horns figured by Mr. Murray; and I therefore greatly doubt his supposed distinction between the barren-ground Caribou and the *wild* Lapland Deer.

Referring also to the detailed notice of the wild Rein Deer of northern Scandinavia, in Mr. L. Lloyd's 'Scandinavian Adventures' (II, 193), I find that this author remarks (probably on the authority of Prof. Nilsson), that the horns of the *wild* Rein Deer of Europe "are large and slender, with brow-antlers *which are broad and palmated.*" But the horns of the wild animal of arctic Europe would seem to be rare in museums; while those from America are exclusively the production of wild animals, and, as a rule, are undoubtedly picked specimens chosen from a considerable number. Hence, perhaps, the difference alleged or suggested by Mr. Murray. Moreover, in no other species of Deer are the horns so extraordinarily variable; wherefore, to arrive at a fair conclusion, it must be necessary to examine a considerable number of unselected horns of the wild animal from both regions.\*

\* The *Cervus coronatus* of Geoffroy was founded on a very remarkable pair, supposed by him to have belonged to a peculiar species of true Elk (or Moose)! *Vide* figure in Griffith's English edition of the *Règne Animal* (IV, 96), and also in Cuvier's *Ossemens Fossiles* together with a gradation of other horns referring them clearly to the Rein Deer: this curious pair consisting of broad palms without any beam, and dividing anteriorly into spillers.

It would appear that the wild Rein Deer of arctic and sub-arctic Scandinavia still exists in very considerable numbers. Thus Lloyd, quoting Prof. Nilsson, states that—"On the high fjälls in the vicinity of Röldahl and Woxlie, the Rein Deer collect at times in astonishing numbers. One day in the beginning of June, 1826 (a couple of months before my visit to this district), the fjäll, for the breadth of a Norwegian mile—which is a trifle more than seven English miles—was as thickly covered with Rein Deer as the ground is where Sheep feed in a flock. \* \* \* The herd extended such a distance, that the eye could not embrace the whole at once. Subsequently the Deer separated into three divisions. \* \* \* This reminds one as well of the interminable herds of Antelopes in the deserts of Africa, as of the equally large herds of Bisons in the prairies of America. \* \* \* That this account is literally true, the Professor adds, is the more certain, because it was given him at different places and by different persons, who all agreed in their relations. The phenomenon excited a great deal of interest—no person having previously seen so large a number of Rein Deer collected in one and the same place. On the Jemtland and Herjedalen mountains in Sweden, as well as in the north-eastern portion of Lapland up to the North Cape, [the wild] Rein Deer are also pretty abundant. But in the intermediate country, which with some propriety may be called Western Lapland, though formerly numerous, very few, according to Læstadius, are now to be found.

"The number of wild Rein Deer killed annually in Scandinavia, by one means or another, is considerable. Very many, to my knowledge, are shot on the Norwegian mountains by peasants and others; as also in the more northern part of the peninsula. One of my guides in Russian Lapland, who was much celebrated as a chasseur, assured me, indeed, that in his time he had destroyed hundreds of those animals—in one instance as many as nine in a single day. For the most part he had shot them during the autumn, when they were in the best condition: but many he had also run down on Skidor." There ought, therefore, to be no great difficulty in procuring fine horns of the wild European animal for museums.

"Of the tame Rein Deer of Lapland," continues Mr. Lloyd, "there are, so to speak, two kinds: the so-called *Fjäll Ren*, or moun-

tain Rein Deer, which for the greater part of the year are herded on such elevated regions as to be destitute, or nearly so, of arboreal vegetation; and the *Scogs Ren*, or forest Rein Deer, that all the year are pastured in the forests. The *Skogs Ren* is the larger of the two; but even he is much inferior in size and nobility of appearance to the wild Rein Deer. The latter is occasionally killed, weighing about 350 lbs.; whereas the tame Rein Deer, according to Swedish naturalists, never attain to more than 200 lbs.\* The wild Rein Deer is of a much lighter and more handsome colour than the tame. His coat—in the winter at least—is immensely thick.” (Lloyd’s ‘Scandinavian Adventures,’ II, 190, 192, 198, 206.)

Another writer describes the wild Rein Deer of Scandinavia as “thinner, with more appearance of bone, and considerably stronger,” than the tame; in fact, a more ‘game’-looking animal, as is usually the case with species in a state of nature.

The object of these citations is to shew that the fossil Rein Deer of the British Islands may well be identical with the existing wild animal of Scandinavia, as distinguished from the tame kind, rather than of a race peculiar to the barren-grounds of arctic America (as has been suggested), which, however, I suspect to be one and the same particular race; † whereas the Musk Ox, likewise met with fossil in Britain, is actually now confined to the American ‘barren-grounds;’ where, also, upon the western continent, the European Bear is exclusively observed.

“Nilsson,” continues Mr. Lloyd, “has a curious speculation respecting the Rein Deer. He imagines that those once inhabiting Scania came from the southward immediately after the boulder-formation,

\* The main reason, I suspect, of the inferior size of the tame Rein Deer, as compared with the wild, is that the young are deprived of their necessary supply of milk. *Vide* end of note to p. 285, *antea*.

† Since the above and the note to p. 283 were written, I have seen the abstract of Dr. H. Falconer’s paper ‘On the Ossiferous Caves of Gower, in Glamorganshire, South Wales,’ published in the *Ann. Mag. N. H.* for October, 1860, p. 297 *et seq.* The fossil Deer referred to in p. 283 (*antea*) are there referred to “species or varieties allied to the Rein Deer (*Cervus Guettardi* and *C. prisceus*).” Prof. Owen’s figure of what he assigns to *C. TARANDUS* in his *Palæontology*, p. 374 is merely a copy of a *restored* figure of a British fossil figured in his *British Fossil Mammals and Birds*, p. 479, and is therefore not authoritative.

and whilst that province was still united to Germany : that, on the contrary, those which at present inhabit the northern portion of Scandinavia, came at a much later period (and subsequent to the land stretching between the Gulf of Bothnia and the White Sea having risen from the deeps), by the way of Finnish Lapland. He has come to this conclusion from fossil remains of the Rein Deer having been found in abundance in the alluvial peat-bogs of Scania ; whereas in the whole of the line of country between that province and southern Lapland, nothing of the kind has been met with." (*Ibid.* II, 191.) No diversity of race is alluded to ; and there can be little doubt that the ancient British was identical with the Teutonic, and both with the existent wild Deer of Scandinavia.

The large Asiatic race, which in a tame state is commonly *ridden* by the Toungouz or Tungusians and others,\* and which I suspect to be identical with the Woodland Caribou of N. America, is doubtless the so-called 'Roe-buck' of the Amûr territory noticed in p. 92 *antea*. This I gather from a passage in the Journal of the celebrated pedestrian traveller, Capt. John Dundas Cochrane, R. N. (nephew of the late venerable Earl of Dundonald), who was informed, at Boukh-tarmisk, that "Rein Deer abound in the mountains [southward, beyond which is the lake from which the river Irtisch takes its rise], which also contain Sheep. The horns of the former are considered valuable, fetching two or three guineas a pair ; when very young the Chinese purchase them and extract a favourite medicine ; the younger the animal who has shed the horns, the greater the value." (Cochrane's 'Narrative,' 2nd edit., I, p. 180). Capt. Cochrane should have said—the younger the horns of the animal, not "the younger the animal." Old Bishop Pontoppidan, as quoted by Mr. Lloyd, remarks that—"When the Rein Deer sheds his horns, and gets new ones in

\* The small Lapland race is occasionally ridden. Thus Clarke writes—"The lad who had conducted me vaulted on the back of one of them, having a Rein Deer skin for his saddle, and two seives by way of stirrups." And again, at Erontikis,—“The rest of the night was passed in mirth and rejoicing, we had races in sledges, drawn by Rein Deer, and amused ourselves by riding on the backs of these animals." (*Clarke's Winter in Lapland*). Capt. Cochrane, writing of the Tongousi (as he terms them) remarks—"I was amused with their manner of catching Rein Deer, as it reminded me of the hunting of wild bullocks I had seen in Mexico ; with this difference only, that there the man rides a Horse fully trained, and here a Rein Deer," &c. &c. (*Pedestrian Journal*, I, 373).

their stead, they appear at first to be covered [as in all other Deer] with a sort of skin, and till they come to a finger's length, are so soft, that they may be cut with a knife, like a sausage, and are delicate-eating even raw. This we have from the huntsmen's account, who, when they are far out in the country, and are pinched for food, eat them, which satisfies both hunger and thirst." Of course they are then most highly vascular and full of blood; and thus it appears that this strange delicacy is not quite peculiar to the Chinese.

Professor Pallas, tracing the geographical range of the Rein Deer in Asia, notices the occurrence of this animal in the Kinyan Alps in Mongolia, between the rivers Amûr and Naun. (*Zoogr. Rosso-asiatica*, edit. 1830, I, 203.) It can hardly migrate annually to the sea-coast from that mountainous far-inland region, which migration is held to be a necessity of existence with the Rein Deer of Lapland. But does the large or Woodland race of this animal anywhere migrate to the sea-coast?

It is remarkable that the Rein Deer has never been domesticated in arctic America; and the more so, as the immediate *western* shore of Behring's Straits and the Aleutian Isles are inhabited by true Esquimaux (*Vide* Von Wrangell, Sabine's Translation, pp. 343, 372), who cannot but know of the domestic herds in the possession of their neighbours the Tschuktschi;\* but a reason may well be, that where

\* By the way, Dr. Godman remarks that the wild "Rein Deer often pass, in summer, by the chain of the Aleutian Islands, from Behring's Straits to Kamschatka, subsisting on the moss found on these islands during their passage" (*i. e.* from America to Asia). Pennant stated that "they are not found in the islands that lie between Asia and America, though numerous in Kamschatka." They do not appear to inhabit them permanently.

Cuvier has shewn, by a laborious investigation, that, during the historic period, this animal never extended in Europe further south than the Baltic and the northern parts of Poland; and, at present, as Sir C. Lyell remarks, it "can scarcely exist to the south of the 65th parallel in Scandinavia; but descends, in consequence of the greater coldness of the climate, to the 50th in Chinese Tartary, and often roves into a country of a more southern latitude than any part of England." Referring to Dekay's 'Natural History of New York,' this author states—"It is with much hesitation that I include the Rein Deer in the *Fauna* of our State; but the representations of hunters lead me to suspect, that, when the yet unexplored parts of the State have been more thoroughly examined, its existence may be disclosed. Pennant, in his time, asserted that the Rein Deer was not found further south than the most northern part of Canada. Charlvoux, however, saw one killed at Quebec. The specimen in the cabinet of the Medical College at Albany came from Nova Scotia; and Harlan asserts that it does not pass the State of Maine into the United States, implying its existence there." Professor Emmons observes—"It is only a few years

Dogs are employed for sledging, and are unaccustomed to the sight of tame Deer, they would be very apt to attack and destroy them, as has happened in instances where individual Rein Deer have been tamed in the American fur-countries by Europeans. In Lapland, however, the herds of domestic Rein Deer are always tended by several Dogs, which guard and keep them in order and serve to hunt back any stragglers. (*Vide* Lloyd's *Sc. Adv.* II, 213.)

Referring to Dr. J. E. Gray's 'Synopsis of the Species of Deer' (*Proc. Zool. Soc.* 1850, p. 225), I observe that he admits one species only of Rein Deer, but which "varies exceedingly in size." He remarks—"They have a large variety in Newfoundland, nearly as large as a heifer [a heifer of what race?], having very large and heavy horns. There are some horns of this variety in the British Museum. M. Middendorf informed me that the horns of the large Siberian variety were as large as, and greatly resembled, the horns from Newfoundland (Nova Scotia) in the British Museum collection." In other words, the American Woodland Caribou, and the large race of N. Asia, are, in all probability, quite identical.

since this animal appeared in the northern parts of Vermont and N. Hampshire; from which it is not unreasonable to infer, that in earlier time it may have passed still further south. Its gregarious habits and unsuspecting character would seem to ensure its speedy destruction, when placed within the reach of man." It is well known how much the climate of the Atlantic States of N. America has been ameliorated, from the seasons being rendered less excessive, by the gradual extensive clearance of the forests; as that of N. Europe since the time of Cæsar. On the Pacific Coast of N. America, Capt. Beechey remarks that Rein Deer occur in some seasons of the year in New Caledonia (now, to avoid confusion, termed British Columbia), or the country drained by Fraser's River.

\* Clarke remarks, of the Cows which he saw in his journey from Tornea to the Muonio river,—“The Cows here are all of the same white colour, and very little larger than sucking calves in England; but so beautiful, and yielding milk of a quality so superior to any we had before tasted, that we longed to introduce the breed into our own country. It is almost all cream; and this cream, with the most delicious sweetness, is, at the same time, even when fresh, so coagulated, that a spoon will nearly remain upright after it has been plunged in it. Of course,” it is added, “its richness must be principally attributed to the nature of the food which, during summer, these cows select for themselves in the forests; and this consists entirely of the tender twigs and young shoots of trees.” *Travels to the North Cape*, p. 309.

The pretty little Norwegian cows are thus incidentally noticed: comment about the “as if” is, of course, unnecessary. “Then came the goats and sheep, and the little cows following like dogs, now and then stopping to take a bite, when the turf looked particularly sweet and tempting—little fairy cows were they, much smaller than our Alderneys, finer in the bone, and more active in the legs; they looked as if they had a cross of the Deer in them. They were all of one colour, a sort of dirty cream-colour approaching to dun, and almost black on the legs and muzzle.” (*Forest Scenes in Norway and Sweden.* By the Rev. H. Newland, p. 156.)

Still it is rare that even the Woodland race in America attains to the weight of 350 lbs.! One,  $4\frac{1}{4}$  ft. high at the shoulder, mentioned in Capt. Cartright's Journal, weighed, his quarters 270 lbs., the head 20 lbs., offal 20 lbs.—310 lbs. in all: he had an inch of fat on his ribs, and  $1\frac{1}{2}$  in. on his haunches. Another, "an old buck of the dwarf breed," five inches lower at the shoulder and which had forty points to his antlers\* (the former having but 29), "was in excellent order, weighing in his quarters 314 lbs., with  $2\frac{1}{2}$  lbs. of fat on his haunches, and  $1\frac{1}{2}$  in. thick on his ribs." A buck of 27 stone is also mentioned, which, "had he been killed in prime of grease, would have stood at least 31 stone, or 434 lbs. A very fat old doe weighed 154 lbs., and another 155 lbs. But all of these were particularly fine animals." In Lapland, "a fat ox-Deer weighed 122 lbs., and had 10 lbs. of tallow. This is, I suppose," continues Mr. Laing, "as much as the tame animal in general will feed to. The wild race, which comes considerably further south, is a good deal larger."

The domestic Deer of Lapland, however, vary even in neighbouring parishes. "None that I saw," relates the Hon'ble A. Dillon, "were larger than our common English Fallow Deer. Those in Russian Lapland, near Kola, are said to be much taller; while the wild ones in Spitzbergen, though exceedingly fat, *are far inferior in size.*" "The Deer which I observed, as I approached Tornea," remarks Sir A. C. Brooke, "and those I afterwards met with beyond it, confirmed me in what I had been told was the fact, that the further they live north, the larger they are; and when I saw those which were brought to England by Mr. Bullock from the Roraas mountains between Christiania and Drontheim (being the southernmost limit of their range in Scandinavia), their very great inferiority in size to the Deer of Finnmark removed all doubt on the point. Large, however, as is their size, I have been assured by persons who have made successive voyages to Spitzbergen, for the purpose of taking this animal and the Walrus, that the Rein Deer found on that island *exceed very considerably in bulk* those of Finnmark; and that their tallow alone, which is a principal object in their capture, in many of them amounts to the extraordinary weight of 40 lbs. Respecting the size of the Spitz-

\* Capt. Cartwright obtained a pair "with 72 terminal points." ("Journal of 16 years' residence in Labrador.")

bergen Deer," continues this author (at variance with Mr. Dillon, and also with a statement in the Appendix to Sir John Ross's 2nd voyage), "I have been able to satisfy myself, from having had an opportunity of seeing in London a haunch, that was brought to England, having been salted, and afterwards dressed; and from the extraordinary dimensions of it, the animal must have been *considerably larger* than any of the Rein Deer of Lapland." According to Clarke,—“The breed of Rein Deer in the parish of Eroutikis [in Lapland] is larger than that of Bickasjerf, but smaller than that of Kittila; and this difference is wholly to be ascribed to the difference in the soil, as suited to the growth of Rein Deer moss; on which account the Rein Deer of the mountains are always smaller than those of the forest.”

Here, indeed, we have probably the key to the difference between the barren-ground and woodland races of America, if not elsewhere;\* but the difference of *habit* is remarkable. “In the fur-countries of North America,” writes Sir John Richardson, “there are two well marked and *permanent* varieties of this animal [*incipient species*, according to Mr. Darwin's theory], one of them confined to the woody and more southern districts, and the other retiring to the woods only in winter, and passing the summer on the coasts of the Arctic Sea, or on the barren-grounds.† The latter weigh so little, that I have seen a Canadian voyageur throw a full grown doe on his shoulders, and carry it as an English butcher would a sheep. The bucks are larger, and weigh (exclusive of the offal) from 90 to 130 lbs. Those of the Woodland variety from 200 to 240 lbs.” “A small doe of this,” remarks Hearne, “is equal to a northern buck: but, though so considerably larger, their antlers, although much stronger, are not so large and branching.” In Sir John Ross's 2nd Voyage, we read that a specimen, “of larger size than ordinary,” was obtained in Boothia, weighing 250 lbs. From nose to base of tail it measured 5 ft. 10 in.; the tail 5½ in.: height at the shoulder 4½ in.; of the hind-quarters 4 ft. 5 in.; and girth behind the four legs 55 in.; those of Melville Island, Boothia, and *Spitzbergen*, it is stated, “did not average above half the weight.” Probably, therefore, a straggler of the woodland

\* The American barren-grounds are physically similar to the mountainous parts of Lapland, and also to the ‘tundras’ of Siberia.

† He subsequently remarks—“Contrary to the habits of the Barren-ground Caribou, the Woodland variety travels southward in the spring.”

race. We may accordingly presume that the current statement that the further northward this animal inhabits, the larger it grows, is true only within certain limitations, depending much on the character of the country. The large woodland race, indeed, inhabits southward of the small barren-ground race: the former migrating in summer to the polar sea; the latter southward to the mountains of the interior; and this alike in Asia and America.

#### A NOTE ON THE ANTIQUITY OF THE HUMAN RACES.

To which I am induced by recalling to mind a passage in the Introduction to Von Wrangell's 'Narrative of an Expedition to the Polar Sea' (Sabine's Translation, p. cxvii), wherein a flint implement is mentioned as being in use in modern times (*A. D.* 1809). Indeed, elsewhere (p. 376), Von Wrangell notices, of the Tschuktschi, that—"Iron being scarce, they sometimes employ Walrus tusks instead;" and also that—"The inhabitants of the Aleutian Isles use spears pointed with slate in killing Whales" (p. 340). So did other Esquimaux further *east* (*i. e.* in America) fashion slate as well as bone weapons until they became acquainted with the use of iron, and acquired possession of metal instruments from their European visitors.—"On Fadegew Island, Sannikow found a Jahakir sledge, and a knife, such as is generally used for scraping Rein Deer skins. The blade, however, was not of iron, but of a hard sharp *flint*. In New Siberia they had found an axe made of the tusk of a Mammoth."—Now Nilsson, exploring certain exceedingly antique *tumuli* in Scania (the *southernmost* province of Sweden), found in them flint arrow-heads or spear-heads—the so-called *Celts* or *Kelts*,—together with bones of now extinct mammalia, and human bones including skulls, which skulls were distinctly of the hyperborean type of humankind, in a latitude considerably to the southward of the abode of the hyperborean Mongol at the present epoch, unless where a much severer winter climate obtains! Considering the ultra-remote antiquity of the 'Celts' elsewhere discovered in temperate latitudes, does not Nilsson's discovery somewhat point to the glacial period of Agassiz? Albeit the human animal most assuredly never originated in the circum-polar regions, any more than on the minor continent now called America, however ancient may be the indis-

putable human remains discovered by Dr. Lund in certain Brazilian caverns, and others since disinterred in the valley of the Mississippi! The human organism pertains strictly to the *catarrhine* as opposed to the *platyrrhine* division of anthropomorphous creatures, the former proper to the major continent, the latter to the minor continent,—the former (as in mankind) having invariably but two præ-molars above and below on either side, the latter as constantly a series of three præ-molars, &c. &c.: and it need hardly be added that the naked frame (with hair on scalp affording some protection from the sun, but certainly not from cold,) most surely indicates the original and indigenous abode of mankind to have been in a hot region of the earth, even where, at the present time, the animals most nearly akin to humanity—so far as their bodily organization is concerned—inhabit. But what do we know of the geology of the regions tenanted by the Gorilla, the Chimpanzee, and the Orangs? Just a little! Of their palæontology, almost nothing. It is therefore exceedingly premature to dogmatize or to venture to affirm whether or not a nearer (fossil) link may even yet be brought to light than is the formidable Gorilla Ape, itself a re-discovery but of yesterday, when the proper regions of the earth for such a quest shall have been duly investigated. These remarks are meant to afford little more than a hint; but it is one that will be understood by those for whom it is intended.—E. B.

#### A NOTE ON DOMESTIC ANIMALS IN GENERAL.

In page 291 *antea*, it is remarked that the efforts of modern Zoological and other Societies have not been attended with much result hitherto, as regards the domestication of wild animals; and I believe, as there intimated, that the subjection of all the more important domestic creatures was effected by human beings in a very rude state of savagery. Since writing those remarks, I have seen the article in No. CCXXV of the ‘Edinburgh Review’ on the “Acclimatization of Animals,” in which the results hitherto attained are brought to notice. “The acclimatization of the Eland,” we are told, “may be now considered a *fait accompli*,” but this is, at most, a preliminary to its *domestication*, which by no means necessarily follows, or may

even be possible. The Common Pheasant, for example, was probably introduced into Britain during the period of Roman domination; yet, however thoroughly naturalized to the country (for the amount of acclimatization in this instance is inconsiderable), and also however tameable, it certainly manifests no tendency to become a domestic bird, like the ordinary Common Fowl or the Turkey. It will not attach itself to a home-stead. "The practical results," we are told, "of reproduction and acclimatization have been so entirely lost sight of for ages, that the Turkey in 1524, the Musk Duck in 1650, the Gold Pheasant in 1725, and the Silver Pheasant in 1740, are the only additions to our catalogue of domesticated animals since the Christian æra." Surely the Gold and Silver Pheasants cannot be justly termed *domesticated*, although tame, and the races permanently maintained either *in strict confinement*, or turned loose into preserves.\* Most assuredly they are not likely to become free denizens of the poultry-yard; like the Guinea-fowl, the domestication of which is really of comparatively modern date. Its name of *Guinea-fowl* indicates the indigenous abode of the particular species, a country unknown to the Greeks and Romans; whose *Meleagris* and *Gallina numidica* (*quasi nubica*?) referred to the species of N. E. Africa and perhaps of Arabia (NUMIDA PTILORHYNCHA of Rüppell), received by them *viâ Nubiæ*.†

Next, of the two other instances cited,—the Turkey and the Musk Duck—it is remarkable that both of these were found by the Spanish discoverers already domesticated in the New World. This Schlegel

\* Neither of them has begun to vary in colour as yet, as the semi-wild British Pheasant often does, to the same extent as the tame Guinea-fowl.

† According to W. G. Browne's 'Travels in Africa,' &c. (1792 to 1798), p. 264, those birds were even then brought in cages, "as a profitable commodity," to Cairo from Darfour; and doubtless therefore at the present day also, as likewise in ancient times. There is no reason to suppose that the Romans domesticated them, even though they may have kept many in captivity. Prince John of Portugal, the famous patron of African discovery (but more probably one of his successors), has the credit of first introducing and multiplying the modernly domesticated species from *Guinea*; and the earliest known *distinctive* description of it is that by Dr. Caius (1570), in which the purple colour of the neck is mentioned, which will not apply to the E. African N. PTILORHYNCHA.

That the E. African bird was that known to the Romans is further distinctly indicated by an expression of Columella, who notices its "*paleam et cristam*" (peak and crest); referring to the frontal crest of N. PTILORHYNCHA (whence its name), which is utterly wanting in the bald-fronted bird of Guinea.

has remarked of the *CARAINA MOSCHATA*,\* and the *Carnivora* of Montezuma's menagerie were fed on the flesh of domestic Turkeys.

\* 'Revue Critique des Oiseaux d' Europe,' p. 108. Were the Geese of *this species* which were "bred to supply feathers for ornaments" in the now ruined city of Quiché (lat. 15° N.), which, like Mexico, had its zoological and botanical gardens attached to its palace? (Stephens's *Incidents of Travel in Central America*, II, 179.) I have not access to the original authorities, and know of no traveller more thoroughly indifferent to all matters of Natural History than was Mr. Stephens, in a country, too, so teeming with objects of interest in its *Fauna* and *Flora*. In the hunts of that most exquisitely plumaged bird, the Ocellated Turkey (*MELEAGRIS OCELLATA*), where so void of fear that he knocked one over with a pistol (I, 397), he does not appear to have distinguished it from the common wild Turkey of the United States (*M. GALLIPAVO*): and at the ruins near Palenque (within the Mexican territory, in about 17° 20'), he remarks—"We expected at this place to live upon game, but were disappointed. A wild Turkey we could shoot at any time from the door of the palace; but, after trying one, we did not venture to trifle with our teeth upon another" (II, 320). Just as, in this country, an old Peafowl has the merited reputation of being tough, as has likewise an aged gander! But it does not follow that all are not excellent eating when of a proper age. (Indeed, another writer describes the flesh of the Ocellated Turkey as "most delicious-eating." *Proc. Lin. Soc.* 1859, pt. 1, p. 62). The Jaguar (*FELIS ONCA*) is indifferently styled by Mr. Stephens both 'Tiger' and 'Leopard,' and the Cougar or Puma (*F. CONCOLOR*) is of course his 'Lion.' This was to have been expected; but that the most superficial of observers should see the Ocellated Turkey and pass no remark on its extraordinary beauty is somewhat surprising. At least it is not probable that the wild *MELEAGRIS MEXICANA* occurs so far southward even as Palenque; and at the modern village from which the neighbouring ruins derive their current name, the author mentions having procured a domestic Turkey for provender.

It may seem strange that the *M. OCELLATA*, in addition to *M. MEXICANA*, was not domesticated by the populous race which the Spaniards found so highly civilized (in some respects) over a vast extent of country which it inhabits; but neither have the Jungle-fowls of S. India and Ceylon respectively (*GALLUS SONNERATHI* and *G. STANLEYI v. Lafayetii*) been domesticated, while their congener of N. India and of all S. E. Asia and its archipelago, even as far as Timor, (*G. FERRUGINEUS v. bankivus*,) has been diffused in a domestic state over the world. Mr. Gosse remarks that—"The common Turkey is, so far as European knowledge is concerned, *indigenous to the greater Antilles*; having been found by the Spanish discoverers already domesticated by the Indians; and the European domestic breed is descended from the West Indian, and not from North American parentage." (*Birds of Jamaica*, p. 329.) He gives no authority for the statement, and its accuracy is more than doubtful. As the late Mr. Broderip remarked—"Mexico was discovered by Grijalva in the year 1518: and we soon after find a description of the Turkey as one of the productions of the country by Gomarra and Hernandez, the latter of whom gives its Mexican name *Huexotoll*, and makes mention of the wild birds *as well as of the tame*. Oviedo, whose work was published in Toledo in 1526, describes the Turkey well, as a kind of Peacock of New Spain, *which had been carried over to the islands and the Spanish main*, and was about the houses of the Christian inhabitants." (Broderip's *Recreations in Natural History*.) This statement of Oviedo quite disposes of Mr. Gosse's assertion of its being *indigenous to the greater Antilles*.

In tracing the southern natural distribution of the genus *MELEAGRIS*, it should be borne in mind that the so-called "wild Turkeys" of Guiana, mentioned by various authors, are *Curassows*, often by their own shewing; while that of Paraguay is no other than the *PSOPHIA CREPITANS* (*Vide* 'Letters from Paraguay, Brazil, and the Plate,' by C. B. Mansfield, M. A., 1856, p. 533); and that the *Dindons savages*,

It is only recently that the true prototype of the common Turkey (*GALLIPAVO MEXICANA* of Gould) has been made known; and the wild bird is peculiar to the eastern water-shed of N. America; the wild Turkey of the Atlantic side of the Rocky Mountains being conspicuously distinct. The domestic Turkey was imported into Spain early in the 16th century; and from Spain it was introduced into England in 1524. "This fowl was first seen in France in the reign of Francis I, and in England in that of Henry VIII. By the date of the reigns of these monarchs, the first Turkeys *must have been brought from Mexico*; the conquest of which was completed A. D. 1521."\* These facts are generally known; but not the fact, for which there is abundant evidence, that the *domestic* Turkey was introduced *from Europe* into the N. American colonies, where a kindred wild species abounded in the forest.† Mr. Gould has remarked that the hybrids

or 'wild Turkeys,' of various regions of the old world are different Bustards; among others the great Bustard of Australia is not unfrequently designated the 'wild Turkey,' and the Australian *TALEGALLA LATHAMI* is termed the 'Brush Turkey.' But it appears that the true wild Turkey of the Atlantic side of the Rocky mountains of North America (*M. GALLIPAVO verus*) was formerly naturalized in Ireland!—"the breed, the true copper-colour, with red legs." (*Vide* Thompson, 'On the former Existence of the Capercali in Ireland.' *Ann. Mag. N. H.*, X (1843), p. 33.) The *Société d'Acclimation* should turn its attention to the naturalization of this fine species, before it is quite extirpated, in various forests of Europe. (For information regarding the Ocellated Turkey, *vide Proc. Lin. Soc.* 1859, pt. 1, p. 62, and *The Ibis*, No. VIII.)

As the indigenous range of the Turkey genus is restricted to North and Central America, so is that of the various Bustards to the major continent with Australia. But the name 'Bustard' is misapplied in the West, as that of 'wild Turkey' in the East. Thus the so-called 'Bustard' of the N. American fur-countries is the Canada Goose! (*Vide* Franklin's 2nd Voyage, p. 80.) Hence 'Bustard Island' on Lake Athabaska! Pernetty, in his *Historical Journal of the Voyage to the Falkland Islands*, under the command of M. de Bougainville, states that "We found the Bustard exquisite, either boiled, roasted, or fricasseed. It appeared from the account we kept that we ate 1500 of them." The Falkland Island Goose is probably here intended. In S. Africa, the largest species of Bustard is known as the *Paouw* (or 'Peacock') to the colonists—perhaps the true pronunciation of the Latin *Pavo*, imitative of the voice of the Peafowl.

\* *Encyclopædia Britannica*.

† The reverend divine, Mr. Francis Higgeson, who wrote 'A Description of New England's Plantation' in 1630, remarks of the harbour of Plymouth, that "the parsnips, carrots, and turnips are here bigger and sweeter than is ordinary to be found in England; the Turkeys are far greater than *our English Turkeys*, and exceedingly fat and sweet and fleshy." I take this quotation from the 'Edinburgh Review,' No. CCVIII, p. 560; and it may be that wild Turkeys are intended; but the reference to *English Turkeys* should indicate that the latter were never derived from the N. American 'plantations,' at least within the knowledge of the colonists more than two centuries ago. Again, Mynheer Vander Donk, in his 'Description of the New Netherlands' (Amsterdam, 1656), describing the State of New York as it appeared at its first settlement by Europeans, states, that "the most important fowl of the country is the wild Turkey. *They resemble the tame Turkey of the Netherlands!*"

raised from the domestic Turkey crossed with the wild species of the Atlantic States are rarely prolific.

Civilized man—or at any rate European civilized man—has domesticated no animal from the New World; he has tamed and bred certain Curassows and Guans, but it is doubtful if they can ever be trusted loose and unmutated in the poultry-yard, like the indigenously domesticated Turkey. The only truly domesticated animals of America are sundry native Dogs, the Llama and Alpaca, and the little insignificant Guinea-pig, among mammalia; and the Turkey and the Musk Duck among birds. Of Old World species, the Rabbit has been domesticated probably within the Christian æra, and also the Ferret (to a certain extent) among *Carnivora*; but neither of these are allowed their liberty (though some Rabbits, I think, might be,) any more than are the races of white and parti-coloured Mice,—all of which are so far domesticated that individuals require no taming, and may be freely handled without occasioning distrust: the development of the breeds of domestic Rabbits is, indeed, quite of modern date; unless, perhaps, in the instance of the long-haired Angora Rabbit. I believe that all of the true Geese are most readily domesticable; and the fine Canada Goose falls within the category, but although tame Canada Geese multiply freely, they have not yet so far succumbed to the usual influences of domestication as to vary in colour, like the Pea-fowl and Guinea-fowl, and even the semi-wild and protected Pheasant and the Fallow Deer. Neither, for that matter, has the semi-domestic Swan, which differs in no respect from the wild mute species, nor the Pea-fowl and Guinea-fowl more than the semi-wild Pheasant. All of the more thoroughly subdued (and highly varying) and of the more important of domestic animals would seem to have been subjected by mankind in an exceedingly low stage of civilization.

The only domestic *Insessorial* bird is the Canary-bird; and it remains to be shewn that this also is not descended from a tame stock possessed by the ancient Guanche inhabitants of the Canary islands. With the exception of the Canary-bird, all *domestic* members of the class *Aves* are either *Pavonidæ*, *Columbidæ*, or *Anatidæ*. The only domestic mammalia are the Dog and Cat (and Ferret to a certain extent) among the *Carnivora*, the Rabbit, Mouse, and Guinea-

pig among *Rodentia*, the Horse, Ass, and Pig among *Pachydermata*, and the rest are *Ruminantia* including the *Camelidæ*.

Of other *Vertebrata*, only the CYPRINUS or CARASSIUS AURATUS; and of *Invertebrata* only one or more species of Hive-bee and of Mulberry silk-moth, unless the *grana-fina* COCCUS which is doubtful,—but the fact is attested that certain insects are *domesticable*. Among mammalia, however, there is the crowning instance of all-dominant civilized and domesticated mankind. Other species are or have been (the individual, not the race,) tamed and trained, as the Elephant—the Chita, Caracal, and even the Lion,—the Otter and the Cormorant,—and various *Falconidæ*;\* but not any of these can claim to be regarded as domesticated races. A few more years will perhaps show whether civilized man is competent to add to the number of the latter.

I now pass to another and comparatively unimportant matter, which I have not before discussed in a scientific Journal. Having treated of the domestic Turkey, it may further be remarked that the origin of the English name *Turkey* has been much discussed, as applied to a bird indigenous to America. The question has often been asked, and I think that it can be answered satisfactorily. It is certain that the *Guinea-fowl* was commonly termed the “Turkey Hen” in former days, and hence a difficulty sometimes in knowing which bird is meant by sundry old authors. As the Portuguese discoveries along the west coast of Africa preceded those of the Spaniards in America, there is reason to infer that our British ancestors became acquainted with the Guinea-fowl prior to their knowledge of the Turkey; and the English trade being then chiefly with the Levantine countries, our ancestors may well have fancied that it came from thence. Referring to a curious old dictionary in my possession (published in 1678), for the word *Meleagris*, I find it translated “a Guinny or Turkey Hen:” *Gallinæ Africanæ seu Numidicæ, Var. sine quæ vulgo Indicæ*” (*Coq d’ Inde* of the French, corrupted into *Dinde* and *Dindon*!). Again, *Numidica guttata* of Martial is rendered “a Ginny or Turkey Hen.” Looking also into

\* Add the Pig-tailed Monkey (INUS NEMESTRINUS) in Sumatra, where trained to gather cocoa-nuts; whence termed by Raffles *Simia carpolegus*. Also CYNOCEPHALUS HAMADRYAS by the ancient Egyptians. (*Vide* figure in Wilkinson’s ‘Domestic Manners of the ancient Egyptians,’ I, 150.)

an English and Spanish Dictionary of so late as 1740, I find *Gallipavo* rendered "a Turkey or Guinea Cock or Hen." Well, it is known that our British forefathers originally derived the domestic Turkey from Spain; and meanwhile they are likely to have obtained a knowledge of the true *habitat* of the Guinea-fowl; and therefore may very probably have supposed the former to be the real *Turkey-fowl*, as distinguished from the *Guinea-fowl*; and if the word 'fowl' be dropped in the one instance and not in the other, be it remembered that there was another special meaning for the word *Guinea*, having reference to the Gold Coast,\* otherwise the bird might have come to be known as the 'Guinea,' as the Bantam-fowl is now currently designated the 'Bantam,' and the Canary-bird as the 'Canary,' or the Turkey-fowl the 'Turkey.'† The latin-sounding name *Gallipavo* seems to be of Spanish origin, and obtains among the Spaniards to this day; but their earliest name for it was *Pavon de las Indias*, "c'est a dire," as Buffon remarks, "*Paon des Indes Occidentales*;" which explains the reference to India (perpetuated in *Dindon*).

\* The name *Guinea-pig*, I believe, is not a corruption of 'Guiana-pig' (as has been suggested); but the animal was brought to Europe in the Guinea slavers on their return voyage; who also brought sundry small African Finches, which have been described as natives of Brazil. It is curious that the Musk Duck was formerly known in England as the 'Guinea Duck,' also because brought from S. America by the Guinea slavers, and it was considered as a great delicacy for the table; and the white breed of it is mentioned by Dr. Caius, so early as 1570, by the name of the 'Turkish Duck!' This species was noticed by Crawford in the Siamese capital, and there known as the 'Manilla Duck.' It has long been diffused over S. E. Asia, and is now common even in Polynesia. (Vide Ellis's *Missionary Tour through Hawaii, &c.*)

† Another curious instance of the kind is that of the small speckled red Finches of India (*ESTRELLA AMANDAVA*), which have long been known in England by the name of 'Amadavats.' They are more than once familiarly referred to, as 'Amadavats,' in Sheridan's 'School for Scandal' (Act V, Sc. 1), brought out in 1777. And they actually take this name from the city of Ahmedabad in Guzerat! Witness the following passage from 'A New Account of East India and Persia,' by John Fryer, M. D., *Contabry*. (1698). Among other curiosities brought to Surát, were—"From *Amadavad* small birds, who, besides that they are spotted with red no bigger than measles, the principal chorister beginning, the rest in concert, make an admirable chorus." In the 'History of the Settlements of the Europeans in the East and West Indies,' translated from the French, by J. Justamont in 1776, I find the name of the Guzerat city spelt *Amadabat!* And hence, again, the specific name *Amandava* of Linnæus, and the generic name *Amadina* of Swainson! The French term these pretty little birds *Bengalis*, adopted as the English generic appellation by Swainson in treating of sundry African species. Our Indian bird is the *Bengalus punctulatus* of Brisson, *le Bengali piqueté* of Buffon, and *Amaduwade Finch* of Albin (about 1750). The name *Bengali* has probably reference to Benguela in W. Africa, whence sundry of the tribe had been brought to Europe.

At the present time the domestic Turkey is nowhere raised more abundantly, nor is more cheaply procurable, than in the country from which it thus erroneously derives its English name: for, although the Musalmáns of India refuse to eat its flesh, (alleging that it partakes of the nature of the Hog, as shewn by the tuft of bristles on its breast,) their co-religionists of Turkey, Egypt, and even Arabia (at Jidda at least, the port of Mekka), esteem it highly; and at Cairo it is customary, some hours before killing one, to give it a dose of *ráki*, which is believed to render the flesh more tender. The only Turkeys I have seen in India are of the Norfolk breed, with generally black plumage; and this, with the bare skin of the head and neck, may possibly have led to a supposition that the bird is akin to a common black Vulture of the country, with bare red neck, the *OTOGYPS PONTICERIANUS*;\* yet, if the bird had been introduced by Muhámmedans—say from Persia, instead of by Christians from Europe, it is probable that people of that faith would have eaten the Turkey here as elsewhere. Old Chardon mentions its introduction into Persia from Venice by some Armenian merchants.

\* Some Turkeys which I once possessed did actually associate, to a certain extent, with a Vulture of the kind chained to a post; that is to say, they generally kept near it, as if imagining the black Vulture to be one of their own kind.

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*Literary Intelligence.*

Dr. Haug writes from Poona, in a letter dated November 16th, that he has sent to press, in Bombay, the text of the Aitareya Bráhmaṇa,\* prepared from three MSS. He is also engaged in making an English translation with notes. Dr. Haug has some thoughts of having a Mahratta translation prepared as well;—which will indeed be a novelty in India! “An edition and English translation of the most important parts of the Rig Veda and Yajur Veda will follow.”—The second part of his very able work on the Gáthás of Zoroaster is also shortly expected from Germany.

The British Museum has lately secured the pick of Capt. Hay’s Bactrian collections for £260, and the choice cabinets of Col. Abbott have also, by the owner’s liberality, been temporarily placed in the same Institution so as to be available for all scientific purposes.

The following is an extract from a very interesting letter received by the President from Col. Cunningham. It is dated 30th September, and is, we hope, only the forerunner of further valuable communications from the same quarter. The inscriptions here referred to have arrived in safety, and are now undergoing translation by Babu Rájendralal Mitter. We publish also the list of coins sent by Col. Cunningham for sale or exchange, in order that others may have the opportunity of supplying themselves at the prices fixed with such coins as the Society do not take.

“The inscriptions which I possess are about equal in number and in importance to the whole that have yet been published in the *Journal* from its first commencement.

“The earliest inscription which I can bring to your notice is one of Asoka’s rock edicts in Indian Palí containing the names of Antiochus, Ptolemy, Antigonus, Magas and Alexander. For the knowledge of this inscription I am indebted to Mr. Forrest of the Canal Department, who discovered the inscription on a huge boulder, or isolated rock, on the western bank of the Jumna, at Khalsi (or Khalsi kangra) *within* the Sewálik range.—I have only seen a portion of

\* M. Regnier, we believe, is preparing an edition in Europe, which will be accompanied by Sáyana’s Commentary.

the inscription copied by hand by Mr. Forrest—but he will no doubt be able to make a complete copy during the approaching cold weather.—I may mention that the letter R is not used at all in this inscription, L being invariably substituted as in *Laja* for *Raja*, and in *dala* instead of *dara* in the name of Alexander.

“I propose to send you the inscriptions by an early opportunity.—One of them I enclose at once, which is the earliest that has yet been found connected with Gwalior. If Rájendralal will kindly undertake to translate the inscriptions, I shall feel myself most deeply indebted to him. His knowledge of the various ancient characters is extensive, and he will have little difficulty in transferring the inscriptions into modern Nagari. But Rájendralal has not the same experience of ancient inscriptions that I have had, and I think it would be worth while if he, or you, or the Secretary of the Asiatic Society would send me the Nagari transcript along with the translation for comparison. I ask this because I am aware of the numerous mistakes in the transcripts and translations of previous inscriptions. I will only refer to *three* inscriptions just now.

“1st.—In the inscription on the Boar Statue at Eran, James Prinsep read the Rája's name as *Tárápáni*—whereas it is *Toramána*.

“2nd.—In an inscription translated by H. H. Wilson (see Thomas's Prinsep's Antiquities, II. 245 note 2) the 4th and 7th names are given as *Vrádipta* and *Siddha*. They should be *Pradipta* and *Singha*. There are other mistakes besides these.

“3rd.—In the great inscription from Kajráha in Bundelkhund, translated by Sutherland, the mistakes are numerous and important, See Journal Asiatic Society of Bengal, 1839. For instance—the date should be Samvat 1056 instead of 1019. The inscription was not re-engraved in *kakuda*, or ‘bad’ letters, but in *kumuda*, or ‘beautiful’ letters. The author of the inscription was *DHANGA*, not *BANGA*, and he did not live 109 autumns (*satam sanavakam*) but upwards of 100 autumns (*satam samadhikam*). Of his ancestors Vágyati and Vahila should be Vákpati and Ráhila. The latter formed the lake which is now called Ráhilya Ságar to the south of Mahaba.

“The correction of the name of Banga to Dhanga is of the greatest value to the history of the Chandels as it connects the Kajráha inscription genealogy, which ends with him, with that of the Mhow

inscription genealogy which begins with him (see Price's translation of this inscription in the 12th vol. Asiatic Researches).

“The Kajraha inscription must of course be revised—but I possess an earlier and equally long inscription of Dhanga, dated in Samvat 1011 or A. D. 954, just forty-five years prior to the other which records his death. A third long inscription refers to Sri Kokalla; but the date, I think, precludes the possibility of this referring to the great founder of the Kuláchuri Haihayas.

“Of the Gwalior inscriptions one of the most interesting is a record of Bhoja Deva, dated in 933 Samvat—both in words and figures = A. D. 876. As this date agrees with that assigned to the great Bhoja of Malwa by Kalhan pundit, viz. A. D. 883—901, there can be little hesitation in attributing this inscription to the *famous* Bhoja—(N. B. The form of the figure 9 in this date is the same as that which Rájendralal has read as 7.) There are many interesting inscriptions of the Kachwáhas and Tomaras of Gwalior—which will afford a sketch of the destinies of the fortress from about A. D. 800 down to the present time. A poem which I possess by the Bard Kharg Rai connects the last Kachwáha prince of Gwalior with the founder of the Kachwáha dynasty of Amber (Jaipoor). The traditions still preserved at Narwar connect that large fortress with the same prince. Tod calls him Dula Rao—but that was not his name. He was called Teg-Pál, and lost his ancestral kingdom by his absence for two years in Rajputána, where he went to fetch his bride. The beauty of the bride and the dalliance of the ‘bridegroom’ (*dulha*) are celebrated by the poet; and tradition still preserves the story of the loss of his kingdom by *Dulha Rao*, or the ‘Bridegroom Prince.’

“Amongst the latest illustrations of the fortunes of the Gwalior family, I may refer to the Sanskrit inscription which was placed over the Kathantiya gate of the fort of Rohtás. (See Journ. As. Soc. Bengal, Sept. 1839.) In this the family is called *Tomara*, and not *Tuar*, as by Tod. The name of the 4th prince has been misread: it should be *Dunggara*, and not Hangara. Eight of the family were Rájas of Gwalior from Vira Sinha the contemporary of Taimúr to Vikramaditya, who fell on the field of Pániput, fighting against the emperor Baber. You will find all these Rajas mentioned in Ferishta's History at different times.

“ I have just packed up five of the Gwalior inscriptions, which will be taken down to Calcutta by an officer who starts to-morrow from Nynce Tál. I have duplicate copies for comparison with the Nágari transcripts that may be sent up to me. I have added also an inscription in small characters from Ratanpur, in the Nágpur district.

“ Another very large inscription in middle-sized well formed letters contains a long genealogy of some unknown princes—with, apparently, the history of a temple between Samvat 960 and 1025, or for sixty-five years. The money of the time is called ‘*Sri-mad Adi Varáha drama,*’ which is clearly the small silver Varáha coinage bearing the Boar incarnation on one side, and the legend ‘*Sri-mad Adi Varáha*’ on the other. A new era is also mentioned, as well as I can remember now (for the inscription is with Mr. Griffith) the Varáhada era, beginning about 438 B. C., which is probably therefore the same as the Virát era. There is a Máharája Bhoja Deva in this list also.

“ I enclose a small inscription from Kajráha which will show Rájendralal two things.—1st, that there may be a blunder in a date, notwithstanding the care that *ought* to have been taken—and 2nd, the form of the figure 5, which is like our English 5 with rather a long head. This peculiar form of the figure is found in one inscription along with the common 5. I should be glad to have a translation of this inscription if Rájendralal would kindly undertake it. The date is probably 1011—at least I satisfied myself by personal inspection that the figure 1 was first engraved and afterwards changed to ○. I understand the inscription to record a series of gifts to the temple of Jinanáth by Dhánga Rája. The gifts are numbered.—1st, the Páhila Garden. 2nd, the Chandra Garden. 3rd, the Little Chandra Garden. 4th, the Sankara Garden. 5th, the Panch Itala Garden. 6th, the Mango Garden. 7th, the *Dhánga* Tank. Perhaps Dhánga should be read Ghánga; but in the 3rd line he is called Rája; and I feel inclined to identify him with the Dhánga Rája of the large inscriptions from the Bráhmanical temples.

“ Of coins I can tell you but little, not from want of new matter, but from want of time. Of novelties I may, however, mention a square copper coin of a new king, Epander, and a tetradrachm of Antiochus *Nikator* with the name of Agathokles on the reverse.

The title of Nikator is, I believe, unknown as belonging to an Antiochus. I have also a hemidrachma of Nikias; and Mr. Bayley and I have each a hemidrachma of Diomedes, but of different types.

“Of Hindu coins I may mention that Mr. Bayley has a gold specimen of *Pravarasena* of Kashmir, and that I have several specimens in copper of *Mihira kula*, and one specimen of *Hiranya kula* and one of Gokarna. These coins prove that Professor Lassen’s arrangement of the Kashmir dynasties is untenable. I have also a fine specimen of Tribhuvana Gupta’s coinage.

“Of Indo-Scythian coins the finest specimens are in gold. One has a male figure standing beside a horse with the legend APΘOACΠO, ‘the divine steed.’ The figure is like that of MIIPO, *Mihir*, or the sun, to whom the horse was sacred. Another coin has a figure standing full face with the legend MAACHNO, that is *Mahásena*. Another coin has two figures both standing to the front with the legend CKANΔO KOMAPO BIZATO—that is *Skanda-kumára*, *Visákha*. Now Mahásena, Skanda, Kumára, and Visákha are all titles of Kárttikeya, the god of war—and I believe that these coins give us the earliest notices of this god.

“By a late paragraph in one of the Calcutta newspapers, I see that the Asiatic Society are anxious to part with some of the duplicate coins of the Stacy collection. I propose therefore to exchange some of my duplicates with the Society. For this purpose I have sent off a packet of coins to your address—all labelled and priced, as per accompanying list—from which the Society can select such coins as they may wish to possess to the extent of 800 Rs. in exchange for a number of the Society’s coins, which I have selected from the Stacy collection as per accompanying list. I think that you will find a very great variety amongst the coins which I send down—and some most beautiful and rare specimens. Amongst them are specimens of the Indo-Scythians APΘOACΠO and CKANΔO KOMAPO.

*List of Coins for Sale or Exchange.*

| Metal. |    |    |               |            |
|--------|----|----|---------------|------------|
| G.     | S. | C. | PERSIA.       | Rs. As. P. |
| 1      | 0  | 0  | Daric, .....  | 30 0 0     |
| 0      | 3  | 0  | Darics, ..... | 15 0 0     |

## GREECE.

|   |   |   |                             |    |   |   |
|---|---|---|-----------------------------|----|---|---|
| 0 | 1 | 0 | Alexander the Great, tetra- |    |   |   |
|   |   |   | drachm,.....                | 25 | 0 | 0 |
| 0 | 1 | 0 | Lysimachus, drachma, .....  | 10 | 0 | 0 |

## SYRIA.

|   |   |   |                                                   |    |   |   |
|---|---|---|---------------------------------------------------|----|---|---|
| 0 | 1 | 0 | Antiochus Theus, tetradrachm,                     | 30 | 0 | 0 |
| 0 | 2 | 0 | Ditto ditto drachmas, .....                       | 12 | 0 | 0 |
| 0 | 0 | 1 | Demetrius Head of Diana and<br>Tripod, .....      | 10 | 0 | 0 |
| 0 | 0 | 1 | Ditto horse's head and ele-<br>phant's head,..... | 5  | 0 | 0 |

## BACTRIA.

|   |   |   |                                            |     |   |              |
|---|---|---|--------------------------------------------|-----|---|--------------|
| 1 | 0 | 0 | Diodotus, stater, .....                    | 100 | 0 | 0            |
| 0 | 1 | 0 | Eucratides, tetradrachma, ...              | 20  | 0 | 0 bare head. |
| 0 | 1 | 0 | Ditto ditto, .....                         | 25  | 0 | 0 helmeted   |
| 0 | 0 | 1 | Lycias, .....                              | 5   | 0 | 0 [head.     |
| 0 | 1 | 0 | Apollodotus, hemidrachma,<br>head, .....   | 10  | 0 | 0            |
| 0 | 3 | 0 | Hippostratus, didrachmas, 3<br>types,..... | 60  | 0 | 0            |
| 0 | 1 | 0 | Hermæus, didrachma, .....                  | 15  | 0 | 0            |
| 0 | 1 | 0 | Ditto drachma,.....                        | 10  | 0 | 0            |
| 0 | 1 | 0 | Azas, didrachma, Jupiter, ...              | 16  | 0 | 0            |
| 0 | 4 | 0 | Ditto hemidrachmas, 4 types,               | 8   | 0 | 0            |
| 0 | 2 | 0 | Azilisas, didrachmas, 2 types,             | 30  | 0 | 0            |
| 0 | 2 | 0 | Ditto hemidrachmas, 2 types,               | 5   | 0 | 0            |
| 0 | 1 | 0 | Vonones and Spalhores, .....               | 10  | 0 | 0            |
| 0 | 1 | 0 | Vonones and Spalgadames, ...               | 10  | 0 | 0            |

## ROME.

|   |   |   |                                            |     |   |   |
|---|---|---|--------------------------------------------|-----|---|---|
| 0 | 0 | 2 | Roman copper As and Semis,                 | 5   | 0 | 0 |
| 0 | 7 | 0 | Demarii, picked coins at 6, ...            | 42  | 0 | 0 |
| 0 | 2 | 0 | Cistopori, Antony and Cleo-<br>patra,..... | 100 | 0 | 0 |
| 1 | 0 | 0 | Theodosius, .....                          | 20  | 0 | 0 |

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 3 36 5

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 628 0 0



|                         |                                           |
|-------------------------|-------------------------------------------|
| <i>Acilia</i> , .....   | Head of Venus, Juno Sospita with snake.   |
| <i>Plancia</i> , .....  | Youthful head. Rev. Goat.                 |
| <i>Metella</i> ,.....   | — P. METELLVS, SCIPIO, IMP.               |
| <i>Augustus</i> , ..... | Bare head, CAESAR, COS. V. Rev. Crocodile |

## AEGYPTO CAPTA.

In a subsequent letter Col. C. adds that he has a square copper coin of Demetrius with an Arian legend. ‘In the Greek legend he takes the title of Nikator, which is translated by Aparajita, and not by the Aparahata of the later kings.’

In another letter dated 16th December, Col. C. writes of still further additions of rare and unique coins made to his cabinet.

“The unique coins are 1st, a gold dinar of Kanishka with *Greek* legends—obverse ΒΑCΙΑΔΕΥC ΒΑCΙΑΕωN ΚΑΝΗΡΚΟΥ—and reverse ΗΑΙΟC. 2nd, a similar gold dinar, with the same figure on the reverse but with both legends in the native language, but Greek characters, respectively ΡΑΟ ΝΑΝΟ ΡΑΟ ΚΑΝΗΡΚΙ ΚΟΡΑΝΟ and ΜΙΠΟ—one of the rarer coins which I have obtained is the dinar of *Hoërke* with three figures on the reverse. The specimen is in the most perfect preservation—and the reverse legend is distinct, exactly as I formerly read it—ΚΑΝΔΟ ΚΟΜΑΡΟ ΜΑΑΧΝΟ ΒΙΖΑΓΟ, these being three of the well known names of the Indian god of war—

*Skanda-kumára, Mahásena, Visákha.*

“But a still more interesting and valuable discovery of this prince Hoërke is the mention of a Vihár named after him in one of the newly found Mathura inscriptions. The inscription records a gift to the monastery of the great king of kings, the heaven descended *Huveshka*. Now as the name of Kanishka became Kanerke on the coins, I infer that *Huveshka* would have been rendered *Huverke* or in Greek ΟΟΗΡΚΕ, which has hitherto been looked upon as equivalent to Hoërke. The only record of this prince’s name is in the Rája Tarangini where he is called *Hushka*, which may either have been the usual contraction of his name—or the casual contraction to suit the metre of Kalhan pundit’s verse.

“This discovery has further led to the true reading of the prince’s name in the Ariano Pali legend of the Wardak Vase. In Prinsep’s Indian Antiquities, Vol. I. p. 63, Thomas reads the name as *Hovesh-*

*shandra*, and I was myself inclined to adopt *Harischandra*, but I feel satisfied now that the true reading is *Hoveshkasa*.

“Three of the Mathura inscriptions are dated in figures the same as those on the Sah coins of Saurashtra, but with the addition of the puzzling  $\times$ , a real unknown quantity, which is also found in the Ariano Pali inscriptions of Manikyala and Wardak. One correction of a previous error I have already derived from these inscriptions—namely that the character *di*, which I read as 10 in the Sanchi inscription, is really only a contraction for *divasa* = day. The date of the Sanchi inscription is therefore *san 93 Bhádrapada di 4*.—“In the year 931 Bhádrpad, 4th day.”

“Amongst the Muttra inscriptions there is one recording the gift of a statue of *Sákya Bhikshu*, on the pedestal of a small standing figure. Amongst the names of donors are *Buddhánanda*, *Buddhaghosha*, and *Buddarakshita*. Amongst the sculptures are the well known representation of *Máyá*, the mother of Buddha, holding by the branch of the *Sál* tree previous to her confinement. There are also the birth of Buddha (the infant with a halo round his head); the meditation; the teaching; and the death. There are several colossal figures of Buddha, and numerous pillars belonging to that peculiar kind of stone enclosure which I have named the “Buddhist railing.” No less than twenty-six bases of pillars have already been found; and more will no doubt be found hereafter. Altogether I consider that the mounds of Mathura most probably contain remains of greater antiquity than those of Benares, and I look forward to further discoveries with much interest.”

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Dr. Sprenger writes from Berne that he has already printed some 200 pages of his continuation of the *Life of Mahommed*.

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In the following extract from a letter from Mr. E. C. Bayley, dated 10th November, will be found an interesting passage regarding plated coins, an instance of which occurred among some old Egyptian coins lately presented to the Society by Mr. C. J. Evans. Mr. B. also pursues the subject of the identification of ‘*Sahet Mahet*’ described in his previous letter on the information communicated to him by *Rájah Maun Singh*.

“First as to plated coins, they are not uncommon, and are evidently ancient, I have myself met with didrachma of Hippostratus, Azilizas, and Azas, with a drachma of Hermæus and with hemidrachmas of Menander, Apollodotus and Philoxenes, &c. I have no doubt too the celebrated silvered Kadphises was one of this type. I have even found a copper hemidrachma of Menander which had clearly never been silvered. Once too near Rawul Pindee I found in a village an immense hoard of Satnanta Deo coins evidently intended to be silvered. They were in brass and blundered terribly in their execution. I have no doubt that the ancient Hindu passed bad money as often as his modern descendant.

“This much for that question. In “re Sahetanâ” I have succeeded by the aid of Fa hian, in getting a clear identification of Sahet Mahet. I find this in the account of Buddha’s death (‘Sakya Muni’) which Laidlay, in speaking of Kusinagar, extracts from Turnour’s Mahawanso. In it Sakya Muni’s disciples are represented as remonstrating with him for selecting so insignificant a place as Kusinagar as the scene of his ‘nirvana,’ and ask why he has not selected one of the six neighbouring great cities, ‘Varanasi’ (Benares), ‘Rajagaho’ (Rajgriha), ‘Sawattho’ (Sravati), SAHETAN—Kosambhi or Champa. Sahetan is clearly ‘Sahet Mahet.’ I have since heard from C. A. Elliott and from the Râja of Kupoorthulla, who have both visited it, and who confirm Maun Singh’s description in all respects. It is, the former says, Jilnabed on the Raptee. It is in the Kupoorthulla Râjah’s illaka, and he purposes clearing it of jungle. This cold season I have spoken to him about it, but it would do no harm if you write to him. He is a very intelligent man and speaks admirable English very fluently. It is no doubt a good field, and I would advise your trying it.

As to ‘Champa’ and ‘Kosambhi’ mentioned above, the former is, I suppose, perhaps to be looked for about Champarun, if similarity of names is worth anything. Kosambhi, Fa hian places N. W. of Sarnath at Benares and at a distance (13 yieow yau = 60 miles) which would land it near Sultanpur, near to which as I told you Râja Maun Singh says, there are Buddhist remains.

“But the pundits here declare it is identical with Karra Manikpur. I had, however, a discussion on the subject and found that their

authority was the Vrihat Kathá or Kathá Sarit Sagar, and that this they declared maintained that Kosambhi was on the Ganges. However, they brought me a portion of this work to-day, and admitted that on referring to it they found that it merely said that the Ganges flowed through the *realm* of Kosambhi, but that one passage almost distinctly said that Kosambhi was not on the Ganges, for it said that the king built it away from rivers to avoid being washed away by them. This book, however, declared that it was founded by 'Satákánik,' translated as 'him of the hundred battalions' and son to 'Sahasrakanik, king of the 1000 battalions.' Can Kosambhi be the 'Sanakaniha' of the Allahabad and Sanchi inscriptions?"

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We are at last in possession of a cast in clay of the famous inscription on the Behar pillar of which an incorrect reading was published in our Journal many years back. The cast is in the hands of Babu Rájendralal Mittra, who hopes to succeed in deciphering and translating it.

Several facsimiles of this inscription have been at different times procured, but the impressions given by them have been too faint and indistinct to allow of the text being correctly read. We owe the present cast entirely to the exertions of Mr. Charles Hollings of Gyah, who deserves the Society's cordial thanks for the perseverance with which he has endeavoured to meet their wishes in regard to this pillar and the important record which it is believed to bear.

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Capt. Lees is engaged in printing for the use of his College the *Kholdi Barín* ( خلد برين ) of Wahshi ( وحشي ) who died A. H. 992. He was born in Kirman, but as he resided chiefly at Yazd, he is generally called *Yazdi*. The *Kholdi Barín* is a short *Masnawi*, written in charming Persian and in the same metre as Jámi's *Sabhat ol-Abrar*, and is deservedly popular. The author is sometimes, in India, confounded with Wahshi-i Dawlatabádi, but though poems are ascribed to him, nothing certain appears to be known about him. Wahshi-i Dawlatabádi must apparently be Wahshi-i Káshi, a pupil of Mohtasham i Káshi, who came to India, and lived here for a long time. He died in India A. H. 1013.

## ERRATA IN VOLUME XXVIII.

- 
- Page 124 line 6 ab infra, *for* आद्याशक्तिं *read* आद्यां शक्तिं.  
 „ 125 „ 19 *for* जानाति वेदं *read* जानानि वेदं.  
 „ 129 „ 15 *for* स *read* म.  
 „ 129 „ 5 ab infra, *for* निन्देयं *read* विन्देयं.
- 

## ERRATA IN THE PRESENT VOLUME.

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- Page 324 line 5 *for* dated *read* stated.  
 „ — „ 20 *for*  $\square\aleph$  *read*  $\aleph\square$ .  
 „ — „ 29 *for* گستن *read* گسستن.  
 „ 338 „ 24 *for* دادا *read* دادار.  
 „ 343 „ 2 *for* p. 3 *read* p. 324.  
 „ 344 „ 30 *for* شکستن *read* شکستن.

PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,

FOR SEPTEMBER, 1860.

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The Monthly General Meeting of the Asiatic Society was held on the 5th instant—

Major H. L. Thuillier, Vice President, in the chair.

The Proceedings of the last Meeting were read and confirmed.

Presentations were received—

1. From Dr. C. Holst, Secretary to the Royal University of Christiania, the latest publications of the University.

2. From the British Association for the Advancement of Science, a report of the 29th Meeting of the Association held at Aberdeen, in September, 1859.

3. From the Secretary to the Government of Bengal, the latest Report of the Geological Survey of India.

4. From the Acting Principal of the Grant Medical College, Bombay, a copy of the report for the College Session 1859-60.

5. From Baboo Runglal Banerjea, a copy of his work on the Importance of Physical Education, being the first work of the kind in the Bengali language.

6. From Mr. J. C. Evans, a few coins found by himself in Egypt; among these are some genuine Ptolemies and one or two forgeries of the Ptolemaic period.

7. From Baboo Rajendra Mullick, a pair of very fine adult Casowaries, male and female, that have been prepared as skeletons.

8. From Captain Haughton, Port Blair, Andamans, through the President, a marine annelide, taken off the coast of Sumatra.

9. From G. J. Evans, Esq., a small lizard and two snakes from Egypt.

10. From Mr. W. Theobald a few fossils from the miocene beds of Bordeaux.

11. From Mr. J. H. Reily, Commissioner of Soonderbunds, a slab-stone containing an Arabic inscription found in a Musjid, 8 miles from Mirzagunge. A sketch of the Musjid drawn by Mr. Gomes accompanied the following letter, addressed to the President by Mr. Reily.

“ I send with pleasure the deer and the stone. The latter was found on the north bank of the Slab River at an *ábád* called Byang in a *Mut* or Musjid, which is in tolerable preservation. The land round the *Mut* is now clear, but the temple was found in the jungle when it was cut down with the stone in it. There is no story or tradition attached to the *Mut*—the generation that built it seems to have passed away, and the place to have run into jungle and remained covered with forest jungle for a great number of years. The principal room in the *Mut* has an arched roof in good preservation inside a regular dome. The mortar of the building is not *soorkie* or pounded bricks but sand and lime, and very adhesive.

There is a good tank near the *Mut*; the inscription on the stone appears to me a verse from the Koran.”

Again on the 10th July last he wrote :—

“ I send a sketch of the Musjid drawn by Mr. Gomes, who fortunately had a drawing of it in his Field Book. The accompanying extract from Lieutenant Hodge’s Map will shew that the site of the Musjid is about eight miles from Mirzagunge, the nearest decennially settled village. The lands about the Musjid are at present under cultivation, but there are still a few of the old forest trees standing, and Mr. Shawe’s Resumption Decree, dated 1842, states that the lands were at that time under dense Soonderbun jungle. The jungle about these parts is tree, not *Null* jungle. There are two slabs of sand-stone evidently used as steps, but bearing no inscription. The interior of the Musjid is ornamented with figures cut in brick, and the dome is very substantially built, and is about 30 feet high. There is a tank not far from the building, and I was told it was found when the jungle was cleared. Of course there are a number of stories connected with this Musjid, one is that a holy Fakeer lived in it, and tigers used to sweep the floor of the building clean with their tails every evening.

Captain W. N. Lees then read the following account of the inscription.

“ I have carefully examined the inscription on this stone. The greater portion is sufficiently clearly written to be legible ; but in consequence of the engraver not having calculated on the length of his inscription, the latter portion has been so crowded that, with the aid of two of the Mawlavis of the Mohammadan College, I have not been able to read it. It is as follows :—

قال النبي صلى الله عليه وسلم من بني مسجدنا بنى الله له  
في الجنة سبعة عشر قصورا \* بنى هذا المسجد في عهد السلطان  
الاعظم ركن الدنيا والدين ابي المظفر باربك شاه بن محمود شاه  
السلطان بن شاه خان معظم اجيال خان بن --- لدين --- ثمانماية وسبعين \*

*Trans.* The Prophet of God (on whom be peace, &c.,) said—  
“ Whoso buildeth a *Masjid*, God shall build for him in Paradise seventy palaces.” This *Masjid* was built in the reign of the *Soltan* the Mighty, the Pillar of the Church and State, Aboo al-Mozaffar Barbak Shah, son of the *Soltan* Mahmood Shah,—by Khan Moazzam Ojyal (?) Khan son of \* \* \* \* \* *Anno Hajri*, 870.

I do not think the builder, or his Engraver, has given the *Hadith* quoted correctly. I find none precisely similar in *Moslim* or *Bokhari*. Both, however, give the following from *Othman* the *Khalifah*.

قال رسول الله صلى الله عليه وسلم من بني مسجدنا يبتغى به  
وجه الله تعالى بنى الله تعالى له بيتا في الجنة \* وفي اخرى بنى  
الله تعالى له مثله في الجنة \*

“ Whoso buildeth a *Masjid*, to please, or for the sake of God, God shall build for him a house in Paradise”—or as others give it “ a house like unto it.” *Tirmidzi* again adds after the word *Masjid* the words “ great or small” *او كبيرا كان او صغيرا* and in this same *Hadith* given, *apud* Nasai, on the authority of 'Amr and Anbasah for the words “ for the sake of God” I find “ in which God shall be praised *ليذكر الله تعالى* فيه. The Prophet, it would appear, then, promised the builder of a *Mosque* one house, not *seventy* houses in Paradise.

According to *Farishtah*, Barbak Shah ascended the throne A. H. 862, and died A. H. 879. His father was commonly called *Náçir* Shah, perhaps to distinguish him from his predecessor the slave and

usurper of the same name, but his full name from the inscription on this stone, it will be seen, was Náçir-al-Deen Mahmood Shah, or—Barbak was not his son at all. It is to be noticed that Farishtah, who is the only authority I have on the kings of Bengal, in entering on the subject says “It should not remain concealed that the Histories in use, are for the most part, silent regarding the affairs of the Kings of the Eastern and Western [Provinces]. I have therefore made use only of the Tarikh-i Alfi, compiled by my teacher Mawlana Ahmad-i Tanáwi; and for this reason, I hope that should my readers find any discrepancies in my account of these matters they will not blame me.”

The following gentlemen, duly proposed at the last Meeting, were balloted for and elected ordinary Members.

W. Forbes Goss, Esq., M. D., and

Major T. James, Bengal Army.

The following gentlemen were named for ballot at the next Meeting.

J. E. L. Brandreth, Esq., Commissioner of Delhi, proposed by Colonel J. Abbott, and seconded by Mr. Atkinson.

Moonshee Ameer Ally Khan, Bahadur, proposed by Mr. Atkinson, and seconded by Baboo Rajendralal Mittra.

Messrs. E. B. Harris, Civil Surgeon, and John Christian, (for reelection) proposed by Dr. T. Duka, and seconded by the President.

C. G. Wray, Esq., C. E., proposed by Major Thuillier and seconded by Major Sherwill.

The Council reported that in consideration of the long and important services of the Zoological curator and the greatly enhanced expense of living in Calcutta, they had resolved, subject to the confirmation of the Society, to give Mr. Blyth an additional house allowance of 40 Rs. per mensem, and to pay his whole allowances free of Income Tax.

*Confirmed.*

The following report of the Philological Committee was also submitted by the Council for the approval of the Society.

The Council beg to recommend the publication in the *Bibliotheca Indica*, of the *Vaiseshika Sutras*, with the valuable Commentary by Sankara Misra. Pundit Joy Narayan Tarkapanchanana, the pro-

fessor of Philosophy in the Calcutta Sanskrit College, has offered to edit the work, with a short additional Commentary of his own, which is not to exceed one fasciculus. The whole work will fill about four fasciculi. A similar offer having been previously received from another Pundit in the same Institution, Pundit Nandakumar Tarkaratna, the Committee recommended that the two Pundits should unite in editing the work. This they have agreed to do, and it will therefore appear under their joint editorship.

The report was adopted.

Mr. Cowell announced the publication in the *Bibliotheca Indica* of the first fasciculus of Zíá Barní's *Tárikhi Ferozsháhi*. A short account of the work was also given, as it appeared that the details communicated at a former Meeting of the Society were incorrect.

Zíá Barní compiled his history in A. H. 758 (A. D. 1357,) in continuation of the *Tabakáti Násiri* of Minhájuddin Juzjáni. It gives an account of the eight reigns during the 95 years between Bulbun's accession in A. H. 664, and the sixth year of Feroz Sháh (A. H. 758), viz. 1. Bulbun, 2. Kaikobád, 3. Jaláluddin Khilji, 4. Aláuddin Khilji, 5. Kutbuddin Khilji, 6. Ghaiásuddin Toghlak, 7. Muhammad Toghlak, 8. Feroz Sháh, to whom the work is dedicated, whence its name. For the later reigns, the author speaks as a contemporary witness, and as such he is often quoted by Ferishta in his history of the Toghlak dynasty. The work is edited from the only three manuscripts known to be extant, by Sayyid Ahmud Khan, under the supervision of Captain Lees.

The publication of this work forms an era in Oriental literature. Hitherto for the Pre-Moghul Muhammadan history of India, we have been dependent on Ferishta who flourished under the Emperor Akbar; Elphinstone's history, for instance, is entirely based on that authority. Zia Barni is the first contemporary author who has been printed to illustrate the five centuries between Mahmud of Ghazni and Baber. It is hoped that the *Tarikhi Ferozsháhi* will be followed by the *Tabakáti Násiri*,—as the two together will throw a flood of light on a confessedly obscure period of Indian history.

Communications received—

1. From Major General R. I. H. Birch, K. C. B. Secretary to the Government of India, Military Department, a copy of a report

drawn up by Officiating Inspector General of Hospitals J. McClelland, on the climate and soils of the three Presidencies as affecting the sanitary condition of European troops in India.

2. From Lord H. Ulick Browne, Secretary to the Government of India, Foreign Department, a copy of the Meteorological observations made by Assistant Surgeon Welsh at Muscat during the month of June last.

3. From Baboo Radhanath Sickdar an abstract of meteorological observations taken at the Surveyor General's office for the month of January last.

4. From Mr. H. Cope, Umritsur, the following accounts of the Aerolite which fell at Dhurmsala on Saturday the 14th July last, accompanied by a specimen.

*Umritsur, 28th July, 1860.*

The Secretary to the Asiatic Society, Calcutta.

SIR,—About two P. M. on Saturday the 14th of July, a tremendous mid-air explosion was heard at Dhurmsala, Kangra, Dalhousie, Madhoopoor and Goordaspoor. The vapour or smoke following the explosion was distinctly *seen* at Dalhousie about 30 miles, and at Kangra 10 miles from Dhurmsala, where the explosion, said to have resembled the discharge of an 84 pounder, was followed by the descent in various parts of the station, some two miles apart, of large masses of aerolite. One piece that fell near the Dhurmsala Police Battalion Lines, was ascertained to have been when entire, one foot in diameter, but it was broken into several fragments. Mr. R. Saunders, C. S., Deputy Commissioner of Kangra, has forwarded to me a portion, with a desire that I should do my best to have it analyzed. It strikes me I cannot do better than forward it to the Asiatic Society. A small part can be taken off for analysis, and the remainder be preserved in your Museum.

I remain, &c.,

HENRY COPE.

*Umritsur, 10th September, 1860.*

MY DEAR SIR,

I have the pleasure to send you an extract from a letter received from Kangra, which is about 11 miles from Dhurmsala and about 1000 feet lower than the spot on which the main mass of the aerolite fell.

“I did not see the explosion in connexion with the falling of the aerolite. I was at the time, reading with my Moonshi in my study and heard an extraordinary noise like that of thunder at a short distance. There could be no doubt that it was near, and I immediately supposed it was something else than thunder. The steady rattling noise which appeared to be travelling in a horizontal direction gradually increased to one tremendous majestic clap; after which the former steady rattling noise continued perhaps for a minute, till at last it died off very gradually. The noise appeared to be so low that I thought a volcano or something like it would immediately appear somewhere in our valley. A servant of mine happened just to return from the Post Office, and told me that above the hill on which our house is situate he had seen a fire travelling towards Dhurmsala, till at last it disappeared. [This would give it a direction from South to North. H. C.] The sky was cloudy, yet there were no such clouds as would justify the opinion that lightning and thunder had issued from them.”

I hope to collect further information, which I will duly communicate.

Yours sincerely,

HENRY COPE.

5. From Mr. R. F. Saunders, B. C. S. Officiating Deputy Commissioner, Dhurmsala, Punjab, in reply to a letter of inquiry addressed to him by the Secretary, the following note accompanying an account of the same meteorite.

*Dhurmsala, August 21, 1860.*

MY DEAR SIR,—From the newspapers you will have seen that an aerolite fell at this station on the 14th ultimo.

I possessed myself of as many fragments as I possibly could for scientific purposes.

One of these I now have the honor to send, together with an account of its fall, in the hope that the subject may not be without interest.

Any questions you may send me regarding this phenomenon I shall be delighted to answer.

If you can furnish me with a brief account of its analysis I shall be much obliged.

Permit me to subscribe myself,

Very truly yours,

REGINALD F. SAUNDERS.

His account of the meteorite was as follows.

*Extract from letter No. 927 from R. F. Saunders, Esq., Deputy Commissioner, Kangra, to R. H. Davies, Esq., Secretary to Punjab Government, dated Dhurmsala, 28th July, 1860.*

In the afternoon between the hours of 2 and 2-30 p. m., the Station of Dhurmsala was startled by a terrific bursting noise, which was supposed at first to proceed from a succession of loud blastings or from the explosion of a mine in the upper part of the Station, others, imagining it to be an earthquake or very large landslip, rushed from their houses in the firm belief that they must fall upon them.

It soon became apparent that this was not the case. The first report, which was far louder in its discharge than any volley of artillery, was quickly followed by another and another to the number of 14 or 16; most of the latter reports grew gradually less and less loud. These were probably but the reverberations of the former, not among the hills but amongst the clouds, just as is the case with thunder. It was difficult to say which were the reports, and which the echoes. There could certainly not have been fewer than 4 or 5 actual reports. During the time that the sound lasted, the ground trembled and shook convulsively.

From the different accounts of three eye-witnesses, there appears to have been observed a flame of fire, described as about two feet in depth, and 9 feet in length, darting in an oblique direction above the station, after the first explosion had taken place. The Meteoric flash was said to be from North N. West to South S. East. Fragments of the aerolite fell in the same direction at the following places.

In the Ravine below the Dhurmsala Kotwallee at the village Sadeir.

On the Barrack Hill close to the Convalescent Dépôt,

At River Guj 4 miles from the Kotwallee.

On the parade ground of the Sheredil Police Battalion, between the graveyard and the Native Distillery.\*

In the village of Keyraree on the Hill to the right of the station looking towards the plains and at the Bowarna Thanah.

Specimens from each of the above localities have been brought into the station.

It is said that the Meteoric stones fell likewise at the following places, but no specimens have been received from them. At Kangra near the slate quarries, at Madhopore and at Bissowlee on the Ravee, and in parts of Chumlea and Rhilloo.

I am making further enquiries with regard to these places.

The stones as they fell, buried themselves from a foot to a foot and a half in the ground, sending up a cloud of dust in all directions.

Most providentially no loss of life or property has occurred.

Some coolies, passing by where one fell, ran to the spot to pick up the pieces; before they had held them in their hands, half a minute, they had to drop them owing to the intensity of the cold which benumbed their fingers.

This, considering the fact that they were, apparently, but a moment before in a state of ignition, is very remarkable, each stone that fell bore unmistakeable marks of partial fusion.

The morning and afternoon, preceding the occurrence, had been particularly dull and cloudy. Temperature was close, sultry, and oppressive. The thermometer was above 80 degrees of Fahrenheit, and no rain had fallen. I had no barometer by me at the time, I am therefore unable to state what was the precise pressure of the atmosphere. The clouds, which were of the form technically called cumulus and cirrus, were hanging low at the time and the atmosphere heavily charged with electricity.

Such are simply the facts of the case as they occurred.

There are of course all sorts of conjectures as to the probable cause of the occurrence, some state the stones to be of volcanic origin, others that they were hurled from the heights above the station or projected from the moon, but I am inclined to regard them as real bonâ fide meteorolites. Their weight seems to indicate that they are semi-

\* It must be noticed that Keyraree, the Barrack Hill, the Kotwallee, the Kudd, the Graveyard and Bowarna are in one direct line, from N. N. W. to S. S. E.

metallic substances composed probably of meteoric iron alloyed with nickel and mixed with silica and magnesia or some other earthy\* substance. They are nearly double the weight of a piece of ordinary stone of similar dimensions.

I have sent specimens of the aerolite to the Museums at Lahore and Umritsur, and to a Scientific Institution in America.† I am about also to send others to the Academy of Sciences in France, to the Asiatic Society in Calcutta, and to Mons. H. Schlagintweit at Berlin in Prussia, for examination and report.

One fact, if true, is curious, viz., that the report preceded the flash instead of following it; this I cannot at all account for.

Another very singular phenomenon was witnessed at Dhurmsala on the evening of the same day, that the aerolite fell; this appears to have been a succession of igneous meteors such as fire balls, or falling or shooting stars. This singular sight did not attract the attention of most people. I quote the account from the writer who describes it, *verbatim*.

“I think it was on the evening of the same day that the meteor fell that I observed lights in the air. They commenced to appear about 7 P. M., and lasted for about three hours till 10; they appeared for about one minute, some for longer, then went out again, other lights appearing in their places; sometimes three or four lights appeared in the same place, together, and one or two moved off, the others remaining stationary, they looked like fire-balloons, but appeared in places where it was impossible for there to have been any houses or any roads, where people could have been. Some were high up in the air moving like fire-balloons, but the greater part of them were in the distance, in the direction of the lower hills, in front of my house, others closer to our house, and between Sir A. Lawrence’s and the Barracks. I am sure from some which I observed closely that they were neither fire-balloons, lanterns, nor bonfires or any other thing of that sort, but *bonâ fide* lights in the heavens. Though I made enquiries amongst the natives the next day, I have never been able to find out what they were or the cause of their appearance.”

\* Probably chrome and cobalt too I think, R. S.

† The Smithsonian; also to the Museums of Munich and Vienna; to Turin, Sardinia, The British Museum, London, and to one or two other localities.

Verily this has been an extraordinary season in more ways than one.

In different newspapers I have read accounts of other very extraordinary phenomena, all occurring within the last few months, for instance, an aerial meteor or water spout in the neighbourhood of Bhurtpore where an aerolite is said also to have fallen, a luminous meteor or something which, from the newspaper account, reads like an Aurora Borealis at Delhi, this was on the night before the meteorolite, a shower of live fish at Benares, unaccompanied by rain, a similar shower accompanied by rain, fell at Agra, a shower of blood at Furruckabad and likewise at Meerut previously, also a dark spot observable on the disc of the sun.

Besides the recent shock of an earthquake slightly felt here, there was an unnatural yellow fog or darkness of some duration followed by a violent Wind storm which lasted from 3 P. M. to 5 P. M. one afternoon early in the present month. These were all more or less strange phenomena. After the fall the largest piece found was said to weigh about 4 maunds.

6. The following extract from a letter from Dhurmsala on the same subject had been also received.

“What a terrific meteor we had yesterday! It burst over Dhurmsala. First there was a loud explosion, and then the stone broke into fragments; one falling near the Barracks and sinking 6 feet into the ground, another below the Kotwallee on the Noorpore Road, and a third in the lines. Two men came running up with some bits in their hand, and gave me one. It is a light grey colour, and hard as iron. The stone when found was cold as ice. The noise was fearful and unearthly, followed by long reverberations, the ground trembling as well as the air. The heat was fearful all day. Ther. 89°. Major —— heard the noise when sitting inside his tent at Kangra, and he thought one of the towers had fallen. The guddees were much frightened and carried off every bit of the stone to do pooja to it. Capt. —— saw it whirling along in the air and so did the Bisaladar who described it as like a pine tree, which I remember was the illustration used by Pliny, when describing the eruption of Vesuvius 1800 years ago, when Pompeii was destroyed. Other fragments of stone fell in other parts of the district, and beyond it at Madoopore. The piece of stone to

be sent, (dawk banghy) was one inside bit, the outside pieces bearing marks of combustion. Before the 14th the weather for several days was excessively close and hot at Dhurmsala and all over the country."

7. The Secretary also read the following extract of a letter from Mr. Oldham, containing a communication from Dr. Haidinger of Vienna on the subject of the meteorites lately sent to the Imperial Museum, Vienna, by the Society.

*Naini Tal, August 27th, 1860.*

MY DEAR ATKINSON,—I have had notes from Dr. Haidinger, Vienna, regarding the meteorites. I suppose from what he says that you have had a letter of thanks, but in case it should have miscarried, I write to tell you the box arrived safely, on 22nd May, and that they are greatly pleased and gratified with this addition to their valuable series of meteorites. Dr. Haidinger's first note stated that several of the specimens had been placed in the lapidary's hands and were then being polished. And now in his second note, just received, dated 30th June, he gives me the result of some of their analyses. Many public duties connected with proposed changes in the organization of some of the scientific bodies of Vienna, with the object of economy, had occupied Dr. Haidinger's time and energies more than he wished, and he regrets in consequence the little progress he has made in the description of these interesting specimens. Of one however he has laid an account before the Imperial Academy of Sciences (Vienna) on the 8th of June. In this he gave a brief account of the whole six meteorites sent to Vienna. The specific gravities of these are:—

|                  |       |
|------------------|-------|
| Allahabad, ..... | 3.526 |
| Shalka, .....    | 3.412 |
| Segowlee, .....  | 3.425 |
| Assam, .....     | 3.792 |
| Pegu, .....      | 3.737 |

(The Pegu specimen was sent by me, not by Asiatic Society.) These do not differ materially from each other, and yet the specimens differ very materially so as to give an almost complete series of meteoric productions, perhaps the class of the Cape or Rokkeveld meteorics excepted.

The Shalka meteorite appeared the most rare and curious. It was

carefully analysed by Herr Charles Von Hauer, Chemist to the Imperial Geological Institute, who found the following contents ;

|                        |          |
|------------------------|----------|
| Silica, .....          | 57.66    |
| Alumina, .....         | a trace. |
| Protox. of Iron, ..... | 20.65    |
| Lime, .....            | 1.53     |
| Magnesia,.....         | 19.00    |
|                        | <hr/>    |
|                        | 98.84    |

In the analysis of Mr. Piddington of the same meteorite, the magnesia had escaped him and remained with the iron, which has been now prevented owing to the later improvements in Chemical Analysis. Von Hauer found the oxygen of the bases to the oxygen of the acids in the ratio of 1 : 2.42 or between bisilicates and trisilicates. Dr. Haidinger says : “Stromeyer already had found a somewhat analagous ratio in an olivine-like body inclosed in a meteoric iron from Saxony. Professor Shepard had given the name of Chladoite to a real trisilicate contained in the Bishopsville meteorites. This certainly new species in the Shalka meteorite, I thought it my duty to name Piddingtonite, in commemoration of that really indefatigable labourer in Natural Sciences to whom we owe the rescue of that most remarkable meteorite of Shalka, and in commemoration too, of the kindness with which you acceded to our proposals of exchange.”

Dr. Haidinger adds that he was engaged in the further investigation of the specimens sent and he hoped to forward a series to the Society from their collections.

When the proceedings of the Academy of Vienna for June arrive, I would suggest that a translation of the valuable account given by Dr. Haidinger of this meteorite should be published in the Journal. I have only given a few of the heads of the notice.

Dr. Haidinger sends two copies of their more recent catalogues of meteorites, and begs me to hand you one for Asiatic Society.

I inclose it, you will see that all the Society sent have been embodied in this. The large mass of iron from the Kurruckpur Hills was considered as by ourselves doubtfully meteoric, but we shall soon have the result of the careful analysis.

It may be interesting to the Society to give them a few results at their next meeting, so I send them to you at once, and the specific gravities could be with advantage attached to the specimens in your collection.

I hope we shall be able to procure some specimen of the great mass said to have fallen at Dhurmsala lately.

In the absence of Mr. Obbard his paper on the translation of waves of water with relation to the great flood of the Indus in 1858, was read by the Secretary.

Archdeacon Pratt made some valuable remarks which have been printed at length in the *Journal*.

Mr. Temple made some interesting observations on the character of the Indus at Attock and the effects of the flood as pointed out to him by Captain Henderson on the spot shortly after the event.

Some discussion ensued on the wave theory as applicable to the phenomena of the flood, in which Sir Bartle Frere, Mr. W. T. Blanford and the Secretary joined.

On the motion of the Chairman the thanks of the meeting were voted to Mr. Obbard and Archdeacon Pratt for their valuable communications.

Major W. S. Sherwill read an interesting paper upon some remarkable Waterspouts, that had been observed by him lately in and near Calcutta; he stated that it was his intention merely to put on record the fact of these curious bodies having been seen, together with the dates of their appearance, times of duration, size and direction of their movements, in the hope that the notes might assist any future enquiries into the nature of the laws regulating these phenomena; as up to the present moment, as Major Sherwill observed, no satisfactory theory has been advanced, that serves to connect these phenomena with the general law of Physics.

The immediate cause of the paper read was the appearance upon the 11th of August last, of two, very perfect and large Waterspouts that appeared, the one between Dum-Dum and Calcutta, the other crossing the Hooghly river opposite to Sulkea. The former was perhaps more than a thousand feet in length, of a pale blue colour, depending from a heavy rain cloud; the upper portion of this im-

mense column gyrated in a rapid manner until, no longer able to contain itself, it burst into a heavy shower of rain. The Waterspout that crossed the river agitated the water beneath it considerably, but did no damage. This body was bent into an elegant double curve like the letter S. by counter currents of light wind; this Waterspout from its light colour and from its great beauty attracted much attention.

Major Sherwill then described a group of twenty Waterspouts that were seen by him whilst surveying the Darjeeling territory. These extraordinary Phenomena were seen to form over the mountain Tonghoo,  $11\frac{1}{2}$  miles from Darjeeling. A diagram showing this wonderful group was exhibited and claimed the attention of the meeting.

Other diagrams of variously formed waterspouts were also exhibited and described. These notes with reduced diagrams will be published in the Journal.

The thanks of the meeting were voted to Major Sherwill for his interesting descriptions.

Baboo Rajendralal Mitra made some remarks on the appearance of a waterspout in the direction of Howrah witnessed by himself on the same day.

The Librarian submitted his usual monthly reports for the months of August and September last.

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#### LIBRARY.

The following additions to the Library were made during the months of August and September, 1860.

#### *Presented.*

General Report on Public Instruction in the Lower Provinces of the Bengal Presidency for 1858-59 with Appendixes.—BY THE DIRECTOR OF EDUCATION.

Nyt Magazine fur Naturvedenskaberne, Vol. X. part 4 Vol. XI. part I.—BY THE ACADEMY.

Selections from the Records of Punjab Government, Vol. V.—BY THE INDIA GOVERNMENT.

The Philosophical Magazine for July, 1860.—BY THE EDITORS.

Address delivered at the Anniversary Meeting of the Geological Society of London.—BY THE SOCIETY.

Selections from the Records of Travancore, Part I.—BY THE GOVERNMENT.  
 Proceedings of the Academy of Natural Sciences of Philadelphia for  
 January and February, 1860.—BY THE ACADEMY.

Journal of the Academy of Ditto, New Series, Vol. IV. P. 3.—BY THE SAME.

New York State Library for 1855.—BY THE SAME.

Ditto ditto State Law Library for 1855.—BY THE SAME.

Ditto ditto State Bibliography, 1858.—BY THE SAME.

Ditto ditto State Maps, MSS. Medals, &c. 1856.—BY THE SAME.

The Cathedral of Throntheim.

Al-Mufussal opus de re grammatica Arabicum.—BY J. P. BROCH.

Karlamagnus Saga ok Kappa hans.—BY THE CHRISTIANIA ACADEMY.

Forlandlinger Videnskabi Selskubet.—BY THE SAME.

Tilottama.—BY M. M. S. DUTT, Esq.

Quarterly Journal of Geological Society for May, 1860, No. 62.—BY THE  
 SOCIETY.

Selections from the Records of Madras Government Report on the Agri-  
 cultural Exhibitions in the Provinces for 1859, No. 64.—BY THE MADRAS  
 GOVERNMENT.

Memoirs of the Geological Survey of India, Vol. II. P. I.—BY THE  
 GEOLOGICAL MUSEUM.

Journal Statistical Society of London, Vol. XXIII. P. II.—BY THE  
 SOCIETY.

Oriental Baptist for July and August, 1860.—BY THE EDITOR.

Oriental Christian Spectator for June and July, 1860.—BY THE EDITOR.

Calcutta Christian Observer for August and September, 1860.—BY THE  
 EDITOR.

Journal Asiatique, Tome, XV. No. 58.—BY THE SOCIETY.

Journal of the Indian Archipelago, New Series, Vol. III. P. I.—BY THE  
 EDITORS.

Proceedings of the Royal Geographical Society of London, Vol. IV. No.  
 2 1860.—BY THE SOCIETY.

Jahrbuch, Vol. X. No. 4.—BY THE ACADEMY.

Annual Report of the Geological Survey of India and of the Museum of  
 Geology for 1859-60.—BY THE GOVT. GEOLOGICAL MUSEUM OF CALCUTTA.

On the Importance of Physical Education.—BY THE AUTHOR.

On the Rise and Progress of Rational Medical Education in Bengal, being  
 an Introductory Lecture, delivered on the 15th June, 1860.—BY DR. EAT-  
 WELL.

Descriptions of a Defaced Fragmentary Human Skull, found in an  
 Ancient Quarry-cave at Jerusalem.—BY DR. MEGGS.

Athenæum for May and June, 1860.—BY THE EDITOR.

*Purchased.*

- The American Journal of Sciences and Arts for May, 1860.  
 The Annals and Magazine of Natural History, Vol. V. No. 30, and Vol. VI. No. 31.  
 The Annales des Sciences Naturelles, Vol. XII. Nos. 2 and 3.  
 Comptes Rendus, Vol. L. Nos. 19 to 26, and Vol. LI. No. 1.  
 Journal des Savants for April and May, 1860.  
 Index ditto for 1859.  
 Revue des Deux Mondes for 15th April, 1st May, 15th May, 1st June, 15th June and 1st July.  
 Revue de Zoologie, Nos. 4, 5 and 6, 1860.  
 Conchologia Iconica, Parts 194 to 198.  
 Zamie Nafaarul Uns.  
 Goldstucker's Dictionary Sanskrit and English.  
 Sanskrit Wörterbuch Dritter Theil Bogen, 24—30.

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 FOR OCTOBER, 1860.

The Monthly General Meeting of the Asiatic Society was held on the 3rd inst.—

A. Grote, Esq., President, in the chair.

The Proceedings of the last Meeting were read and confirmed.

Presentations were received—

1. From Mr. R. F. Saunders, specimens of the aerolite which fell at Dhurmsala, an account of which was submitted at the last meeting. The larger piece was picked up in the lines at Dhurmsala, and the smaller at Bowarna, about 20 miles to the east of Dhurmsala.
2. From Mr. H. Scott Smith, Registrar Calcutta University, a copy of the Calendar and Minutes of the Senate for the last 3 years.
3. From J. H. Gurney, Esq., M. P., Norfolk, a small collection of bird skins.
4. From Major H. L. Thuillier, a copy of Simm's new map of Calcutta, and two Indian Atlas sheets, Nos. 112 and 113.

The following gentlemen duly proposed at the last meeting, were balloted for, and elected ordinary members :—

J. E. L. Brandreth, Esq., Commissioner of Delhi; Moonshee Ameer Ally Khan Bahadur, Pleader of the Sudder Court; E. B. Harris, Esq.; John Christian, Esq., (for re-election) and C. G. Wray, Esq., C. E.

The Council report the following nominations to fill the six vacancies on the list of Honorary Members.

1st.—Dr. Albrecht Weber, as one of the most eminent Sanskrit scholars of Germany. He has particularly devoted himself to the study of the White Yajur Veda, and he has the enviable distinction of having edited an entire series, comprising the Sanhita of the Hymns, the accompanying Satapatha Brahmana, and the Ritual Sutras of Katyayana. Beside this great work, his four volumes of *Indische Studien* abound with new and valuable information in reference to the Vaidic period of Hindu literature.

2d.—Edward Thomas, Esq., as the author of valuable papers in our Journal and in those of the Royal Asiatic and Numismatic Societies, on several series of Asiatic medals, and more especially on those series which contribute to the early history of India; and as the editor of Prinsep's *Indian Antiquities*.

3rd.—Mons. Stanislas Julien, whose researches in the history and antiquities of China have raised him among the most distinguished Orientalists of the present day. His contributions to the *Journal Asiatique* are numerous and of great interest. Among his separate publications may be noticed his *Travels and Life of Hiouen Thsang*; *Mengtsieu, vel Mencius inter Sinenses philosophus*; *L' Histoire du Cercle de Craie*, and *Le Livre des Recompenses et des Peines*. They are works of consummate erudition, and any one of them is sufficient to establish the character of a scholar.

4th.—Dr. Aloys Sprenger, as an Arabic scholar of celebrity and as a valuable contributor in that capacity to early Mahommedan history, and as now engaged on what promises to be the best extant biography of Mahommed.

5th.—Dr. Robert Wight as a valuable contributor to our knowledge of Indian Botany, and more especially of that of the Peninsula and the Neilgherries.

6th.—Colonel George Everest, Fellow of the Royal Society, formerly of the Bengal Artillery, Surveyor General of India, and Superintendent of the Great Trigonometrical Survey of India from 1823 to 1843 and Surveyor General 1830 to 1843. Of the many important works executed under Col. Everest's direction, the most important and that by which he will be best known to posterity is the northern

portion of the Great Meridional Arc of India comprised between the Damargida and Dehra Dhoon Base lines  $11\frac{1}{2}$  degrees in length, the account of the measurement of which was published by himself in 1847. The whole Indian Arc is equal to  $21^{\circ}, 21', 16''$ , or about 1469 miles. No geodetic measure in any part of the world surpasses, or perhaps equals, in accuracy this splendid achievement. By the light it throws on researches into the figure and dimensions of the earth, it forms one of the most valuable contributions to that branch of science which we possess, whilst at the same time, it constitutes a foundation for the geography of Northern India, the integrity of which must for ever stand unquestioned.

Col. Everest reduced the whole system of the great national Survey of India to order, and established the fixed basis on which the geography of India now rests. His determination of the amplitudes of the two Northern sections of the great Meridional Arc by means of simultaneous observations taken to the same stars with counterpart circular instruments, and his method of determining the celestial azimuth, still practised, may be considered the most perfect modes of obtaining an astronomical element known to science.

The following gentlemen were named for ballot at the next meeting.

W. A. D. Anley, Esq. Assistant Engineer in the East Indian Railway, proposed by Capt. Layard and seconded by the President.

Captain C. D. Newmarch, Chief Engineer, Pegu, and Captain Horace Browne, Assistant Commissioner, Pegu.

E. O. Riley, Esq., Magistrate of Rangoon, proposed by Lieutenant Colonel A. Phayre, and seconded by the Secretary.

Baboo Degumber Mittra, proposed by Baboo Ramapersaud Roy, and seconded by Baboo Rajendralal Mittra.

Reverend K. M. Banerjee (for re-election,) and

R. T. H. Griffith, Esq., proposed by Mr. Cowell, seconded by Mr. Atkinson.

Communications were received—

1. From Mr. W. T. Blanford, "Notes on a Collection of land shells made in Upper Assam by J. W. Master, Esq., Assistant Commissioner of Golughat, with descriptions of a new species of *Spiraculum*, &c."

2. From Baboo Radha Nauth Sikdar, "An abstract of Meteorological observations taken at the Surveyor General's Office in the months of February and March last."

3. From Rev. I. Löwenthal, Peshawur, "A paper on the Non-Semitic character of the Pushto language."

This paper was read to the meeting by the Secretary.

The Librarian submitted his usual monthly report for September last.

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FOR NOVEMBER, 1860.

The Monthly General Meeting of the Asiatic Society was held on the 7th instant,

The Ven. Archdeacon J. H. Pratt, as Senior Member, in the chair. Presentations were received—

1st. From Professor Griffith, through Mr. W. Halsey, a singular iron sun-dial called *Pratoda* or *Pratola*, (serving also for an hour-glass a gun and a spear) believed to have been made by Sirdar Lena Singh for Lord Hardinge.

2nd. From the Royal Geological Society of London, the 29th Vol. of their Journal.

3rd. From A. Seonce, Esq., the following Arabic Books:—Willmet's Arabic Lexicon, Schultens's Hariri and De Sacy's Arabic Grammar, and Niebuhr's Travels.

4th. From the Editors of Rajah Radhakant's Subda Kulpadrúma the 1st No. of the new edition of the Encyclopedia, together with a brief sketch of the Rajah's life.

5th. From Baboo Kaliprasuno Singh the 2nd No. of his valuable work "Púrana Sangraha," being a Bengalee translation in prose of the "Mahabharat."

The *Pratoda* (noted above) was accompanied by the following extract from an old Hindoo work on astronomy, communicated by Pundit Bapu Deva.

1. I am explaining the instrument called *Pratoda* (a goad) invented by Ganesa, by which the hour of the day can be easily known. Take a straight stick of moderate thickness of the tree called *Dalbergia Sisu*, of any length.

2. Make it of the form of a right prism whose ends should be regular polygons having as many angles as the number of *ghatikas* contained in the excess of the longest day above the shortest (at the given place); and for the convenience of holding it join a chain (or string) to its top: (and mark the numbers of *ghatikas* from that of the *ghatikas* of the shortest day to that of those of the longest on the upper parts of the sides of the prism successively.)

3. Below its support, in order to place a gnomon, make holes in each side of the prism at the beginning of its length in such a manner that they may not touch each other in the middle (of the prism).

4. In order to conceal the gnomon (in this instrument) make another hole near the support (of the prism) at its top in the middle. Let the length of the gnomon be such as after placing it in the hole (made in each side) the length of its external part be nearly equal to the sixth part (of the length of the prism).

5. A twelfth part of the length of the external portion of the gnomon should be considered an *Angula* (a digit) in this *Pratoda* instrument. And find the sines of the (sun's) zenith distance and altitude at the end of each of the given *ghatikas* (from the sun-rise of every day, the number of the length of which is marked on the instrument) by the rule mentioned by former Astronomers.

6. The sine of the (sun's) altitude (found at the end of the given *ghatikas* from sun-rise) multiplied by 12 and divided by the sine of the zenith distance (of the sun found at the same time) gives the number of digits belonging to the given *ghatikas*.

Thus find the digits belonging to the given *ghatikas* one, two, &c., from sun-rise (of every day, the length of which is marked on the instrument) and mark these digits on the respective sides (of the prism) from the hole.

7. (When you want to know the time after sun-rise at the given day) place the gnomon in the hole of that side (of the prism) on which the number of the *ghatikas* contained in the length of the given day are marked, and hang the instrument by holding it in the chain in such a manner that the shadow of the gnomon falls on the side. And reckon the *ghatikas* (on the side) from the hole to the end of the shadow. These *ghatikas* are after sun-rise (when you observe the shadow) before noon, (but when you observe it) after noon they are the *ghatikas* remaining (to complete the whole day.) (This holds then when the end of the shadow falls exactly on the mark of the *ghatikas*) but when it falls between two marks, there will be required a proportion."

The Archdeacon then gave the following account of its character and uses :—

"The instrument appears to be roughly graduated and to be in a

ricketty condition. It has nine sides. If these are *exactly* suited to the latitude, the place for which it was made was in latitude  $27^{\circ} 56'$  or thereabouts. If the latitude of the place did not accord with an *exact* number of sides, then it must have been between  $26^{\circ} 40'$  and  $29^{\circ} 12'$  that is, corresponding to  $8\frac{1}{2}$  and  $9\frac{1}{2}$  sides. Delhi lies between these last two latitudes. The instrument may, therefore, have been made for that city.

“The manner of using the instrument appears to be this. Suppose the day that you use it is the one of which the length is 50 minutes longer than the shortest day; then as  $50 = 2 \times 24 + 2$  and 24 minutes make a *ghatika*, you must screw the gnomon into the hole in the third side, in which the figures run down the third shortest length. Then hang up the instrument and turn it round, thus hanging, so that the shadow of the gnomon may fall on the length of the instrument; the extremity of the shadow will point out the hour of the day in *ghatikas* from sunrise or sunset as it is before or after noon.

“The instrument is certainly curious, though of no particular scientific value.”

Colonel Baird Smith communicated to the meeting the following interesting particulars respecting the constructor of the dial.

“Lena Singh Majetteeah, the constructor of the *Pratoda* Dial, was the representative of a well known distinguished Sikh family. He did not take any very prominent part in the Sikh campaign, but his brother Runjoor Singh commanded the Khalsa army at the battle of Aliwal where, as all know, he was signally overthrown by the force under Sir Harry Smith. On that occasion an exquisitely beautiful battery of six field guns, the property of Lena Singh, and the produce, probably, of the same workshops which produced the *Pratoda* Dial, was captured. Nothing could surpass the whole design and details of these guns, and while they were ornamented with great taste, they were at the same time good working guns, and had been vigorously used during the day.

“Lena Singh had very considerable mechanical capacity. He enjoyed greatly hearing of all forms of mechanical invention. The long range and explosion shells for guns were favorite subjects of experiment and discussion with him, and he was altogether a notable man among his race, and in his position as a Sikh Chieftain of large pos-

sessions, having strong intellectual tendencies in spite of the semi-barbarism amid which he lived."

The following gentlemen, duly proposed at the last meeting, were balloted for and elected Honorary Members :—

|                  |                  |
|------------------|------------------|
| Dr. Weber.       | E. Thomas, Esq.  |
| M. St. Julien.   | Dr. R. Wight.    |
| Dr. A. Sprenger. | Col. G. Everest. |

The following gentlemen who were proposed at the last meeting were also balloted for and elected ordinary members.

- W. A. D. Anley, Esq., Assistant-Surgeon, East Indian Railway.  
 Captain C. D. Newmarch, Chief Engineer, Pegu.  
 E. O'Riley, Esq., Magistrate, Rangoon.  
 Captain Horace Browne, Assistant Commissioner, Pegu.  
 Baboo Degumber Mitter, Zemindar.  
 Reverend K. M. Banerjee for re-election.  
 R. T. H. Griffith, Esq., Benares.

The following gentlemen were named for ballot at the next meeting :

F. Cooper, Esq., C. S., proposed by the President, and seconded by the Secretary.

Moulavee Abdool Luteef Khan Bahadur, Deputy Magistrate and Deputy Collector, 24-Pergunnahs.

Babu Gooroo Churn Doss, Deputy Magistrate, Jessore, proposed by Babu Rajendrolal Mittra and seconded by Mr. Cowell.

D. H. Macfarlane, Esq., Calcutta, proposed by H. Woodrow, Esq., and seconded by C. G. Wray, Esq.

A note from Dr. F. Mouat announcing his intention to withdraw from the Society was recorded.

The following report was read from the Council on a recommendation from the Philological Committee :—

#### *Report.*

The Council recommend to the Society the acceptance of Mr. F. E. Hall's offer to edit the *Dasa Rupaka* (text and commentary) in the *Bib. Indica*. This work is the oldest authority for the dramatic system of the Hindus, and is also of great interest from the numerous quotations which are found in it. Mr. Hall has a very old MS. which will serve as the basis of his text. The work will occupy about

two fasciculi, and Mr. Hall will add a translation of the text and an introduction.

The recommendation was adopted by the Meeting.

A communication was received from Babu Radha Nauth Sickedar, being an abstract of Meteorological observations taken at the Surveyor General's office for the month of April last.

Mr. H. F. Blanford read a paper on the subject of Dr. Bronn's work on the laws of development of organised beings.

Mr. Blanford stated that the work, a brief notice of which he proposed bringing before the Society, was written by Dr. Bronn in 1855, in answer to a series of prize questions proposed by the French Academy of Sciences in 1853-4. Dr. Bronn's work was adjudged as successful and crowned by the Academy in 1857 and the work itself published shortly after. Its object was to ascertain the laws of the development of organised beings in time, a question which the recent publication of Mr. Darwin's work had rendered one of general interest, and the work possessed this great merit as evidence in the discussion provoked by Mr. Darwin, that having appeared long before the publication of Mr. Darwin's views, it was unbiassed in its conclusions by any controversial spirit.

The objects of Dr. Bronn's work differed in so far from those of Mr. Darwin's, that the former sought simply to determine the formal laws expressing the nature of the sequence of organisms in time and the relation of that sequence to the parallel sequence of geologic changes, while the latter endeavoured to solve the higher problem of which these formal laws are merely consequences, *viz.* the *modus operandi* of the cause to which the succession of varying organisms in past times is due. Dr. Bronn's objects bear the same relation to Mr. Darwin's as those of Kepler and Copernicus, the discoverers of the laws of the Heliocentric Planetary System did to Newton's, the discoverer of gravitation.

Of the two parts into which Dr. Bronn's Essay was divided, *viz.* the exposition of the laws of development; and the proving of these laws by the comparison and analysis of tabular evidence, only the first could be noticed in the brief space of a single lecture. Mr. Blanford's object was simply to bring to the notice of the Society, the general results at which Dr. Bronn had arrived, and would refer

those who might wish to enter in detail into the question, and satisfy themselves of the soundness or unsoundness of Dr. Bronn's views, to the original work, which had been published in German, French and English, the latter translation by the Ray Society of London.

The two fundamental laws laid down by Dr. Bronn as having regulated the sequence of organisms from the earliest period to the present time were :

1. That there had been the operation of an independent producing power or force (*Kraft*) progressive in intensity and in its sphere of operation.

2. That the results of this power or force had been limited by, and dependant upon, the nature and changes of the external conditions of existence, such as climate, habitat, food, &c.

With respect to the first law, a clear idea of the meaning of progression could only be gathered from a consideration of the whole range of organized beings, and the evolution of general propositions concerning form, organization, and habits of life. In this way, it was shewn that the criteria of higher types as compared with lower were :—

*Higher.**Lower.*

Bilateral symmetry of form.

Quadrilateral or circular symmetry of form.

Few homologous parts.

Numerous homologous parts.

Organs various, specialized to discharge one or few functions, concentrated, and enclosed.

Organs few, fitted to perform various functions, dispersed, and superficial.

Habits terrestrial.

Habits aquatic.

Breathing air.

Breathing water.

Food, (in the case of animals) vegetable.

Food, (in the case of animals) animal.

With respect to the second law, the conditions of existence might be considered under two heads, viz. as :—*inorganic*, which bore reference to terrestrial phenomena, such as temperature, climatal zones, the composition of the atmosphere, and the distribution of land and sea ; and *organic*, which included the supply of food, a consideration which had been developed to an extent unanticipated by

Dr. Bronn in Mr. Darwin's well known chapter on the "Struggle for Existence."

The hypothesis to which we had to apply these conditions was, that of an originally fluid globe, cooling by radiation, until a solid crust had formed, upon which the greater part of the water had condensed in the form of seas, while the atmosphere contained a larger proportion of aqueous vapour and carbonic acid than at present.

The excess of carbonic acid was subsequently fixed in the form of limestone, and eliminated, especially during the coal period, by the luxuriant vegetation which abstracted the carbon stored up in the coal formed of its remains. The carbonic acid since converted into coal and limestone had been calculated by Brogniart and Bischof to amount to 6 per cent. of the entire atmosphere, or one hundred times its actual proportion; and although it is probable that it never reached this amount, and that much of it was evolved from the interior of the earth through volcanic vents, contemporaneously with its absorption by the vegetation of the epoch, still, it had been proved by the experiments of Daubeng and Regnault, that a proportion of 5 per cent. of carbonic acid was by no means injurious to ferns, and that provided sufficient oxygen were present, animals could live without apparent inconvenience in an atmosphere containing half its volume of the former gas. The surface of the earth being then in such a condition as to support animal and vegetable life, we might expect, according to Dr. Bronn, the following series of phenomena, which, ranged in parallel columns exhibit the historic interdependence of the organic and inorganic kingdoms.

- |                                                                                                                                |                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <p>1. The simultaneous appearance of plants and animals, to sustain a proper relation in the components of the atmosphere,</p> | <p>1. When by condensation and chemical absorption the atmosphere became fitted to support life.</p> |
| <p>2. An universal and continuous change in the fauna and flora of the earth,</p>                                              | <p>2. As the temperature universally and continuously diminished.</p>                                |
| <p><i>a.</i> The primary fauna and flora were universal and tropical,</p>                                                      | <p><i>a.</i> The temperature of the earth's surface was likewise uniform and tropical, until,</p>    |

b. becoming subsequently diversified according to climate.

3. New forms of life could not have arisen from those preceding them, but were provided for by a new creation. (Schöpfung). The assumption of specific and generic centres, is therefore unnecessary and improbable.

4. As the older forms disappeared, in consequence of the cooling of the earth and the formation of continental areas, they were continuously replaced by new forms with but a slight variation in the intensity of the producing force.

5. The general character of the first fauna and flora was entirely different from that of the present day, the passage being, however, gradual throughout.

6. Organisms became more varied and respectively adapted to more diversified conditions of life.

7. The appearance of most plants and animals was conditional on the previous fulfilment of the conditions necessary for their existence, as regard nourishment, habitat, &c.

8. The absolute number of species, genera, and families increased with the differentiation of

b. the internal heat being diminished by radiation, the climate became differentiated in different zones.

3. The new stations formed were not always in connexion with those previously populated.

4. The cooling of the earth's surface and the extension of continental land areas proceeded gradually and equably.

5. The physical condition of the earth's surface was likewise originally very different from that of the present day, and the passage gradual.

6. In consequence of the above change, stations became more numerous and varied.

7. The Earth, having become peopled with such plants and animals as depended solely on each other and on the purely terrestrial conditions, was, by their existence, rendered habitable for succeeding races.

8. The differentiation of the requisite external conditions proceeded continuously, but espe-

external conditions.

9. The tendency of all successive changes may be termed terripetal. The first population of the globe was almost exclusively pelagic. Land animals succeeded, and increased most rapidly both in numbers and in perfection of organization.

10. The higher and more perfect plants and animals are, so are the conditions requisite for their existence more complicated and numerous. The more perfect animals could not exist without the less perfect. And thus a necessary consequence of the progressive development of the earth's surface, was a gradual higher development of the organic world as a whole, as well as of its subordinate divisions, and while the organic world tended more and more to the formation of the existing higher types, the latter tended to increase in a more rapid ratio than the less perfect. Meanwhile many of the less perfect either simply disappeared or were replaced by more perfect compensating forms.

11. There are also some special cases in which the progression of the organic world towards a higher degree of development,

cially characterized the close of the carboniferous epoch and the commencement of tertiary times.

9. Simultaneous and parallel with these changes was the diminution and sub-division of watery areas and the formation of continental, as distinguished from insular divisions of the land area.

10. The external conditions of existence became more varied and fitted for the existence of higher organisms.

either generally and systematically, or specially from embryonic types, appears to have progressed, independently of any apparent external causes, and in accordance with the operation of some independent internal law, except in so far as there is a necessary reciprocal relation between the laws of development of the organic and inorganic world, which could only be definitely expressed if we knew the nature of the power or force which gives rise to new organisms.

In commenting on the above, Mr. Blanford remarked that although the hypothesis of a cooling globe and an universal equable temperature in early geologic times had been rejected by Sir Charles Lyell and some other eminent authorities, there were many important facts, such as the existence of a coal flora within the Arctic regions in a great measure identical with that of the temperate zone, and the wide distribution of generic and specific types in Palæozoic times, which gave much probability to the hypothesis upon which Dr. Bronn's theoretical conclusions were based.

These views were stated necessarily at much disadvantage before the Society, as time would not permit of even an abstract of Dr. Bronn's proofs of the laws above enunciated, by a review of the geologic record, which could be the only test of their truth or falsity. With respect to the third of Dr. Bronn's secondary laws, viz. that new stations were frequently isolated, and consequently that their faunas and floras were necessarily of independent origin, it appeared to Mr. Blanford that both the fact and inference were pure assumption, and neither proved by the author in the subsequent part of his work, nor indeed very capable of historic proof. Many of the now isolated stations, such as the islands of Polynesia, had been shewn to be very probably mere remnants of former widely extended stations; (in the case cited, by Dr. Hooker on botanic

grounds and by Mr. Darwin on geological grounds;) and even were it granted, as it might be theoretically, that such isolated stations may occasionally have been formed, until we can ascertain the period at which they were first populated, and can assert that no possible accidental transport of eggs, seeds, &c. would account for that population, the inference drawn by Dr. Bronn would be by no means legitimate.

In some other points, it appeared that Dr. Bronn had laid too much stress upon negative evidence as e. g. in the ninth of the secondary laws, but as this had no important bearing on the principal object of the paper, viz. a comparison of Dr. Bronn's laws with Mr. Darwin's theory of natural selection, it need not be further alluded to.

Setting aside the assumption of independent faunas and floras, as unproved in any case and at variance with the tendency of our present knowledge, the laws evolved by Dr. Bronn were stated to be in close accordance with the requirements of Mr. Darwin's theory. With respect to the formal portion of Dr. Bronn's first fundamental law, (i. e. the fact of progression, apart from any hypothesis of a force,) very little had been said by Mr. Darwin; his only reference to it being to the following effect, viz. :—the higher forms have their organs more distinctly specialized for different functions; and as such division of physiological labour seems to be an advantage to each being, natural selection will tend in so far to make the later and more modified forms higher than their early progenitors, or than the slightly modified descendants of such progenitors.\* This view appeared to be identical with that taken by Dr. Bronn in the majority of cases, as enunciated in Nos. 7, 8, 9 and 10 of his secondary laws. In No. 11, indeed something more is indicated, viz. a progression of type, independent, or apparently independent of external conditions, and referred somewhat vaguely to an unknown force; but this was scarcely necessary, and the phenomenon of progression according to embryonic types, the progression from general to specialized forms, which had been admitted by Agassiz, Owen, Carpenter and others, as having obtained in past times, was perfectly and most simply explained by Mr. Darwin's theory.

\* *Origin of species*, p. 336.

Dr. Bronn's second fundamental law, the correlation of the development of organized beings, with that of the external conditions of life, and the multiplication of varieties and species as these conditions became more varied, formed one of the fundamental requirements of Mr. Darwin's theory.

The chief point on which the two authors were at issue, was that of the origin of new forms. On this subject, Dr. Bronn did not enunciate any theory, and in the expression of his formal laws, referred vaguely to an undefined force. He denied, however, the possibility of their origin by descent, with variation, from pre-existing forms, as well as their origin by spontaneous generation from inorganic matter, and regarded that by immediate act of creation repeated for every new species, as inconsistent with the tenor of our knowledge of all natural operations. It was difficult therefore to understand how and upon what, the hypothetical force could be supposed to act, nor was this anywhere suggested in the essay. The objection by anticipation to Mr. Darwin's views, rested as it appeared, solely on the assumption of isolated stations before alluded to, and if this be rejected as unsound, there appeared nothing in Dr. Bronn's laws at all irreconcilable with Mr. Darwin's theory. For the rest Mr. Darwin had suggested a *vera causa* and it remained for the naturalist and geologist to say how far it was sufficient to account for the facts.

Some discussion arose after the lecture was concluded.

Dr. Kay remarked, that the way in which the subject had been treated, appeared to him calculated to produce serious confusion of thought. There had been a perpetual vibrating between two entirely distinct inquiries; the search into *forms* and the search into *causes*. A great deal of fallacious reasoning was owing to the neglect of this distinction. Morphology was a deeply interesting study; but it gave absolutely no information about the causes of the differential characteristics observed in analogous species of plants and animals at successive epochs. In examining such species it was natural to use such words, as *advance*, *progression*, &c.; but these terms simply mean that the species of a later era are found to differ in certain ways from those of an earlier era. The morphological progression proves nothing as to the existence of an ætiological connexion between the

successive stages. It is simply a historical fact that there is an advance in the observed forms. But to state a fact is not to account for it, and Molière's physician added nothing to science when he averred that medicine cured because it possessed a *vis medicatrix*. All present were aware that theories such as Dr. Bronn's or Dr. Darwin's had a far wider and deeper interest than they would have simply as scientific speculations, because they touched on questions relating to man's spiritual nature. That nature enabled man to look upward to the eternal, and downward to the endless variety of cosmical phenomena. Would any similarities of structure between man and other contemporary or palæozoic species bridge over the chasm placed between him and them by the possession of that spiritual nature? If it be said that the power of ulterior development had existed from the date of the primal monad,—this would only increase a billion-fold any difficulties that may be supposed to lie in the received theories of creation;—for, whence came this monad? It must have been created. And what a marvellous creature! to hold shut up within it the numberless forms of all the species that have arisen in the world through countless ages, along with all the laws of their successive development, each one involving such marvellous adaptations to all other portions of the Kosmos!

He would add an expression of his hearty concurrence with two remarks made by the lecturer:—*viz.* where he spoke of the rashness with which his author theorized on the early geological periods; and where he stated his belief that Dr. Bronn's assumption of a mysterious "Kraft" or power was neither legitimate nor very intelligible.

Mr. Blyth rose, as the friend of Mr. Darwin of more than a quarter of a century standing, to advocate his theory. He expatiated upon the vastness of geological periods, as amply sufficient for bringing about the present order of things in the organic kingdoms, by the operation of Mr. Darwin's principle of Natural Selection. The immensity of the lapses of past time he illustrated by comparing them with the profundities of space, and by the computed distances of sundry astronomical objects. He also argued a far higher antiquity than is generally supposed for the existence of the human being upon this planet, as testified by the discoveries of Dr. Lund in certain low caverns in Brazil, more than twenty years ago, and abundantly by

recent discoveries in various regions : more especially he referred to certain tumuli in Scania, where flint arrow-heads or spear-heads were found together with the bones of extinct mammalia, and associated also with human remains, the skulls of which indicated them to belong to the hyperborean type of mankind, being similar to those of modern Esquimaux ; an important fact, which tended, as he thought, to connect the epoch of those remains with the glacial era of Agassiz, or at least with the time when the Rein Deer and the Musk Ox roamed over what is now Britain. But he maintained that however ancient may be the remains of this hyperborean race in modern Scania, perhaps one of the present American types of humanity in the New World, still, for various reasons adduced, we must look to the tropical regions of the major continent for the aboriginal habitat of the human being ; countries of which the palæontology is almost utterly unknown. Mr. Blyth then adverted to the incompleteness of the geological record as insisted upon by Mr. Darwin ; and touched upon some other points, which the lateness of the hour prevented his dwelling upon.

Mr. Blanford briefly replied to remarks which fell from Dr. Kay, that he had not professed to enter upon the subject of causation at all ; but only upon the study of forms as indicating the direction which causation had taken.

The interesting discussion was closed by the Chairman, stating that the thanks of the meeting were due to Mr. Blanford for laying before them the views of Dr. Bronn. He observed that a comparison had been made by Mr. Blanford between the progress of this new or newly-revived theory of the mutability of species and the establishment of the theory of universal gravitation. But he would remark that in the establishment of the theory of gravitation there had been two grand stages, the second of which was far longer and more laborious than the first. The first was the conception of the law, the second was its verification. In the second, as well as the first Newton did a vast deal himself, but it had been the work of the last 200 years to complete the demonstration, so long as nearly 100 years after Newton the celebrated Clairant had been staggered by an error in the moon's motion, which at first he could not explain on Newton's theory, and went so far as to suggest that the law varied partly as the inverse square and partly as the inverse fourth power of the dis-

tance. So lately as the time of Laplace similar difficulties had presented themselves, which his sagacity alone had removed. But now such perfection had been attained that as the instruments of observation and the method of calculation are from time to time improved, the smallest variations detected in the motions of the heavenly bodies are explained, and the theory of gravitation, as applicable to the minutest particles of matter, fully established. He added that in this new theory of the mutability of species Mr. Darwin seems to have taken the first step in striking out a bold generalization. But the more laborious and lengthy process of testing his law has yet to be gone through, and when completed as satisfactorily as that of gravitation, he (the Chairman) for one would believe in it as a law of nature.

With reference to remarks which fell from Mr. Blyth regarding the incompleteness of the geological evidence, he recommended to his notice two papers in *Fraser's Magazine* for June and July, by Mr. William Hopkins of Cambridge, well known as a first rate mathematician and geologist. He thought these papers were among the most thoughtful and convincing replies to Mr. Darwin's whole theory that he had read.

A vote of thanks was then passed to Mr. Blanford for his lecture.

The Librarian submitted his usual monthly Report for October last.

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LIBRARY.

The following books have been added to the Library since November last.

*Presented.*

Journal of the American Oriental Society, Vol. VI. No. 2.—BY THE ORIENTAL SOCIETY.

Burges's Trans. of Surya Siddhanta.—BY THE AUTHOR.

Report on the Survey operations in the Lower Provinces, for 1858-59.—BY THE AUTHOR.

Oriental Christian Spectator for September and October 1860.—BY THE EDITOR.

Journal of the Statistical Society of London, Vol. XXIII. Part III.—BY THE SOCIETY.

Proceedings of the Zoological Society of London, Pt. II. of 1860.—BY THE SOCIETY.

Ditto, of Royal Society of London, Vol. X. No. 39.—BY THE SOCIETY.

De Sacy's Arabic Grammar, Vol. I. Pt. II.—BY THE AUTHOR.

Willmet's Lexicon Linguæ Arabicæ Niebuhr's Voyage en Arabie, Vol. I. Pt. II.—BY A. SCONCE, ESQ.

Ditto, descriptions del' Arabic Schultens Harriri, Vol. I. Pt. II.—BY THE

Williams F. F. Guide to Indian Photography.—Report on the Teneriffe. astronomical experiment of 1856 addressed to the Lord Commissioner of the Admiralty, London.—BY THE LORDS COMMISSIONERS.

Monthly notices of Royal Astronomical Society of London, Vol. X. Part III.—BY THE SOCIETY.

The Life of Rajah Radhakanta Deva Bahadur.—BY THE EDITORS.

Sabda Kalpadruma in series, No. 1.—BY THE EDITORS.

Report on the result of the Administration of the Salt Dept, 1858-59, Bengal Govt.—BY THE BENGAL GOVT.

Oriental Baptist for November 1860.—BY THE EDITOR.

Calcutta Christian Observer for Nov. 1860.—BY THE EDITORS.

Trans. of the Bombay Geographical Society, Vol. XV.—BY THE SOCIETY.

Bengali Translation of Mahabharata, Pt. II.—BY THE EDITOR.

Selections from the Records of Government of India For. Dept. No. 28, BY THE GOVERNMENT.

Memoirs of Royal Astronomical Society, Vol. XXVII.—BY THE SOCIETY.

*Exchanged.*

Zeitschrift der Deutschen Morgenländischen Gesellschaft, Pt. VIII.

Athenæum, for August, 1860.

London and Edinburgh Philosophical Magazine, No. 132, for September, 1860.

*Purchased.*

The Literary Gazette, Nos. 112 to 115.

Comptes Rendus, Nos. 6 to 9 Tome 51.

Revue des Deux Mondes, Tome XXX. for 15th August and 1st September, 1860.

Annales des Sciences Naturelles, Tome XII. No. 56, 1860.

Journal des Savants for July and August, 1860.

Revue de Zoologie, Nos. 7 and 8, 1860.

The Annals and Magazine of Natural History, Vol. VI. No. 33.

Flugels die classen der Hanefitischen Rechtsgelehrten.

Foucause Buddhar.

- Capt. Raverty's Gulshan-rah—Afghan Poetry and Prose.  
 Ditto. Dictionary of the Pushto or Afghan language.  
 Ditto. Grammar, Ditto. Ditto.

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FOR DECEMBER, 1860.

At a meeting of the Society held on the 5th Instant—

A Grote, Esq., President, in the chair.

Presentations were received—

1st. From Major Hollings, a baked clay fac-simile of Sanscrit inscription on a stone pillar in the Behar Fort.

2nd. From the Bombay Geographical Society, the 25th Vol. of their Transactions.

3rd. From Mr. W. S. Seton-Karr, Secretary to the Government of Bengal, forwarding, on behalf of the India House, certain copies of the Memoirs and Reports of the Royal Astronomical Society.

4th. From the Academy of Natural Sciences at Philadelphia, a copy of the proceedings of the Academy for 1860.

The Secretary announced the publication of the Shell catalogue, a copy of which was laid on the table, price fixed at 3 Rs. a copy.

The following gentlemen who were proposed at the last meeting were balloted for and elected ordinary members.

F. Cooper, Esq. C. S.

Moulavie Abdool Luteef Khan Bahadur, Deputy Magistrate and Deputy Collector, 24-Pergunnahs.

Baboo Gooroo Churn Doss, Deputy Magistrate, Jessore.

D. H. Macfarlane, Esq., Calcutta.

The following gentlemen were named for ballot at the next meeting.

J. C. Erskine, Esq. proposed by Sir Bartle Frere and seconded by Captain W. N. Lees.

Lewis Jackson, Esq. C. S. proposed by Mr. Atkinson and seconded by Mr. Cowell.

William Thompson Dodsworth, Esq., Surveyor, Ganges Canal, Dehra Dhoon, proposed by Colonel Waugh and seconded by Major Thuillier,

Notes from the following gentlemen intimating their wish to withdraw from the Society were recorded.

Messrs. A. K. Dyer, H. V. Bayley and F. A. Goodenough.

Communications were received—

1. From Major H. L. Thuillier, forwarding copy of a letter as follows from Colonel Waugh, Surveyor General of India, containing further information relative to the fate of the late lamented Mons. A. Schlagintweit.

Surveyor General's Field Office,

Dehra, 13th November, 1860.

FROM LIEUT.-COL. A. S. WAUGH,

*Surveyor General of India.*

TO MAJOR H. L. THUILLIER,

*Deputy Surveyor General of India,*

*Calcutta.*

SIR,—Adverting to correspondence marginally cited,\* I have the

\* No. 940, dated 19th July, 1859, from Secy. to the Govt. of India, Mily. Dept. to my address.

My reply to the above No. 42.409 of 29th July, 1859.

Also my letter in continuation No. 62.576 of 28th Sept. 1859.

honor to transmit herewith a letter in original No. 380.901 of 3rd instant, with enclosures, just received from Captain T. G. Montgomerie, Engineers, 1st assistant G. T. Survey, in charge of the Kashmir series, conveying infor-

mation which he has recently obtained relative to the fate of the lamented Mr. Adolphe Schlagintweit.

I beg you will be good enough to forward these papers for submission to Government, and also take such steps as may be necessary to make their contents known to the Asiatic Society, which has already recorded such particulars as have been hitherto gathered on the subject.

OFFICE OF THE KASHMIR SERIES,

Camp Kartarpore, 3rd November, 1860.

TO THE SURVEYOR GENERAL OF INDIA.

SIR,—With reference to my letter No. 500 of 23rd August, 1859,

\* In original.

I have the honor to enclose a Persian document\* concerning the fate of Mr.

A. Schlagintweit.

This document is apparently written by one Mahomed Ameen of Yarkand, who was in Mr. S.'s service at the time of his murder. He

mentions having sent two letters round to the West by Peshawar and says that he has received no answer. Col. Edwardes received one of the letters and it is printed in the collection of Official Reports circulated by the Messrs. Schlagintweit. Vide No. 10 in the list.

A small leather bag accompanied the letter; the bag contained four very thin old copper coins and an instrument for cutting leather, with an awl, the two latter I understand to be of the kind used by Bhistees.

The letter does not throw any new light on Mr. Schlagintweit's fate and does not entirely agree with the letter sent to Col. Edwardes but, being of a later date, it may be interesting. The writer says he has not managed to secure either the boxes or the property of the unfortunate Mr. S.

I enclose the statement made before Mr. Civil Assistant W. H. Johnson by Kunj Khan of Yarkand, the bearer of Mahomed Ameen's letter, who says he was taken into Mr. S.'s service the day before he was imprisoned and declares he was present when Mr. S. was murdered. This man states that Mr. Schlagintweit's property is in the possession of Shaidarwag of Badakshan and that it includes a large folio of drawings and other papers. Kunj Khan thinks that the property might be recovered.

I did not myself see Kunj Khan and have not the means of forming an opinion as to his veracity or as to the feasibility of the plan he proposes. The man was given a present and told that a suitable reward would be given for any drawings, papers, or other property recovered. The folio is no doubt the most valuable. Just before leaving the Hills, I heard that Lieutenant-Colonel Irby of H. M.'s 51st foot had met another man from Yarkand with Mr. Schlagintweit's skull. As to the truth of this I have not as yet heard. The hopes of reward are no doubt, likely to produce a good number of impostors. During the hot weather I heard that Mr. S.'s bones had been carried into Kuta.

I propose forwarding the bag with copper coins, &c., to the care of Major H. L. Thuillier. I will of course avail myself of every opportunity that there may be to get further information on the subject. Should any be forthcoming I shall again address you.

(Sd.) T. G. MONTGOMERIE, *Capt. Engrs.*

*First Asst. G. T. Survey of India.*

## STATEMENT OF KHUNJ KHAN OF YARKAND.

Mr. Schlagintweit left Leh with seven servants, viz., Mahomed Ameen, Yarkandi, Abdul, Kashmiri Kitmadgar, Moorad Jood, Caubuli, (who remained at Yarkand and is still there) Hoshir and Ali from Skeardo, and Tashi and Bhots of Shashot village. Mr. S. first visited Yarkand and afterwards Kashkar; on his arrival at the latter place he found the Kokanies at war with the Kashkar people. The Kokan troops were commanded by Wali khan. Mr. S. sent Mahomed Ameen to Wali khan to obtain permission to go to Kokan; Wali khan replied that if Mr. S. would take Kashkar and the Chinese fort first he would allow Mr. S. to go to Kokan. Mr. S. told him he could not take Kashkar without troops and guns, this made Wali khan vexed, upon which Mr. S. and all his servants were imprisoned by Wali khan, who took all Mr. S.'s property. The day after their imprisonment Mr. S. the two Baltis and two Bhots were murdered by Wali khan. The other two servants, Mahomed Ameen and Abdul were to have suffered the same fate, only the approach of a Chinese Army made the Kokanies retreat. Mahomed Ameen and Abdul went afterwards to Kokan and complained to the Rajah Kodayar, who was very angry with Wali khan and intended to have sent him a prisoner to Lahore to meet his punishment, but at this time Mali khan assisted by Wali khan raised an insurrection and expelled the former ruler Kodayar. When Kodayar intended seizing Wali khan the latter gave charge of all Mr. S.'s property to Shaidarwag of Badakshan; after Kodayar went away to Bokhara, Wali khan went to recover the property but did not; subsequently Mali khan, the new ruler of Kokan, went with an army of 20,000 troops but was defeated by Shaidarwag, with whom Mr. S.'s property is to this day. The property has not been removed from the place where it was first put, and may be obtained by sending a sharp man to Shaidarwag with presents, &c. A man in Leh, by name Tulsiram, is willing to try and get the property if he is assisted.

The two servants Mahomed Ameen and Abdul were well treated by Kodayar, but not so by Mali khan, upon which Abbul left for Peshawar 14 months ago, viâ the Samarkand route. Mahomed Ameen remained in Kashkar.

With Mr. S.'s property there are a great number of drawings and other papers in a large folio which Khunj Khan saw Mr. S. open.

Mahomed Ameen, is an old man, being hardly able to work ; he says if he got some money he could purchase a horse and come down to Lahore if wanted.

Note by Mr. Johnson.—The above was taken down as given by Kunj Khan, who was present when Mr. S. was murdered, and it is in some measure confirmed by a letter which has been sent by Tulsiram's brother from Yarkand.

I hear that the Moonshi who was sent from Simla or Kooloo never went beyond Leh and therefore got no correct information.

(Signed) W. H. JOHNSON,  
Civil Assistant G. T. Survey.

*Camp Leh in Ladak, 11th September, 1860.*

عرضداشت کمینہ جاگر جان نثار محمد امین بای کاروان باشی یار کندی به خدمت صاحبان غریب پرور عدالت کسٹر دولت بهیہ انکلیسیہ انکہ احوال پیرہ غلام در تاریخ غره و بیع الاخر در ولایت کاشغر بموجب صبر است و چشم امید این پیرہ غلام ہمیشہ در راه است کہ بلکہ ازان جانب خبری یا کہ خط کہ باعث بر خوشوقتی باشد برسد ہیچ معلوم نشد تاکہ درین ایام یکی از چاکران کہ از سابق پرورش یافته دست خود این پیرہ غلام بودہ و بسخن و مطلب این جان نثار محرم است گویا مثل فرزند خود دانستہ روانہ خدمت کردہ فرستادم کہ بعد از بار یافت حضور صاحبان نامبرده را بہ اندک زمانی مرخص نمودہ معہ آنچه فرمایشات نہ ازان جانب حکم شود خط کردہ بدست نامبرده فرستادہ انشاء اللہ آنچه کہ از دست این پیرہ غلام براید در طریقہ جان نزاری کوتاهی نخواهد شد دیگر معروض غلام انکہ از گذارشات گذشتہ تا حال بست و دو خط ازین طرف بہ پایہ سریر دولت معروض داشتہ فرستادہ ام یکی را بجواب سرفراز نشدم ندانم کہ ان صاحبان صاحب داعیہ را چه در خاطر کہ ہیچ در جواب عریضجات غلام و باز یافتی از احوال صاحب مقتول نہ پرداختہ چشم پوشی نمودند اگر غلام خارج طریقہ و آئین صاحبان میباشم و یا خدمت من منظور نشد انصاحب مقتول در وفاداری و خدمت کاری و خیرخواهی دولت و آبروی ہم کیشان ملت خود کہ صاحبان دولت باشند از سر و جان خود بہ نا امیددی گذشت ازان چرا چشم پوشیدند حقوق جان نزاریش ہمین بود خبر احوال باشد صاحبان صاحب اختیار اند بعد از اظهار

در د والم و مصیبت رسید کی این عاجزان معروض خدمت میشود که باز هم از احوال گذشته آنکه بعد از آنکه در کاشغر خراب آباد از بد بختی خود بی صاحب و صاحب اختیار شدیم مدت بیست و چهار روز را در زندان خواجه ظالم بودیم قطع حیات خود کردیم منتظر آنکه این ساعت یا ساعتی دیگر ما را هم مثل آقای ما خواهند کشت اینکه لشکر خطای رسیده و خواجه ظالم گریخته در آن فرصت هر کس به اعمال خود گرفتار این پیره غلام از زندان برآمده فرار سمت خوفند گذاشته بهزاران مشقت خود را تا ولایت خوفند رساندم مدت هشت ماه را در خوفند بودم و از آن جا عبدل نام که خوانساران صاحب مقتول بود آن را اسپ و خرچی داده خط کرده از راه کابل و سمت پیدشاور فرستادم و خود از بعضی احتیاط نه خدا یار خان حاکم خوفند گریخته برادرش ملا خان ولایت را در تصرف آورده بود از خوفند برآمده ولایت روش که مشهور به تخت سلیمان است بین راه خوفند و کاشغر در آن ولایت پناه گرفته مدت هشت ماه را هم در آن ولایت بسر بردم از هر سمت که اهل تجار روانه آن ولایت میشد خط کرده میفرستادم که باشد از جانب صاحبان به این بی صاحبان احوالی برسد تا اینکه خط مراد یهودی رسید که برخواستند خود را به کاشغر برسان که مطالبات نریب دست آمد سه چهار خط که فرستاده این پیره غلام برخواستند در کاشغر آمدیم که از آن مطالب ها هیچ در دست نیامده لا علاج مراد یهودی را برای انداخته فرستادم و خود به اتفاق میرزا عبد الوحد خان هراتی که نکلسین صاحب در پشاور آن را بدین امر حاق در قید کرده بود محرم همین عریضه باشد شب و روز جو یای احوال کتاب های صاحب واستخوان های آن مقتول میباشم شاید که لطف خداوند شامل شده از گم شده خود نشانی بیابیم و احوال مراد یهودی چنان معلوم شد که در یار کند مانده است دانسته پیره غلام هنوز نشد که چرا در یار کند مانده است این جا اسپ و اخرا جانش بهر طریق که بود تمام کرده بودم در امر سفرش نا تمامی نبود دیگر تا بعد از این حالی شون از سبب ماندن مراد کنجه خان را که حامل عریضه میباشد به پایه سر بر دولت سرفرازش نموده فرستادم امیدوارم که به زودیش مرخص فرمایند که تا برگشت کنجه خان این پیره غلام در کاشغر چشم امید در راه میباشم و منظور غلام آنکه بهر طریق فرمایش بشود غلام همچنان

بحان کوشیده بهمان طریق عمل نمایم و اگر فرمایش صاحبان در طلبیدن پیروه غلام باشد همراه دو پسر خود از راه خرپروه یا مر سر فرار حضور فراهم شد خوبی که در دل پیروه غلام میباشد از تبت است و دیگر از احوال پیروه غلام کنگه خان مخبر است که خانه معه اسباب خانه بقاراج رفت و کم بیدش که از هر جانب ترون کردیم ان را هم بر شوت و پاره بهر کس که رسید مضایقه نگردیم شاید که از گم شده کان خود نشانی بیابیم شب و روز به اتفاق مرزای مذکور که ذکرش در بین عریضه شد جو یای احوال مطالبات هستم تا خداوند چه لطف کند زبانی کنگه خان آنچه معروض دارد مخبر احوال است و دیگر احوالات که درین ولایت میباشد قبل بر این خبر معلوم شد لشکر آروس به بالای اور کنج آمده و در این روزها را باز احوال رسید که لشکر قلبلی آمده باز برگشت راه دور است تا معلوم شود و امیر دوست محمد خان کابلی لشکرش ولایت قندوز را گرفته در تصرف دارد تا بعد ازین چه کند گویا از گرفتن قندوز بدخشانی و گولابی و حصاری این هر سه ولایت اتفاق کرده خیال جنگ را دارد تا چه شود و از سمت آق مسجد هم لشکر آروس آمده است و تدارک بسیاری از غنّه و قورخانه آورده و می آورد و از سمت قزل هم جایی است که بسمت هشترخان هم می رود و بختن هم می رود بخوقند هم می رود از آن طرف هم لشکر آروس به تدارک تمامی آمده است قزاق و قرقز همه تابع شدند و ثانیاً معروض پیروه غلام آنکه کاروان تبت را هم درین روزها کنگونی زده غارت کرده است یک خط بدست سید افغانی از احوالات خود پیروه غلام و ثانیاً احوالات بهمان کاروان کوه فرستاده شد اگر سید افغانی در کاروان زدنی باشد خط نرسیده باشد و اگر بدیگر کاروان باشد انشا الله منظور خواهد شد باقی ایام دولت بردوام باد \*

2. From Dr. Carter, the concluding portion of his report on Geological specimens from the Persian Gulf collected by Captain C. G. Constable, the former portion of which was published in the first No. of the last year's vol. of the journal.

The Secretary read the above papers to the Meeting.

The thanks of the Meeting were voted to Dr. Carter for his interesting contribution.

The Librarian submitted his usual monthly report for November last.

*Report of Curator, Zoological Department, for April and May Meetings.*

The following presentations have now to be recorded.

1. From J. H. Gurney, Esq. M. P., Catton Hall, Norwich. A series of beautifully prepared skeletons already mounted, *viz.* :—

*Mammalia.*

European Fox (*VULPES VULGARIS*).

Polecat or Fomart (*MUSTELA PUTORIUS*).

Badger (*MELES TAXUS*).

Seal (*PHOCA VITULINA*).

Hedgehog (*ERINACEUS VULGARIS*).

Water Vole (*ARVICOLA AMPHIBIA*):

*Aves.*

Great Black-backed Gull (*LARUS MARINUS*).

Goosander (*MERGUS MERGANSER*).

Black-throated Loon (*COLYMBUS ARCTICUS*).

Puffin (*FRATERCULA ARCTICA*).

The whole of the above being new to the museum as perfect skeletons, though it possesses an incomplete skeleton of the Seal.

Also British examples of three species of birds (skins), for comparison with their Indian representatives; *viz.* the Quail, the common Snipe, and the European Little Grebe or Dabchick.

The large or common Indian Quail is considered as a particular race by Mr. Gould; while the late Mr. Yarrell, on comparing specimens of Quails from Europe, India, and S. Africa, expressed his opinion that they were identical. In the examples now compared, the only difference that I can perceive consists in the fact, that our Indian Quails were killed during the cold season, with more newly moulted plumage; while the British examples were as obviously killed during the summer, when their feathers had been longer worn.

The same remark applies to the Snipe.

With regard to the Little Grebes of the two regions, there seems to be more of white at the bases of the *remiges* in the Indian race (*P. PHILIPPENSIS*, Scopoli); but it may be doubted if this be constant, and a Chinese example is intermediate.

2. M. Zill, travelling naturalist. A fragment of the egg-shell of the huge extinct Dodo-like bird of Madagascar, *EPIORNIS MAXIMUS*, Is. Geoff.,—an egg beside which that of the Ostrich is comparatively diminutive, and which is stated to hold about two gallons.\*

3. Donor unknown. Skin of *LAGOMYS ROYLEI*, from Tibet.

4. Major G. G. Pearse, commanding 3rd Sikh Irregular Cavalry, Sigouli. Skin of *HÆMATORNIS CHEELA*, in semi-adult plumage.

5. Rájá Rádakhánta Deb, Bahádur. A large specimen of *TRYGON MARGINATUS*, Blyth; referred to in a note to p. 38 *antea*.

6. Capt. Jethro Fearweather, late commanding the ship 'Forfarshire.' Skull of *DELPHINUS EURYNOME*, Gray, from the Bay of Bengal. A very beautiful and perfect specimen.

7. Mrs. Edwards. A fish in spirit, from Port Blair, Andamáns. It is a *SERRANUS*, one of several species which are uniformly dotted over with small white spots; but it has not hitherto been identified satisfactorily. (D. 9/17—A. 3/8.)

8. Capt. E. Fowle, of Rangoon, through Capt. Niblett, commanding the 'Sydney' S. V. A small specimen of the curious crustacean, *THALASSINA SCORPIONOIDES*, Leach. Capt. Fowle writes—"The Burmese call it *Padzoon ken* (or 'Scorpion Prawn'). It does not live on the surface of the ground, but burrows to a depth of three or four feet. This specimen was found at that depth." It is occasionally though rarely brought to the Calcutta fish-bazars.

9. Bábu Gour Doss Bysack, Deputy Magistrate of Balasore. Skins of *CHILOSCYLLIUM PLAGIOSUM* and *TRYGON IMBRICATUS*.

10. Capt. Eales, of the 'Fire Queen,' S. V. A Dog-fish, 6 ft. long, from the Aguáda Reef, stated to be only found in shoal-water, and known to sailors as the 'Sun-fish.' It is evidently the *NEBRUS CONCOLOR*, Rüppell (*Ginglymostoma concolor*, Müller and Henle); but is stated by Capt. Eales to have been toothless! The skull has been completely removed from the specimen.

11. Mr. Blyth. A stuffed specimen of the rare *RUPICOLA SANGUINOLENTA*, Gould, *P. Z. S.*, 1859, p. 99. Inhabits Bogota.

\* Here it may be remarked that the two types of Ostrich-eggs, from N. and S. Africa respectively, noticed by myself in *J. A. S.* XXVIII, 241, 282, and XXIX., 113, have likewise been remarked by the Rev. H. B. Tristram in No. V of Mr. Selater's new Ornithological Journal *The Ibis*, p. 74.

I observe that the Chinese Pangolin is referred to *MANIS JAVANICA* by Mr. Arthur Adams, in the *P. Z. S.* for 1839, p. 133; and upon re-examination of the flat skin sent by Mr. Swinhoe, I find that Mr. Adams is right, and that I was incorrect in following the late Dr. Cantor (*Ann. Mag. N. H.* IX, 274), in assigning it to the Indian *M. PENTADACTYLA* in p. 93 *antea*.

With reference to my remark in *J. A. S.* XXIX, 493 (note), that I was unaware of the existence of any 'Susú (*PLATANISTA*) in the Burmese rivers, Lt.-Col. Blake, commanding at Schwe Gyen, writes word—"As regards the Porpoise, I have not been able to procure you one; but that they do exist in these rivers is certain. I have seen them tumbling over each other in the Irawádi, the Pegu river, and the Sitang, as high up as Sitang." The genus, however, remains to be ascertained, and the habit referred to of "tumbling over each other," is what I have never seen done by the Susú. Perhaps the following species is intended:—

A small cetal new to the Gangetic streams was brought to me on the 18th July, 1860.\* It proved to be an adult male of—

*NEOMERIS PHOCÆNOIDES*, Gray, founded on the *Delphinus phocænoides*, Dussumier, *MS.*, Cuvier, *R. A.* I, 291, and *D. et Delphinapterus melas*, Temminck, of the *Fauna Japonica* (should these prove to be identical, as suggested with much probability by Dr. J. E. Gray, *Br. Mus. Catal., Cetacea*, p. 80). It appears that a skull in the Paris Museum, marked *D. phocænoides*, was brought from Malabar by Dussumier in 1837; "teeth  $\frac{2}{19}$ ;" while the Japanese skull of *D. melas* in the Leyden Museum has "teeth  $\frac{1}{16}$ ," according to Dr. Gray. In the Calcutta individual the teeth are  $\frac{5}{7}$ — $\frac{6}{8}$ ; the foremost pair in the lower jaw being situate *underneath* the next, and *transversely*, meeting at the tips. The fresh animal had so much the appearance of a young *GLOBICEPHALUS* (except in having no dorsal fin), that seeing it under rather adverse circumstances, in a violent downpour of rain, I mistook it for such as I had obtained in the corresponding month of the preceding year; so, not requiring another young *GLOBICEPHALUS* for the Society's museum, and being

\* On reference to the date of this Report, it will be perceived that the above notice of the *NEOMERIS* is here interpolated, and rightly so, as I had the chance of noticing it on the present suitable occasion.

short of hands just then in the taxidermist's department, with two large animals in course of preparation, I made the specimen over to Dr. Crozier of the Calcutta Medical College. Under that gentleman's superintendence the entire skeleton has been prepared, which he has kindly made over to the museum of this Society; but, unfortunately, no external part of the animal has been preserved, though Dr. Crozier has made notes of its outward appearance and anatomy, from which he has kindly permitted me to extract the following. It indeed occurred to me that the specimen was of a more leaden black than I had observed in *GLOBICEPHALUS INDICUS*, with the throat and pectoral region conspicuously albescent.

Dr. Crozier notices it as "a Porpoise 5 ft. long, of a bluish-black or lead-colour over the whole body, a little lighter on the under surface, and a white tinge under the throat and around margin of lips; a round head, protruding more convex on tip of upper jaw; blow-hole on upper-part of head, between two rather small eyes; opening [of the mouth] transverse and concave anteriorly, on posterior margin a row of small teeth of equal size in each jaw; a pair of long pectoral fins or flippers; body rather flattened laterally, and along the back a slight groove or depression of skin, which rises to a ridge posteriorly, on which is scattered a double series of *squamæ* or ossicles recalling to mind those of a Shark. Tail-flukes 17 in. in diameter."

On dissection, the animal proved to be a fully adult male, with a general resemblance in structure to *PHOCÆNA VULGARIS*, and others of the great *DELPHINUS* series.\*

\* Dr. Crozier also dissected the young *GLOBICEPHALUS INDICUS* obtained by me last year from some fishermen, who caught it in one of the streams connected with the salt-water lake E. of Calcutta; its skeleton being now in our museum. He remarks of it—"A *GLOBICEPHALUS* 4 $\frac{3}{4}$  ft. long; with blow-hole single, on upper-part of head, transverse and concave anteriorly; no external ear or *meatus auditorius*; eyes very small, just behind and above the angle of the mouth; opening of eyelids oblong from before backwards; opening of mouth large, with a thick fleshy soft tongue; 7 or 8 teeth in each jaw, very small, just appearing above the gums, indicating that the animal had been born only a very short time. The whole of the body is of a dark bluish colour, and the skin covered over with very thin cuticle; there is a slight constriction between the head and the body; flippers a good deal elongated; a small dorsal fin about the hinder two-thirds of the length of the body; tail-flukes large and notched in the centre; in middle of body a longitudinal umbilical depression."

Judging from my own recollection, and also from the stuffed specimen, 9 ft. long, in the Society's museum, I should not state the eyes to be "very small," but of the usual size in the *Delphinidæ*. In the *Susú* (*PLATANISTA*) they are exceedingly minute. In the *GLOBICEPHALUS* of 9 ft., the milk-teeth are consi-

The following highly interesting communication, regarding the Great Rorqual of the Indian Seas, has been kindly communicated by the Hon. Sir H. Bartle Frere.

“The Indian Rorqual is very common still in the seas off the coast of Arabia and Mekran, Scind, Cutch, Kattywar; and the Rorqual fishery is still one of the many strings which a Yankee captain trading on those coasts is apt to have to his bow. During the calm weather from September to February these ‘Whales’ are very constantly seen by any vessel between Bhoj and Kurrachee; the captains of coasting steamers told me they saw them almost every voyage at that time of the year. I have myself seen them twice in the few trips I have made from Bombay to Scind, once very close,—and remarked the large dorsal fin. They are also not unfrequently seen from Manora (the entrance to Kurrachee Port) in a very calm afternoon in the autumn, their black bodies, and jets of breath being visible with a glass in the offing when there is a bright light on the water from the afternoon sun. I have notes of three ‘Whales’ having come ashore, two early in our tenure of Scind, and one while I was there. We found him out by the stench from his carcase, and on going to the spot (a few miles from Kurrachee) found him stranded and half devoured by the Hyænas, Jackals, and Sharks, many of which were tugging at portions of the carcase which floated. We collected most of the bones, and sent them to the Kurrachee museum, whence I will get a photograph of them, and if possible a few of the bones, which are frequently found on that coast. John Macleod, whom you may perhaps know by name as an amateur naturalist, calculated the length of the ‘Whale’ we found as about 65 or 70 ft.; but it was in fragments, and nothing to lead to identification but the bones.”—

derably eroded, and a few of them had been shed, but without the tips of any of the permanent teeth appearing. The number of milk-teeth shewing above the gum would seem to have been  $\frac{6-6}{11-11}$ . In the skeleton of the newly born young, there had been a series of at least 12 on each side above, and more below; but I can only give the former number as *in situ* *bus veris*. Teeth of adult  $\frac{7-7}{8-8}$ . In the newly born young, the atlas and axis vertebræ are already partially joined, the other cervical vertebræ being still separate: in the adult the series are ankylosed into one mass, the whole of these being united into a single obtuse peak above.

Doubtless the identical specimen mentioned as having been "stranded near Kurrachee" in *J. A. S.* XXIX, note to p. 482.

At the time that my memoir on the Great Rorqual of the Indian Ocean was published (Vol. XXVIII, 481 *et seq.*), I had not seen Dr. J. E. Gray's British Museum Catalogue of *Cetacea* published in 1850. In that work Dr. Gray arranges the *Balænidæ* into four genera, thus—

"*A. Dorsal fin none. Belly smooth. Baleen elongate, slender.*

1. BALÆNA.

*B. Dorsal fin distinct. Belly plaited. Baleen broad, short.*

2. MEGAPTERA. Pectoral fins elongate. Dorsal fin low.

3. BALÆNOPTERA. Pectoral fins moderate. Dorsal fin falcate,  $\frac{2}{3}$  from nose. Vertebræ 46 or 48.

4. PHYSALUS. Pectoral fins moderate. Dorsal fin falcate,  $\frac{3}{4}$  length from nose. Vertebræ 54 or 64."

Now, if my cited authority regarding the great Rorqual of the Indian Seas be fully trustworthy, the dorsal fin of this animal "is about one-third or a little more from the head and is well developed;" which I take to mean from the setting on of the head, rather than from the extremity of the muzzle; though even this would place it nearly about the middle of the animal, or considerably too forward for either of the two genera with "falcate fin" recognised by Dr. Gray. Referring to an experienced whaler, who is familiar with the animal, he also states that "the fin is near the middle of the back, if anything rather backward." Further observation is required; as also respecting the number of vertebræ composing the entire series, the amount of *anchylosis* of the cervical vertebræ (or of junction or union of those that form the neck), the position of the sexual organs with reference to the dorsal fin, and likewise the dimensions of a specimen correctly taken, with those of its dorsal fin, flippers, and tail-flukes, the position of the eye, &c. &c., and above all a carefully executed figure is exceedingly desirable.

It appears that Sperm Whales (*PHYSETER MACROCEPHALUS*?) are by no means uncommon off the coast of Ceylon, where, on the eastern side, my informant has seen a 'schule' of 30 or 40 within sight of land. They are also seen about Cochin, and thence across to Zanzibar, and especially about the Seychelles which is a noted

resort of the species. As a general rule, however, the Sperm Whale keeps to the open ocean, and is rarely observed in what seamen term 'narrow seas,' as the Bay of Bengal or Sea of Arabia even. My informant, who has been long engaged in the so-called 'fishery' for Sperm Whales, may be trusted as a safe authority for the species or genus.

Lastly, with reference to the remark of Nearchus (XXVIII, 481,) that the bones of Whales were, in his time, made use of for building purposes on the coast of Mekran, I may notice that they have also been thus used on the shores of the Polar Sea, at the N. E. extremity of Siberia. Thus Von Wrangell remarks that—"At many places along this coast we saw the bones of Whales stuck upright in the ground; our interpreter, and subsequently the Tschuktschi whom we met, said that they were the remains of the former dwellings of a stationary tribe. They appeared to have been of a better and more solid kind than are now used, and to have been partly sunk in the ground." And again—"There are traditions which relate that two centuries ago the Onkilon occupied the whole of the coast from Cape Schelagskoi to Behring's Straits; and it is true that there are everywhere along this tract the remains of huts constructed of earth and whale bones, and quite different from the present dwellings of the Tschuktschi." Von Wrangell's *Narrative of an Expedition to the Polar Sea* (*Sabine's translation*, 1840, pp. 360, 372.) E. BLYTH.\*

\* Referring to the recent use of flint implements, in p. 384 *antea*, I have since read the following passage concerning the American red man, quoted in the *London Athenæum* for Sept. 15th, 1860, No. 1716, p. 346. "They dig their ground with a flint, called in their language *tom-a-pea-kan*, and so put five or six grains into a hole the latter end of April or beginning of May," &c. &c. Quoted from a reprint of a *Two years' Journal in New York, and part of its Territories in America*, by Charles Wooley, or Wolley, A. M. (about A. D. 1678). Of course a research into the narratives of the old navigators will disinter many instances of the kind, by those who have the leisure for it, among nations unacquainted with the use of metals.

Two stupid *errata* have crept into my memoir on Indian *Cetacea*. One (p. 486 *antea*) is in the extract from the *Friend of India* newspaper. For "diameter" read *circumference*! The other relates to the longitude of the Sulu or Mindoro Sea (p. 484), which rectify as being from 118° to 122° meridians E. of Greenwich.





*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of January, 1860.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 2     | 29.932                                    | 30.005                                 | 29.878  | 0.127   | 64.8                       | 75.4                                     | 56.4 | 19.0  |
| 3     | .961                                      | .042                                   | .906    | .136    | 66.0                       | 76.4                                     | 59.0 | 17.4  |
| 4     | .981                                      | .052                                   | .935    | .117    | 64.2                       | 75.4                                     | 55.0 | 20.4  |
| 5     | 30.002                                    | .092                                   | .942    | .150    | 62.2                       | 72.1                                     | 54.8 | 17.3  |
| 6     | 29.960                                    | .036                                   | .900    | .136    | 61.8                       | 72.8                                     | 53.2 | 19.6  |
| 7     | .952                                      | .024                                   | .904    | .120    | 64.4                       | 77.8                                     | 54.4 | 23.4  |
| 8     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 9     | .994                                      | .067                                   | .947    | .120    | 67.9                       | 79.4                                     | 58.1 | 21.3  |
| 10    | 30.000                                    | .082                                   | .951    | .131    | 65.9                       | 75.4                                     | 57.4 | 18.0  |
| 11    | 29.999                                    | .078                                   | .949    | .129    | 62.8                       | 73.6                                     | 54.5 | 19.1  |
| 12    | 30.060                                    | .130                                   | .978    | .152    | 62.4                       | 74.0                                     | 52.7 | 21.3  |
| 13    | .109                                      | .203                                   | 30.048  | .155    | 63.1                       | 75.0                                     | 52.8 | 22.2  |
| 14    | .081                                      | .158                                   | .015    | .143    | 64.4                       | 76.1                                     | 56.0 | 20.1  |
| 15    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 16    | .051                                      | .153                                   | 29.993  | .160    | 64.4                       | 75.7                                     | 55.6 | 20.1  |
| 17    | .068                                      | .149                                   | 30.012  | .137    | 64.0                       | 74.9                                     | 56.0 | 18.9  |
| 18    | 29.996                                    | .083                                   | 29.925  | .158    | 64.6                       | 76.4                                     | 54.9 | 21.5  |
| 19    | .978                                      | .039                                   | .906    | .133    | 68.5                       | 81.4                                     | 57.5 | 23.9  |
| 20    | 30.040                                    | .109                                   | .989    | .120    | 69.2                       | 80.0                                     | 63.0 | 17.0  |
| 21    | .039                                      | .122                                   | .971    | .151    | 66.9                       | 78.2                                     | 57.4 | 20.8  |
| 22    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 23    | .010                                      | .086                                   | .954    | .132    | 69.3                       | 82.2                                     | 58.4 | 23.8  |
| 24    | 29.982                                    | .062                                   | .917    | .145    | 72.8                       | 83.2                                     | 66.8 | 16.4  |
| 25    | 30.030                                    | .102                                   | .979    | .123    | 71.3                       | 80.6                                     | 65.2 | 15.4  |
| 26    | .085                                      | .163                                   | 30.027  | .136    | 67.4                       | 76.6                                     | 59.4 | 17.2  |
| 27    | .047                                      | .123                                   | 29.974  | .149    | 66.1                       | 77.0                                     | 57.6 | 19.4  |
| 28    | .040                                      | .123                                   | .993    | .130    | 67.1                       | 79.2                                     | 57.2 | 22.0  |
| 29    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 30    | .039                                      | .139                                   | .979    | .160    | 70.5                       | 82.8                                     | 61.0 | 21.8  |
| 31    | 29.998                                    | .081                                   | .934    | .147    | 72.1                       | 84.4                                     | 62.8 | 21.6  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermo-<br>meter. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of Air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humidity,<br>complete saturation be-<br>ing unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                   |
| 1     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 2     | 59.6                            | 5.2                 | 56.5                | 8.3                          | .465                             | 5.18                                             | 1.65                                                                    | .76                                                               |
| 3     | 59.1                            | 6.9                 | 55.0                | 11.0                         | .442                             | 4.91                                             | 2.17                                                                    | .69                                                               |
| 4     | 57.5                            | 6.7                 | 52.8                | 11.4                         | .411                             | .58                                              | .11                                                                     | .69                                                               |
| 5     | 55.3                            | 6.9                 | 50.5                | 11.7                         | .380                             | .25                                              | .04                                                                     | .68                                                               |
| 6     | 56.0                            | 5.8                 | 51.9                | 9.9                          | .398                             | .46                                              | 1.75                                                                    | .72                                                               |
| 7     | 58.0                            | 6.4                 | 53.5                | 10.9                         | .421                             | .68                                              | 2.06                                                                    | .69                                                               |
| 8     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 9     | 61.5                            | 6.4                 | 57.7                | 10.2                         | .485                             | 5.35                                             | .16                                                                     | .71                                                               |
| 10    | 59.1                            | 6.8                 | 55.0                | 10.9                         | .442                             | 4.91                                             | .15                                                                     | .70                                                               |
| 11    | 56.3                            | 6.5                 | 51.7                | 11.1                         | .396                             | .42                                              | 1.99                                                                    | .69                                                               |
| 12    | 56.0                            | 6.4                 | 51.5                | 10.9                         | .393                             | .39                                              | .94                                                                     | .69                                                               |
| 13    | 56.7                            | 6.4                 | 52.2                | 10.9                         | .402                             | .49                                              | .98                                                                     | .69                                                               |
| 14    | 58.2                            | 6.2                 | 53.9                | 10.5                         | .426                             | .74                                              | 2.00                                                                    | .70                                                               |
| 15    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 16    | 59.1                            | 5.4                 | 55.2                | 9.2                          | .445                             | .96                                              | 1.78                                                                    | .74                                                               |
| 17    | 58.6                            | 5.4                 | 54.8                | 9.2                          | .440                             | .89                                              | .76                                                                     | .74                                                               |
| 18    | 58.9                            | 5.7                 | 55.5                | 9.1                          | .450                             | 5.01                                             | .77                                                                     | .74                                                               |
| 19    | 63.3                            | 5.2                 | 60.7                | 7.8                          | .536                             | .90                                              | .75                                                                     | .77                                                               |
| 20    | 63.3                            | 5.9                 | 60.3                | 8.9                          | .528                             | .82                                              | .99                                                                     | .75                                                               |
| 21    | 60.4                            | 6.5                 | 56.5                | 10.4                         | .465                             | .15                                              | 2.13                                                                    | .71                                                               |
| 22    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 23    | 63.3                            | 6.0                 | 60.3                | 9.0                          | .528                             | .82                                              | .01                                                                     | .74                                                               |
| 24    | 67.8                            | 5.0                 | 65.3                | 7.5                          | .623                             | 6.82                                             | 1.89                                                                    | .78                                                               |
| 25    | 64.9                            | 6.4                 | 61.7                | 9.6                          | .554                             | .07                                              | 2.26                                                                    | .73                                                               |
| 26    | 60.4                            | 7.0                 | 56.2                | 11.2                         | .461                             | 5.10                                             | .29                                                                     | .69                                                               |
| 27    | 59.7                            | 6.4                 | 55.9                | 10.2                         | .456                             | .06                                              | .04                                                                     | .71                                                               |
| 28    | 61.0                            | 6.2                 | 57.2                | 9.9                          | .476                             | .26                                              | .06                                                                     | .72                                                               |
| 29    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 30    | 64.7                            | 5.8                 | 61.8                | 8.7                          | .555                             | 6.10                                             | .03                                                                     | .75                                                               |
| 31    | 66.1                            | 6.0                 | 63.1                | 9.0                          | .580                             | .35                                              | .18                                                                     | .74                                                               |

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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer for<br>each hour during the<br>month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture for each hour<br>during the<br>month. |      |       |
|----------------|-------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|---------------------------------------------------------------------|------|-------|
|                |                                                 | Max.                                                         | Min.    | Diff.   |                               | Max.                                                                | Min. | Diff. |
|                | Inches.                                         | Inches.                                                      | Inches. | Inches. | o                             | o                                                                   | o    | o     |
| Mid-<br>night. | 30.017                                          | 30.114                                                       | 29.930  | .184    | 61.7                          | 68.4                                                                | 57.2 | 11.2  |
| 1              | .011                                            | .115                                                         | .928    | .187    | 61.0                          | 67.8                                                                | 56.4 | 11.4  |
| 2              | .004                                            | .108                                                         | .915    | .193    | 60.2                          | 67.2                                                                | 55.6 | 11.6  |
| 3              | 29.998                                          | .096                                                         | .911    | .185    | 59.7                          | 67.7                                                                | 55.0 | 12.7  |
| 4              | .993                                            | .095                                                         | .902    | .193    | 58.9                          | 68.2                                                                | 54.5 | 13.7  |
| 5              | 30.004                                          | .109                                                         | .915    | .194    | 58.6                          | 67.7                                                                | 53.7 | 14.0  |
| 6              | .016                                            | .125                                                         | .927    | .198    | 57.9                          | 67.0                                                                | 52.8 | 14.2  |
| 7              | .085                                            | .141                                                         | .947    | .194    | 57.7                          | 67.4                                                                | 52.7 | 14.7  |
| 8              | .062                                            | .151                                                         | .977    | .174    | 60.4                          | 68.4                                                                | 55.9 | 12.5  |
| 9              | .089                                            | .203                                                         | 30.004  | .199    | 64.1                          | 70.8                                                                | 59.0 | 11.8  |
| 10             | .096                                            | .199                                                         | .005    | .194    | 67.7                          | 73.2                                                                | 62.8 | 10.4  |
| 11             | .078                                            | .177                                                         | 29.982  | .195    | 71.1                          | 77.4                                                                | 66.2 | 11.2  |
| Noon.          | .048                                            | .136                                                         | .959    | .177    | 74.2                          | 79.6                                                                | 69.2 | 10.4  |
| 1              | .013                                            | .096                                                         | .924    | .172    | 76.2                          | 82.0                                                                | 71.2 | 10.8  |
| 2              | 29.985                                          | .071                                                         | .886    | .185    | 77.3                          | 83.8                                                                | 72.1 | 11.7  |
| 3              | .968                                            | .056                                                         | .881    | .175    | 77.4                          | 84.4                                                                | 71.8 | 12.6  |
| 4              | .962                                            | .048                                                         | .878    | .170    | 75.3                          | 82.6                                                                | 69.4 | 13.2  |
| 5              | .967                                            | .053                                                         | .882    | .171    | 73.3                          | 80.2                                                                | 68.0 | 12.2  |
| 6              | .976                                            | .064                                                         | .900    | .164    | 70.4                          | 78.6                                                                | 64.8 | 13.8  |
| 7              | .994                                            | .093                                                         | .907    | .186    | 68.0                          | 74.8                                                                | 62.7 | 12.1  |
| 8              | 30.010                                          | .111                                                         | .930    | .181    | 66.4                          | 73.4                                                                | 61.2 | 12.2  |
| 9              | .023                                            | .118                                                         | .941    | .177    | 65.3                          | 71.4                                                                | 60.0 | 11.4  |
| 10             | .027                                            | .130                                                         | .949    | .181    | 64.0                          | 70.6                                                                | 59.4 | 11.2  |
| 11             | .019                                            | .105                                                         | .947    | .158    | 63.3                          | 70.2                                                                | 58.6 | 11.6  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

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taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic Force<br>of Vapour. | Mean Weight of Va-<br>pour in a cubic<br>foot of Air. | Additional Weight of<br>Vapour required<br>for complete satu-<br>ration. | Mean degree of Hu-<br>midity, complete<br>saturation being<br>unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                                | T. gr.                                                                   |                                                                      |
| Mid-<br>night. | 58.5                            | 3.2                 | 56.3                | 5.4                          | 0.462                            | 5.18                                                  | 1.01                                                                     | 0.84                                                                 |
| 1              | 57.9                            | 3.1                 | 55.4                | 5.6                          | .449                             | .02                                                   | .04                                                                      | .83                                                                  |
| 2              | 57.3                            | 2.9                 | 55.0                | 5.2                          | .442                             | 4.97                                                  | 0.94                                                                     | .84                                                                  |
| 3              | 56.8                            | 2.9                 | 54.5                | 5.2                          | .435                             | .89                                                   | .93                                                                      | .84                                                                  |
| 4              | 56.1                            | 2.8                 | 53.9                | 5.0                          | .426                             | .80                                                   | .87                                                                      | .85                                                                  |
| 5              | 55.9                            | 2.7                 | 53.7                | 4.9                          | .423                             | .77                                                   | .85                                                                      | .85                                                                  |
| 6              | 55.6                            | 2.3                 | 53.5                | 4.4                          | .421                             | .75                                                   | .74                                                                      | .87                                                                  |
| 7              | 55.3                            | 2.4                 | 53.1                | 4.6                          | .415                             | .68                                                   | .78                                                                      | .86                                                                  |
| 8              | 57.4                            | 3.0                 | 55.0                | 5.4                          | .442                             | .97                                                   | .98                                                                      | .84                                                                  |
| 9              | 59.4                            | 4.7                 | 56.1                | 8.0                          | .459                             | 5.12                                                  | 1.55                                                                     | .77                                                                  |
| 10             | 61.0                            | 6.7                 | 57.0                | 10.7                         | .473                             | .22                                                   | 2.24                                                                     | .70                                                                  |
| 11             | 62.3                            | 8.8                 | 57.9                | 13.2                         | .488                             | .35                                                   | .93                                                                      | .65                                                                  |
|                |                                 |                     |                     |                              |                                  |                                                       |                                                                          |                                                                      |
| Noon.          | 63.3                            | 10.9                | 57.8                | 16.4                         | .486                             | .30                                                   | 3.79                                                                     | .58                                                                  |
| 1              | 64.3                            | 11.9                | 58.3                | 17.9                         | .494                             | .36                                                   | 4.30                                                                     | .56                                                                  |
| 2              | 64.8                            | 12.5                | 58.5                | 18.8                         | .498                             | .39                                                   | .59                                                                      | .54                                                                  |
| 3              | 64.7                            | 12.7                | 58.3                | 19.1                         | .494                             | .35                                                   | .66                                                                      | .53                                                                  |
| 4              | 63.4                            | 11.9                | 57.4                | 17.9                         | .480                             | .22                                                   | .18                                                                      | .56                                                                  |
| 5              | 63.3                            | 10.0                | 58.3                | 15.0                         | .494                             | .39                                                   | 3.45                                                                     | .61                                                                  |
| 6              | 62.9                            | 7.5                 | 59.1                | 11.3                         | .508                             | .58                                                   | 2.52                                                                     | .69                                                                  |
| 7              | 62.1                            | 5.9                 | 58.6                | 9.4                          | .499                             | .52                                                   | .01                                                                      | .73                                                                  |
| 8              | 61.3                            | 5.1                 | 58.2                | 8.2                          | .493                             | .46                                                   | 1.71                                                                     | .76                                                                  |
| 9              | 60.6                            | 4.7                 | 57.8                | 7.5                          | .486                             | .39                                                   | .54                                                                      | .78                                                                  |
| 10             | 60.0                            | 4.0                 | 57.2                | 6.8                          | .476                             | .29                                                   | .36                                                                      | .80                                                                  |
| 11             | 59.5                            | 3.8                 | 56.8                | 6.5                          | .470                             | .24                                                   | .27                                                                      | .81                                                                  |

All the Hygrometrical elements are computed by the Greenwich constants.

Meteorological Observations.

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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, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                         |
|-------|-----------------------|---------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------|
|       | o                     | Inches.                         |                                   |                                                                                                    |
| 1     | Sunday.               |                                 |                                   |                                                                                                    |
| 2     | 132.0                 | ..                              | N. W. & N. & E.                   | Cloudless till 7 P. M. Scatd. \i afterwards.                                                       |
| 3     | 134.0                 | ..                              | N. & E.                           | Cloudless.                                                                                         |
| 4     | 134.0                 | ..                              | N. & N. W.                        | Cloudless.                                                                                         |
| 5     | 130.5                 | ..                              | N. & N. W.                        | Cloudless.                                                                                         |
| 6     | 131.8                 | ..                              | N. & W.                           | Cloudless.                                                                                         |
| 7     | 135.0                 | ..                              | N.                                | Cloudless.                                                                                         |
| 8     | Sunday.               |                                 |                                   |                                                                                                    |
| 9     | 133.0                 | ..                              | W.                                | Cloudless.                                                                                         |
| 10    | 131.0                 | ..                              | N. & N. W.                        | Cloudless.                                                                                         |
| 11    | 134.0                 | ..                              | N. W.                             | Cloudless.                                                                                         |
| 12    | 133.0                 | ..                              | N. W. & N.                        | Cloudless.                                                                                         |
| 13    | 132.4                 | ..                              | N. & N. W.                        | Cloudless.                                                                                         |
| 14    | 133.0                 | ..                              | N. W.                             | Cloudless.                                                                                         |
| 15    | Sunday.               |                                 |                                   |                                                                                                    |
| 16    | 130.0                 | ..                              | N. & S. & W.                      | Cloudless.                                                                                         |
| 17    | 124.0                 | ..                              | N. & N. W. & W.                   | Cloudless.                                                                                         |
| 18    | 134.6                 | ..                              | W. & S. W.                        | Cloudless.                                                                                         |
| 19    | 132.0                 | ..                              | S. & S. W.                        | Cloudless.                                                                                         |
| 20    | 136.0                 | ..                              | N. & E. & S.                      | Cloudless; also heavy fog between 5 & 9 A. M.                                                      |
| 21    | 130.8                 | ..                              | N. W. & N.                        | Cloudless.                                                                                         |
| 22    | Sunday.               |                                 |                                   |                                                                                                    |
| 23    | 139.0                 | ..                              | S. W. & S.                        | Cloudless.                                                                                         |
| 24    | 137.6                 | ..                              | S. W. & S.                        | Cloudless; also foggy between 2 & 6 A. M.                                                          |
| 25    | 134.6                 | ..                              | N. & S.                           | Cloudless.                                                                                         |
| 26    | 129.0                 | ..                              | N. & N. E.                        | Cloudless.                                                                                         |
| 27    | 130.0                 | ..                              | N. W. & N.                        | Cloudless.                                                                                         |
| 28    | 135.0                 | ..                              | N. & N. W. & S. W.                | Cloudless till 8 A. M. Scatd. \i & \i till 3 P. M. Cloudless afterwards.                           |
| 29    | Sunday.               |                                 |                                   |                                                                                                    |
| 30    | 140.5                 | ..                              | S.                                | Cloudless till 8 A. M. Scatd. \i till 2 P. M. Cloudless afterwards; also foggy between 6 & 8 A. M. |
| 31    | 139.6                 | ..                              | S. & S. W.                        | Cloudless till 10 A. M. Scatd. \i till 6 P. M. Cloudless afterwards.                               |

\i Cirri, \i Cirro strati, \i Cumuli, \i Cumulo strati, \i Nimbi, —i Strati, \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1860.*

## MONTHLY RESULTS.

|                                                                         |    |    |              |
|-------------------------------------------------------------------------|----|----|--------------|
|                                                                         |    |    | Inches.      |
| Mean height of the Barometer for the month,                             | .. | .. | 30.017       |
| Max. height of the Barometer occurred at 9 A. M. on the 13th,           | .. | .. | 30.203       |
| Min. height of the Barometer occurred at 4 P. M. on the 2d,             | .. | .. | 29.878       |
| <i>Extreme range</i> of the Barometer during the month,                 | .. | .. | 0.325        |
| Mean of the daily Max. Pressures,                                       | .. | .. | 30.096       |
| Ditto ditto Min. ditto,                                                 | .. | .. | 29.958       |
| <i>Mean daily range</i> of the Barometers during the month,             | .. | .. | 0.138        |
| —————                                                                   |    |    |              |
|                                                                         |    |    | o            |
| Mean Dry Bulb Thermometer for the month,                                | .. | .. | 66.3         |
| Max. Temperature occurred at 3 P. M. on the 31st,                       | .. | .. | 84.4         |
| Min. Temperature occurred at 7 A. M. on the 12th,                       | .. | .. | 52.7         |
| <i>Extreme range</i> of the Temperature during the month,               | .. | .. | 31.7         |
| Mean of the daily Max. Temperatures,                                    | .. | .. | 77.5         |
| Ditto ditto Min. ditto,                                                 | .. | .. | 57.6         |
| <i>Mean daily range</i> of the Temperature during the month,            | .. | .. | 19.9         |
| —————                                                                   |    |    |              |
|                                                                         |    |    | o            |
| Mean Wet Bulb Thermometer for the month,                                | .. | .. | 60.2         |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, ..           |    |    | 6.1          |
| Computed Mean Dew-point for the month, ..                               | .. | .. | 56.5         |
| Mean Dry Bulb Thermometer above computed Mean Dew-point, ..             |    |    | 9.8          |
|                                                                         |    |    | Inches.      |
| Mean Elastic force of Vapour for the month,                             | .. | .. | 0.465        |
| —————                                                                   |    |    |              |
|                                                                         |    |    | Troy grains. |
| Mean Weight of Vapour for the month, ..                                 | .. | .. | 5.15         |
| Additional Weight of Vapour required for complete saturation, ..        | .. | .. | 2.00         |
| Mean degree of humidity for the month, complete saturation being unity, |    |    | 0.72         |
| —————                                                                   |    |    |              |
|                                                                         |    |    | Inches       |
| Rained No days, Max. fall of rain during 24 hours, ..                   | .. | .. | Nil.         |
| Total amount of rain during the month, ..                               | .. | .. | Nil.         |
| Prevailing direction of the Wind, ..                                    | .. | .. | N. & N. W.   |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour, when  
any particular wind was blowing, it rained.

| Hour.     | Rain on.     |          | N. E. |          | E. |          | S. E. |          | S. |          | S. W. |          | W. |          | N. W. |          | Rain on. | Calm.    | Rain on. | Missed. |
|-----------|--------------|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|----------|----------|----------|---------|
|           | N.           | Rain on. | N. E. | Rain on. | E. | Rain on. | S. E. | Rain on. | S. | Rain on. | S. W. | Rain on. | W. | Rain on. | N. W. | Rain on. | Calm.    | Rain on. | Missed.  |         |
|           | No. of days. |          |       |          |    |          |       |          |    |          |       |          |    |          |       |          |          |          |          |         |
| Midnight. | 8            |          |       |          | 2  |          |       |          | 4  |          | 4     |          | 1  |          | 7     |          |          |          |          |         |
| 1         | 9            |          |       |          | 1  |          |       |          | 4  |          | 3     |          | 2  |          | 7     |          |          |          |          |         |
| 2         | 9            |          |       |          | 1  |          |       |          | 4  |          | 3     |          | 2  |          | 7     |          |          |          |          |         |
| 3         | 8            |          |       |          | 1  |          |       |          | 4  |          | 3     |          | 1  |          | 7     |          |          |          |          | 2       |
| 4         | 8            |          |       |          | 1  |          |       |          | 2  |          | 4     |          | 2  |          | 7     |          |          |          |          | 2       |
| 5         | 8            |          | 1     |          | 1  |          |       |          | 3  |          | 3     |          | 2  |          | 7     |          |          |          |          | 1       |
| 6         | 11           |          | 1     |          |    |          |       |          | 2  |          | 3     |          | 4  |          | 5     |          |          |          |          |         |
| 7         | 12           |          | 2     |          |    |          |       |          | 1  |          | 3     |          | 4  |          | 4     |          |          |          |          |         |
| 8         | 12           |          | 3     |          | 2  |          |       |          | 2  |          | 2     |          | 1  |          | 3     |          |          |          |          | 1       |
| 9         | 11           |          | 2     |          | 3  |          |       |          | 2  |          | 3     |          | 2  |          | 3     |          |          |          |          |         |
| 10        | 11           |          | 2     |          | 4  |          |       |          | 2  |          | 2     |          | 2  |          | 3     |          |          |          |          |         |
| 11        | 8            |          | 1     |          | 4  |          | 1     |          | 3  |          | 2     |          | 2  |          | 5     |          |          |          |          |         |
| Noon.     | 7            |          |       |          | 5  |          | 1     |          | 2  |          | 3     |          | 3  |          | 5     |          |          |          |          |         |
| 1         | 7            |          |       |          | 2  |          | 1     |          | 2  |          | 4     |          | 3  |          | 7     |          |          |          |          |         |
| 2         | 6            |          |       |          | 2  |          | 1     |          | 3  |          | 3     |          | 6  |          | 5     |          |          |          |          |         |
| 3         | 7            |          |       |          | 1  |          | 1     |          | 2  |          | 3     |          | 5  |          | 7     |          |          |          |          |         |
| 4         | 12           |          |       |          |    |          | 1     |          | 2  |          | 4     |          | 7  |          | 7     |          |          |          |          |         |
| 5         | 9            |          |       |          |    |          | 1     |          | 3  |          | 3     |          | 2  |          | 8     |          |          |          |          |         |
| 6         | 6            |          | 1     |          | 1  |          |       |          | 4  |          | 3     |          | 2  |          | 9     |          |          |          |          |         |
| 7         | 7            |          | 1     |          |    |          |       |          | 5  |          | 3     |          | 2  |          | 8     |          |          |          |          |         |
| 8         | 7            |          | 1     |          |    |          |       |          | 5  |          | 3     |          | 2  |          | 8     |          |          |          |          |         |
| 9         | 7            |          | 1     |          |    |          |       |          | 5  |          | 3     |          | 2  |          | 8     |          |          |          |          |         |
| 10        | 7            |          | 1     |          |    |          |       |          | 5  |          | 3     |          | 2  |          | 8     |          |          |          |          |         |
| 11        | 6            |          | 1     |          |    |          |       |          | 5  |          | 3     |          | 2  |          | 8     |          |          |          |          | 1       |



*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February, 1860.*

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° Fahr. | Range of the Barometer during the day. |                   |                  | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |           |           |
|-------|-------------------------------------------|----------------------------------------|-------------------|------------------|----------------------------|------------------------------------------|-----------|-----------|
|       |                                           | Max.                                   | Min.              | Diff.            |                            | Max.                                     | Min.      | Diff.     |
| 1     | Inches.<br>29.954                         | Inches.<br>30.031                      | Inches.<br>29.887 | Inches.<br>0.144 | o<br>73.0                  | o<br>85.3                                | o<br>64.2 | o<br>21.1 |
| 2     | .955                                      | .030                                   | .887              | .143             | 72.7                       | 80.6                                     | 69.0      | 11.6      |
| 3     | .977                                      | .047                                   | .918              | .129             | 73.6                       | 82.8                                     | 66.2      | 16.6      |
| 4     | .985                                      | .078                                   | .915              | .163             | 74.6                       | 82.0                                     | 69.4      | 12.6      |
| 5     | <i>Sunday.</i>                            |                                        |                   |                  |                            |                                          |           |           |
| 6     | .946                                      | .023                                   | .872              | .151             | 76.9                       | 85.6                                     | 71.8      | 13.8      |
| 7     | .977                                      | .052                                   | .925              | .127             | 75.8                       | 84.0                                     | 70.6      | 13.4      |
| 8     | .945                                      | .035                                   | .879              | .156             | 73.1                       | 83.4                                     | 65.0      | 18.4      |
| 9     | .886                                      | 29.954                                 | .822              | .132             | 75.1                       | 84.6                                     | 68.0      | 16.6      |
| 10    | .898                                      | .970                                   | .820              | .150             | 75.8                       | 84.2                                     | 68.8      | 15.4      |
| 11    | .905                                      | .983                                   | .834              | .149             | 76.0                       | 84.6                                     | 68.6      | 16.0      |
| 12    | <i>Sunday.</i>                            |                                        |                   |                  |                            |                                          |           |           |
| 13    | .912                                      | 30.001                                 | .832              | .169             | 74.1                       | 83.4                                     | 66.6      | 16.8      |
| 14    | .893                                      | 29.973                                 | .825              | .148             | 74.8                       | 85.7                                     | 65.2      | 20.5      |
| 15    | .961                                      | 30.042                                 | .905              | .137             | 77.4                       | 87.5                                     | 68.6      | 18.9      |
| 16    | 30.006                                    | .086                                   | .947              | .139             | 78.3                       | 88.2                                     | 69.6      | 18.6      |
| 17    | .004                                      | .095                                   | .937              | .158             | 78.9                       | 88.2                                     | 70.8      | 17.4      |
| 18    | 29.912                                    | 29.994                                 | .826              | .168             | 78.6                       | 88.6                                     | 69.2      | 19.4      |
| 19    | <i>Sunday.</i>                            |                                        |                   |                  |                            |                                          |           |           |
| 20    | .922                                      | 30.001                                 | .851              | .150             | 76.9                       | 84.7                                     | 72.2      | 12.5      |
| 21    | .962                                      | .054                                   | .890              | .164             | 75.1                       | 86.0                                     | 65.0      | 21.0      |
| 22    | .887                                      | 29.973                                 | .808              | .165             | 73.7                       | 85.6                                     | 63.6      | 22.0      |
| 23    | .877                                      | .956                                   | .826              | .130             | 74.9                       | 86.5                                     | 64.0      | 22.5      |
| 24    | .866                                      | .947                                   | .803              | .144             | 76.4                       | 88.0                                     | 65.8      | 22.2      |
| 25    | .856                                      | .941                                   | .788              | .153             | 75.7                       | 84.2                                     | 70.9      | 13.3      |
| 26    | <i>Sunday.</i>                            |                                        |                   |                  |                            |                                          |           |           |
| 27    | .831                                      | .919                                   | .782              | .137             | 74.8                       | 86.2                                     | 63.9      | 22.3      |
| 28    | .772                                      | .844                                   | .690              | .154             | 79.8                       | 93.4                                     | 69.0      | 24.4      |
| 29    | .743                                      | .815                                   | .688              | .127             | 78.2                       | 87.6                                     | 71.0      | 16.6      |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four 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, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermo-<br>meter. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of Air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humidity,<br>complete saturation be-<br>ing unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                   |
| 1     | 66.0                            | 7.0                 | 62.5                | 10.5                         | .568                             | 6.21                                             | 2.55                                                                    | .71                                                               |
| 2     | 67.5                            | 5.2                 | 64.9                | 7.8                          | .615                             | .74                                              | 1.94                                                                    | .78                                                               |
| 3     | 68.4                            | 5.2                 | 65.8                | 7.8                          | .634                             | .93                                              | 2.00                                                                    | .78                                                               |
| 4     | 71.0                            | 3.6                 | 69.2                | 5.4                          | .708                             | 7.73                                             | 1.47                                                                    | .84                                                               |
| 5     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 6     | 72.6                            | 4.3                 | 70.4                | 6.5                          | .736                             | .99                                              | .87                                                                     | .81                                                               |
| 7     | 69.3                            | 6.5                 | 66.0                | 9.8                          | .638                             | 6.94                                             | 2.60                                                                    | .73                                                               |
| 8     | 66.1                            | 7.0                 | 62.6                | 10.5                         | .570                             | .23                                              | .56                                                                     | .71                                                               |
| 9     | 70.2                            | 4.9                 | 67.7                | 7.4                          | .674                             | 7.36                                             | 1.98                                                                    | .79                                                               |
| 10    | 72.0                            | 3.8                 | 70.1                | 5.7                          | .729                             | .93                                              | .61                                                                     | .83                                                               |
| 11    | 69.4                            | 6.6                 | 66.1                | 9.9                          | .640                             | 6.96                                             | 2.64                                                                    | .73                                                               |
| 12    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 13    | 66.8                            | 7.3                 | 63.1                | 11.0                         | .580                             | 6.33                                             | .74                                                                     | .70                                                               |
| 14    | 69.0                            | 5.8                 | 66.1                | 8.7                          | .640                             | .97                                              | .29                                                                     | .75                                                               |
| 15    | 71.5                            | 5.9                 | 68.5                | 8.9                          | .692                             | 7.51                                             | .50                                                                     | .75                                                               |
| 16    | 72.0                            | 6.3                 | 68.8                | 9.5                          | .699                             | .56                                              | .72                                                                     | .74                                                               |
| 17    | 71.6                            | 7.3                 | 67.9                | 11.0                         | .679                             | .34                                              | 3.13                                                                    | .70                                                               |
| 18    | 70.0                            | 8.6                 | 65.7                | 12.9                         | .632                             | 6.84                                             | .54                                                                     | .66                                                               |
| 19    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 20    | 66.1                            | 10.8                | 60.7                | 16.2                         | .536                             | 5.81                                             | 4.05                                                                    | .59                                                               |
| 21    | 64.1                            | 11.0                | 58.6                | 16.5                         | .499                             | .43                                              | 3.91                                                                    | .58                                                               |
| 22    | 63.6                            | 10.1                | 58.5                | 15.2                         | .498                             | .43                                              | .53                                                                     | .61                                                               |
| 23    | 65.6                            | 9.3                 | 60.9                | 14.0                         | .539                             | .87                                              | .41                                                                     | .63                                                               |
| 24    | 66.8                            | 9.6                 | 62.0                | 14.4                         | .559                             | 6.08                                             | .64                                                                     | .63                                                               |
| 25    | 68.5                            | 7.2                 | 64.9                | 10.8                         | .615                             | .70                                              | 2.81                                                                    | .71                                                               |
| 26    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 27    | 64.9                            | 9.9                 | 59.9                | 14.9                         | .521                             | 5.67                                             | 3.59                                                                    | .61                                                               |
| 28    | 70.3                            | 9.5                 | 65.5                | 14.3                         | .628                             | 6.78                                             | .97                                                                     | .63                                                               |
| 29    | 66.6                            | 11.6                | 60.8                | 17.4                         | .537                             | 5.82                                             | 4.43                                                                    | .57                                                               |

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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.920                                    | 30.021                                                 | 29.733  | 0.288   | 71.6                       | 76.3                                                     | 68.1 | 8.2   |
| 1          | .913                                      | .014                                                   | .716    | .298    | 70.9                       | 75.0                                                     | 66.8 | 8.2   |
| 2          | .902                                      | .001                                                   | .714    | .287    | 70.2                       | 74.6                                                     | 66.8 | 7.8   |
| 3          | .889                                      | 29.997                                                 | .711    | .286    | 69.9                       | 74.0                                                     | 65.6 | 8.4   |
| 4          | .893                                      | .989                                                   | .704    | .285    | 69.5                       | 73.6                                                     | 64.8 | 8.8   |
| 5          | .904                                      | .999                                                   | .704    | .295    | 68.8                       | 72.6                                                     | 64.9 | 7.7   |
| 6          | .915                                      | 30.017                                                 | .717    | .300    | 68.3                       | 73.2                                                     | 63.8 | 9.4   |
| 7          | .934                                      | .043                                                   | .735    | .308    | 68.2                       | 73.0                                                     | 63.6 | 9.4   |
| 8          | .962                                      | .062                                                   | .782    | .280    | 70.9                       | 74.2                                                     | 66.0 | 8.2   |
| 9          | .985                                      | .095                                                   | .805    | .290    | 73.6                       | 78.0                                                     | 67.8 | 10.2  |
| 10         | .993                                      | .092                                                   | .815    | .277    | 76.7                       | 81.4                                                     | 71.6 | 9.8   |
| 11         | .979                                      | .076                                                   | .803    | .273    | 79.5                       | 84.8                                                     | 74.0 | 10.8  |
| Noon.      | .954                                      | .047                                                   | .776    | .271    | 82.0                       | 88.0                                                     | 75.2 | 12.8  |
| 1          | .921                                      | .020                                                   | .756    | .264    | 83.9                       | 90.4                                                     | 77.4 | 13.0  |
| 2          | .888                                      | 29.997                                                 | .726    | .271    | 85.1                       | 91.8                                                     | 79.0 | 12.8  |
| 3          | .863                                      | .966                                                   | .706    | .260    | 85.6                       | 93.4                                                     | 80.6 | 12.8  |
| 4          | .852                                      | .963                                                   | .692    | .271    | 84.8                       | 92.8                                                     | 79.0 | 13.8  |
| 5          | .852                                      | .947                                                   | .688    | .259    | 83.2                       | 91.2                                                     | 77.8 | 13.4  |
| 6          | .860                                      | .966                                                   | .690    | .276    | 80.3                       | 85.5                                                     | 75.6 | 9.9   |
| 7          | .878                                      | .986                                                   | .704    | .282    | 77.5                       | 81.6                                                     | 74.0 | 7.6   |
| 8          | .902                                      | 30.013                                                 | .733    | .280    | 75.7                       | 79.8                                                     | 72.2 | 7.6   |
| 9          | .920                                      | .032                                                   | .751    | .281    | 74.5                       | 79.3                                                     | 71.6 | 7.7   |
| 10         | .923                                      | .026                                                   | .756    | .270    | 73.5                       | 78.2                                                     | 69.8 | 8.4   |
| 11         | .919                                      | .027                                                   | .751    | .276    | 72.9                       | 77.5                                                     | 69.6 | 7.9   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February, 1860.*

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. | 67.3                       | 4.3                 | 65.1                | 6.5                       | 0.619                         | 6.79                                          | 1.61                                                          | 0.81                                                      |
| 1          | 66.9                       | 4.0                 | 64.9                | 6.0                       | .615                          | .77                                           | .46                                                           | .82                                                       |
| 2          | 66.5                       | 3.7                 | 64.6                | 5.6                       | .609                          | .70                                           | .35                                                           | .83                                                       |
| 3          | 66.4                       | 3.5                 | 64.6                | 5.3                       | .609                          | .71                                           | .27                                                           | .84                                                       |
| 4          | 66.3                       | 3.2                 | 64.7                | 4.8                       | .611                          | .73                                           | .15                                                           | .85                                                       |
| 5          | 65.5                       | 3.3                 | 63.8                | 5.0                       | .593                          | .54                                           | .17                                                           | .85                                                       |
| 6          | 65.4                       | 2.9                 | 63.7                | 4.6                       | .591                          | .52                                           | .08                                                           | .86                                                       |
| 7          | 65.3                       | 2.9                 | 63.6                | 4.6                       | .590                          | .50                                           | .08                                                           | .86                                                       |
| 8          | 67.1                       | 3.8                 | 65.2                | 5.7                       | .621                          | .83                                           | .40                                                           | .83                                                       |
| 9          | 68.0                       | 5.6                 | 65.2                | 8.4                       | .621                          | .80                                           | 2.13                                                          | .76                                                       |
| 10         | 69.0                       | 7.7                 | 65.1                | 11.6                      | .619                          | .72                                           | 3.08                                                          | .69                                                       |
| 11         | 69.5                       | 10.0                | 64.5                | 15.0                      | .607                          | .56                                           | 4.10                                                          | .62                                                       |
| Noon.      | 70.1                       | 11.9                | 64.1                | 17.9                      | .599                          | .43                                           | 5.04                                                          | .56                                                       |
| 1          | 70.7                       | 13.2                | 64.1                | 19.8                      | .599                          | .40                                           | .73                                                           | .53                                                       |
| 2          | 71.2                       | 13.9                | 64.2                | 20.9                      | .601                          | .41                                           | 6.16                                                          | .51                                                       |
| 3          | 71.3                       | 14.3                | 64.1                | 21.5                      | .599                          | .38                                           | .38                                                           | .50                                                       |
| 4          | 70.7                       | 14.1                | 63.6                | 21.2                      | .590                          | .29                                           | .17                                                           | .51                                                       |
| 5          | 70.4                       | 12.8                | 64.0                | 19.2                      | .597                          | .40                                           | 5.49                                                          | .54                                                       |
| 6          | 70.3                       | 10.0                | 65.3                | 15.0                      | .623                          | .72                                           | 4.19                                                          | .62                                                       |
| 7          | 69.7                       | 7.8                 | 65.8                | 11.7                      | .634                          | .87                                           | 3.17                                                          | .68                                                       |
| 8          | 69.0                       | 6.7                 | 65.6                | 10.1                      | .630                          | .86                                           | 2.65                                                          | .72                                                       |
| 9          | 68.6                       | 5.9                 | 65.6                | 8.9                       | .630                          | .87                                           | .31                                                           | .75                                                       |
| 10         | 68.1                       | 5.4                 | 65.4                | 8.1                       | .626                          | .84                                           | .06                                                           | .77                                                       |
| 11         | 67.9                       | 5.0                 | 65.4                | 7.5                       | .626                          | .84                                           | 1.89                                                          | .78                                                       |

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, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                             |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1     | 140.0                 | 0                               | S.W. & S.                         | Cloudless, also foggy between 6 & 7 A. M.                                                                              |
| 2     | 125.4                 | ..                              | E.                                | Cloudless till 5 A. M. Cloudy till Noon. Scatd. \i afterwards.                                                         |
| 3     | 137.5                 | 0.09                            | S. & E.                           | Cloudy till 8 P. M. Cloudless afterwards; also little drizzling with lightning and thunder between 4 and 5 A. M.       |
| 4     | ..                    | ..                              | S.                                | Cloudless till 4 A. M. Scatd. Clouds afterwards.                                                                       |
| 5     | <i>Sunday.</i>        |                                 |                                   |                                                                                                                        |
| 6     | 136.0                 | ..                              | S. & S. W.                        | Cloudy till 5 P. M. Cloudless afterwards.                                                                              |
| 7     | 136.0                 | ..                              | S. & N.                           | Cloudless till 2 A. M. cloudy till 8 A. M. Scatd. \i till 8 P. M. cloudless afterwards; also slightly foggy at 7 A. M. |
| 8     | 138.0                 | ..                              | E. & S. W. & W.                   | Cloudless.                                                                                                             |
| 9     | 135.2                 | ..                              | S. W. & S.                        | Cloudless till 7 A. M. Scatd. \i & \i till 5 P. M. Cloudless afterwards; also foggy between 5 & 7 A. M.                |
| 10    | ..                    | ..                              | S. E. & S.                        | Cloudless till 7 A. M. Scatd. \i afterwards; also foggy between 6 & 7 A. M.                                            |
| 11    | 135.6                 | ..                              | N. E. & N.                        | Cloudless till Noon. Scatd. \i till 6 P. M. Cloudless afterwards.                                                      |
| 12    | <i>Sunday.</i>        |                                 |                                   |                                                                                                                        |
| 13    | 136.2                 | ..                              | N. E. & N. W.                     | Scatd. \i till 3 P. M. Cloudless afterwards.                                                                           |
| 14    | 140.5                 | ..                              | S. & S W. & W.                    | Cloudless till 5 A. M. Cloudy till 10 A. M. Cloudless afterwards.                                                      |
| 15    | 139.0                 | ..                              | S. W. & S.                        | Cloudless.                                                                                                             |
| 16    | 142.0                 | ..                              | S. W. & S. E.                     | Cloudless.                                                                                                             |
| 17    | 139.0                 | ..                              | S. E. & S. W.                     | Cloudless.                                                                                                             |
| 18    | 140.0                 | ..                              | S. & W. & N. W.                   | Cloudless.                                                                                                             |
| 19    | <i>Sunday.</i>        |                                 |                                   |                                                                                                                        |
| 20    | ..                    | ..                              | N. & N. W.                        | Cloudless till 4 A. M. Scatd. \i till 6 P. M. Cloudless afterwards.                                                    |
| 21    | 138.8                 | ..                              | N. & N. E.                        | Cloudless.                                                                                                             |
| 22    | 140.0                 | ..                              | W. & N. & N. W.                   | Cloudless.                                                                                                             |
| 23    | 132.0                 | ..                              | N. W. & S.                        | Cloudless till 5 A. M. Cloudy till 10 A. M. Cloudless afterwards.                                                      |

\i Cirri, \i Cirro strati, \i Cumuli, \i Cumulo strati, \i Nimbi, —i Strati, \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, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                         |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------|
|       | o                     | Inches.                         |                                   |                                                                                    |
| 24    | 138.8                 | ..                              | S. & N. W.                        | Cloudless.                                                                         |
| 25    | 120.8                 | ..                              | E. & S. W.                        | Cloudy till 9 P. M. Cloudless afterwards ;<br>also drizzling at 1 A. M. & 10 P. M. |
| 26    | <i>Sunday.</i>        |                                 |                                   |                                                                                    |
| 27    | 138.8                 | ..                              | S. & W. & S. W.                   | Cloudless.                                                                         |
| 28    | 141.0                 | ..                              | S. & S. W.                        | Cloudless.                                                                         |
| 29    | 132.0                 | ..                              | S. & S. W.                        | Cloudless.                                                                         |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February, 1860.*

MONTHLY RESULTS.

|                                                               |    |    | Inches |
|---------------------------------------------------------------|----|----|--------|
| Mean height of the Barometer for the month,                   | .. | .. | 29.913 |
| Max. height of the Barometer occurred at 9 A. M. on the 17th, | .. | .. | 30.095 |
| Min. height of the Barometer occurred at 5 P. M. on the 29th, | .. | .. | 29.688 |
| <i>Extreme range</i> of the Barometer during the month,       | .. | .. | 0.407  |
| Mean of the daily Max. Pressures,                             | .. | .. | 29.994 |
| Ditto ditto Min. ditto,                                       | .. | .. | 29.846 |
| <i>Mean daily range</i> of the Barometer during the month,    | .. | .. | 0.148  |

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|                                                              |    |    | o    |
|--------------------------------------------------------------|----|----|------|
| Mean Dry Bulb Thermometer for the month,                     | .. | .. | 75.8 |
| Max. Temperature occurred at 3 P. M. on the 28th,            | .. | .. | 93.4 |
| Min. Temperature occurred at 7 A. M. on the 22nd,            | .. | .. | 63.6 |
| <i>Extreme range</i> of the Temperature during the month,    | .. | .. | 29.8 |
| Mean of the daily Max. Temperatures,                         | .. | .. | 85.7 |
| Ditto ditto Min. ditto,                                      | .. | .. | 67.9 |
| <i>Mean daily range</i> of the Temperature during the month, | .. | .. | 17.6 |

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|                                                               |    |    | o      |
|---------------------------------------------------------------|----|----|--------|
| Mean Wet Bulb Thermometer for the month,                      | .. | .. | 68.4   |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, .. |    |    | 7.4    |
| Computed Mean Dew-point for the month, ..                     | .. | .. | 64.7   |
| Mean Dry Bulb Thermometer above computed Mean Dew-point, ..   |    |    | 11.1   |
|                                                               |    |    | Inches |
| Mean Elastic force of Vapour for the month,                   | .. | .. | 0.611  |

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|                                                                         |    |    | Troy grains |
|-------------------------------------------------------------------------|----|----|-------------|
| Mean Weight of Vapour for the month, ..                                 | .. | .. | 6.65        |
| Additional Weight of Vapour required for complete saturation, ..        | .. | .. | 2.89        |
| Mean degree of humidity for the month, complete saturation being unity, |    |    | 0.70        |

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|                                                   |    |    | Inches     |
|---------------------------------------------------|----|----|------------|
| Rained 2 days, Max. fall of rain during 24 hours, | .. | .. | 0.09       |
| Total amount of rain during the month, ..         | .. | .. | 0.09       |
| Prevailing direction of the Wind, ..              | .. | .. | S. & S. W. |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of February, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.           | Rain on. | N. E. | Rain on. | E. | Rain on. | S. E. | Rain on. | S. | Rain on. | S. W. | Rain on. | W. | Rain on. | N. W. | Rain on. | Calm. | Rain on. | Missed. |
|-----------|--------------|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|-------|----------|---------|
|           | No. of days. |          |       |          |    |          |       |          |    |          |       |          |    |          |       |          |       |          |         |
| Midnight. | 1            | 1        | 2     | 2        | 13 | 4        | 2     | 2        | 13 | 4        | 1     | 2        | 2  | 2        | 2     | 2        |       |          |         |
| 1         | 1            | 1        | 3     | 2        | 12 | 4        | 2     | 2        | 12 | 4        | 1     | 2        | 2  | 2        | 2     |          |       |          |         |
| 2         | 1            | 1        | 2     | 2        | 12 | 4        | 2     | 2        | 12 | 4        |       | 2        | 2  | 2        | 2     |          |       |          |         |
| 3         | 2            | 1        | 2     | 2        | 10 | 4        | 2     | 2        | 10 | 4        |       | 2        | 2  | 2        | 2     |          |       |          | 1       |
| 4         | 2            | 1        | 2     | 1        | 11 | 2        | 3     | 3        | 11 | 2        |       | 2        | 2  | 2        | 2     |          |       |          | 2       |
| 5         | 2            | 1        | 2     | 1        | 10 | 3        | 3     | 3        | 10 | 3        |       | 3        | 2  | 2        | 2     |          |       |          | 1       |
| 6         | 1            | 2        | 3     | 2        | 9  | 2        | 2     | 2        | 9  | 4        |       | 4        | 4  | 4        | 4     |          |       |          |         |
| 7         | 2            | 4        | 3     | 3        | 5  | 2        | 2     | 2        | 5  | 5        |       | 5        | 4  | 4        | 4     |          |       |          |         |
| 8         | 2            | 5        | 4     | 4        | 5  | 1        | 1     | 1        | 5  | 3        |       | 3        | 1  | 3        | 3     |          |       |          | 1       |
| 9         | 4            | 5        | 4     | 4        | 1  | 4        | 4     | 1        | 1  | 3        |       | 3        | 2  | 1        | 2     |          |       |          |         |
| 10        | 4            | 3        | 2     | 2        | 7  | 2        | 2     | 2        | 7  | 3        |       | 3        | 2  | 2        | 2     |          |       |          |         |
| 11        | 4            | 2        | 1     | 1        | 3  | 1        | 1     | 3        | 3  | 5        |       | 5        | 6  | 3        | 3     |          |       |          |         |
| Noon.     | 4            | 2        | 2     | 2        | 2  | 2        | 2     | 2        | 2  | 9        |       | 4        | 4  | 4        | 4     |          |       |          |         |
| 1         | 5            | 1        | 2     | 2        | 2  | 2        | 2     | 2        | 2  | 8        |       | 5        | 5  | 4        | 4     |          |       |          |         |
| 2         | 5            | 2        | 2     | 2        | 1  | 1        | 1     | 1        | 1  | 6        |       | 5        | 5  | 4        | 4     |          |       |          |         |
| 3         | 6            | 2        | 1     | 1        | 2  | 2        | 2     | 2        | 2  | 5        |       | 5        | 7  | 2        | 2     |          |       |          |         |
| 4         | 4            |          | 2     | 2        | 2  | 2        | 2     | 2        | 2  | 8        |       | 5        | 5  | 4        | 4     |          |       |          |         |
| 5         | 3            | 1        | 3     | 3        | 1  | 3        | 3     | 3        | 3  | 8        |       | 8        | 4  | 2        | 2     |          |       |          |         |
| 6         | 3            | 2        | 3     | 3        | 1  | 1        | 1     | 1        | 1  | 5        |       | 5        | 3  | 3        | 3     |          |       |          |         |
| 7         | 3            | 2        | 3     | 3        | 1  | 1        | 1     | 1        | 6  | 5        |       | 5        | 3  | 2        | 2     |          |       |          |         |
| 8         | 1            | 2        | 3     | 3        | 1  | 1        | 1     | 1        | 9  | 5        |       | 5        | 2  | 2        | 2     |          |       |          |         |
| 9         | 2            | 2        | 2     | 2        | 1  | 1        | 1     | 1        | 10 | 5        |       | 5        | 1  | 2        | 2     |          |       |          |         |
| 10        | 2            | 2        | 1     | 1        | 10 | 1        | 1     | 1        | 10 | 5        |       | 5        | 1  | 2        | 2     |          |       |          |         |
| 11        | 2            | 2        | 1     | 1        | 10 | 1        | 1     | 1        | 10 | 5        |       | 5        | 1  | 2        | 2     |          |       |          |         |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March, 1860.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | 29.772                                    | 29.841                                 | 29.706  | 0.135   | 76.9                       | 88.9                                     | 64.8 | 24.1  |
| 2     | .795                                      | .875                                   | .737    | .138    | 76.5                       | 87.4                                     | 65.8 | 21.6  |
| 3     | .762                                      | .840                                   | .684    | .156    | 77.0                       | 89.0                                     | 65.4 | 23.6  |
| 4     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 5     | .822                                      | .907                                   | .774    | .133    | 81.3                       | 91.4                                     | 74.8 | 16.6  |
| 6     | .841                                      | .925                                   | .774    | .151    | 81.8                       | 92.0                                     | 74.5 | 17.5  |
| 7     | .770                                      | .860                                   | .681    | .179    | 81.6                       | 92.2                                     | 75.6 | 16.6  |
| 8     | .744                                      | .826                                   | .692    | .134    | 80.5                       | 89.6                                     | 73.6 | 16.0  |
| 9     | .770                                      | .854                                   | .708    | .146    | 78.6                       | 85.6                                     | 73.0 | 12.6  |
| 10    | .785                                      | .865                                   | .732    | .133    | 80.6                       | 89.9                                     | 73.0 | 16.9  |
| 11    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 12    | .895                                      | .971                                   | .822    | .149    | 82.1                       | 92.2                                     | 75.2 | 17.0  |
| 13    | .865                                      | .943                                   | .794    | .149    | 81.7                       | 93.0                                     | 74.2 | 18.8  |
| 14    | .858                                      | .927                                   | .781    | .146    | 82.4                       | 93.6                                     | 75.2 | 18.4  |
| 15    | .844                                      | .914                                   | .783    | .131    | 85.0                       | 97.2                                     | 75.4 | 21.8  |
| 16    | .873                                      | .961                                   | .808    | .153    | 84.6                       | 95.6                                     | 76.2 | 19.4  |
| 17    | .866                                      | .942                                   | .813    | .129    | 83.1                       | 93.6                                     | 75.3 | 18.3  |
| 18    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 19    | .856                                      | .949                                   | .791    | .158    | 83.2                       | 93.3                                     | 74.7 | 18.6  |
| 20    | .864                                      | .955                                   | .787    | .168    | 84.4                       | 96.8                                     | 75.0 | 21.8  |
| 21    | .819                                      | .891                                   | .700    | .191    | 82.5                       | 91.0                                     | 77.2 | 13.8  |
| 22    | .826                                      | .902                                   | .766    | .136    | 81.9                       | 92.4                                     | 72.8 | 19.6  |
| 23    | .858                                      | .939                                   | .796    | .143    | 82.8                       | 92.4                                     | 74.8 | 17.6  |
| 24    | .888                                      | .969                                   | .828    | .141    | 83.4                       | 95.4                                     | 73.4 | 22.0  |
| 25    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 26    | .761                                      | .840                                   | .668    | .172    | 86.5                       | 97.6                                     | 78.7 | 18.9  |
| 27    | .772                                      | .857                                   | .710    | .147    | 86.4                       | 97.0                                     | 79.4 | 17.6  |
| 28    | .779                                      | .872                                   | .686    | .186    | 86.7                       | 98.4                                     | 78.8 | 19.6  |
| 29    | .742                                      | .817                                   | .679    | .138    | 84.7                       | 93.5                                     | 78.2 | 15.3  |
| 30    | .710                                      | .786                                   | .649    | .137    | 85.8                       | 95.2                                     | 79.5 | 15.7  |
| 31    | .652                                      | .742                                   | .560    | .182    | 88.4                       | 100.4                                    | 80.6 | 19.8  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                     |
| 1     | 64.2                            | 12.7                | 57.8                | 19.1                         | .0486                            | 5.27                                             | 4.59                                                                    | .53                                                                 |
| 2     | 65.1                            | 11.4                | 59.4                | 17.1                         | .513                             | .56                                              | .19                                                                     | .57                                                                 |
| 3     | 65.7                            | 11.3                | 60.0                | 17.0                         | .523                             | .67                                              | .22                                                                     | .57                                                                 |
| 4     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 5     | 75.7                            | 5.6                 | 72.9                | 8.4                          | .797                             | 8.59                                             | 2.65                                                                    | .76                                                                 |
| 6     | 74.9                            | 6.9                 | 71.4                | 10.4                         | .761                             | .18                                              | 3.22                                                                    | .72                                                                 |
| 7     | 74.7                            | 6.9                 | 71.2                | 10.4                         | .756                             | .13                                              | .21                                                                     | .72                                                                 |
| 8     | 73.7                            | 6.8                 | 70.3                | 10.2                         | .734                             | 7.92                                             | .06                                                                     | .72                                                                 |
| 9     | 73.3                            | 5.3                 | 70.6                | 8.0                          | .741                             | 8.02                                             | 2.36                                                                    | .77                                                                 |
| 10    | 75.6                            | 5.0                 | 73.1                | 7.5                          | .803                             | .65                                              | .36                                                                     | .79                                                                 |
| 11    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 12    | 73.6                            | 8.5                 | 69.3                | 12.8                         | .711                             | 7.63                                             | 3.88                                                                    | .66                                                                 |
| 13    | 74.1                            | 7.6                 | 70.3                | 11.4                         | .734                             | .90                                              | .47                                                                     | .70                                                                 |
| 14    | 76.6                            | 5.8                 | 73.7                | 8.7                          | .819                             | 8.80                                             | 2.81                                                                    | .76                                                                 |
| 15    | 77.0                            | 8.0                 | 73.0                | 12.0                         | .801                             | .55                                              | 3.98                                                                    | .68                                                                 |
| 16    | 75.8                            | 8.8                 | 71.4                | 13.2                         | .761                             | .13                                              | 4.26                                                                    | .66                                                                 |
| 17    | 72.2                            | 10.9                | 66.7                | 16.4                         | .653                             | 7.00                                             | .86                                                                     | .59                                                                 |
| 18    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 19    | 72.5                            | 10.7                | 67.1                | 16.1                         | .661                             | .09                                              | .80                                                                     | .60                                                                 |
| 20    | 72.7                            | 11.7                | 66.8                | 17.6                         | .655                             | .00                                              | 5.31                                                                    | .57                                                                 |
| 21    | 71.4                            | 11.1                | 65.8                | 16.7                         | .634                             | 6.80                                             | 4.84                                                                    | .58                                                                 |
| 22    | 69.1                            | 12.8                | 62.7                | 19.2                         | .527                             | .15                                              | 5.29                                                                    | .54                                                                 |
| 23    | 72.3                            | 10.5                | 67.0                | 15.8                         | .659                             | 7.07                                             | 4.68                                                                    | .60                                                                 |
| 24    | 74.2                            | 9.2                 | 69.6                | 13.8                         | .717                             | .68                                              | .28                                                                     | .64                                                                 |
| 25    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 26    | 77.2                            | 9.3                 | 72.5                | 14.0                         | .787                             | 8.39                                             | .71                                                                     | .64                                                                 |
| 27    | 77.3                            | 9.1                 | 72.7                | 13.7                         | .792                             | .44                                              | .62                                                                     | .65                                                                 |
| 28    | 77.3                            | 9.4                 | 72.6                | 14.1                         | .790                             | .42                                              | .76                                                                     | .64                                                                 |
| 29    | 78.7                            | 6.0                 | 75.7                | 9.0                          | .873                             | 9.34                                             | 3.08                                                                    | .75                                                                 |
| 30    | 79.8                            | 6.0                 | 76.8                | 9.0                          | .905                             | .65                                              | .18                                                                     | .75                                                                 |
| 31    | 77.2                            | 11.2                | 71.6                | 16.8                         | .766                             | 8.11                                             | 5.73                                                                    | .59                                                                 |

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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.815                                    | 29.907                                                 | 29.688  | 0.219   | 77.8                       | 82.1                                                     | 70.6 | 11.5  |
| 1          | .805                                      | .901                                                   | .676    | .225    | 77.3                       | 81.6                                                     | 70.6 | 11.0  |
| 2          | .793                                      | .891                                                   | .659    | .232    | 76.8                       | 80.8                                                     | 68.6 | 12.2  |
| 3          | .783                                      | .884                                                   | .627    | .257    | 76.3                       | 81.0                                                     | 67.4 | 13.6  |
| 4          | .780                                      | .867                                                   | .621    | .246    | 75.9                       | 81.0                                                     | 66.2 | 14.8  |
| 5          | .795                                      | .894                                                   | .633    | .261    | 75.6                       | 80.6                                                     | 65.2 | 15.4  |
| 6          | .810                                      | .913                                                   | .661    | .252    | 75.0                       | 80.8                                                     | 64.8 | 16.0  |
| 7          | .833                                      | .929                                                   | .693    | .236    | 74.9                       | 81.0                                                     | 64.8 | 16.2  |
| 8          | .864                                      | .958                                                   | .727    | .231    | 78.1                       | 83.6                                                     | 70.6 | 13.0  |
| 9          | .881                                      | .971                                                   | .737    | .234    | 81.2                       | 86.8                                                     | 73.6 | 13.2  |
| 10         | .886                                      | .969                                                   | .742    | .227    | 84.3                       | 89.4                                                     | 78.8 | 10.6  |
| 11         | .874                                      | .961                                                   | .731    | .230    | 87.1                       | 93.5                                                     | 80.2 | 13.3  |
| Noon.      | .851                                      | .941                                                   | .705    | .236    | 89.6                       | 96.8                                                     | 81.6 | 15.2  |
| 1          | .821                                      | .906                                                   | .665    | .241    | 91.7                       | 99.3                                                     | 83.2 | 16.1  |
| 2          | .786                                      | .877                                                   | .619    | .258    | 92.6                       | 99.9                                                     | 85.6 | 14.3  |
| 3          | .759                                      | .848                                                   | .602    | .246    | 92.9                       | 100.4                                                    | 85.6 | 14.8  |
| 4          | .742                                      | .832                                                   | .576    | .256    | 92.3                       | 99.6                                                     | 84.5 | 15.1  |
| 5          | .740                                      | .828                                                   | .560    | .268    | 90.5                       | 98.2                                                     | 82.0 | 16.2  |
| 6          | .744                                      | .833                                                   | .561    | .272    | 87.3                       | 94.2                                                     | 80.2 | 14.0  |
| 7          | .766                                      | .851                                                   | .597    | .254    | 84.1                       | 89.6                                                     | 77.8 | 11.8  |
| 8          | .790                                      | .874                                                   | .615    | .259    | 82.1                       | 88.6                                                     | 75.6 | 13.0  |
| 9          | .808                                      | .888                                                   | .640    | .248    | 80.7                       | 85.6                                                     | 74.4 | 11.2  |
| 10         | .820                                      | .899                                                   | .660    | .239    | 79.5                       | 85.0                                                     | 73.2 | 11.8  |
| 11         | .815                                      | .890                                                   | .659    | .231    | 79.0                       | 84.0                                                     | 71.8 | 12.2  |

The Mean Height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers 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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb<br>Thermometer. | Dry Bulb above Wet. | Computed Dew point. | Dry Bulb above Dew<br>point. | Mean Elastic force of<br>Vapour. | Mean Weight of Va-<br>pour in a Cubic foot<br>of Air. | Additional Weight of<br>vapour required for<br>complete saturation. | Mean degree of Hu-<br>midity, complete satu-<br>ration being unity. |
|----------------|-------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                             | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                           |                                                                     |
| Mid-<br>night. | 73.5                          | 4.3                 | 71.3                | 6.5                          | 0.758                            | 8.21                                                  | 1.92                                                                | 0.81                                                                |
| 1              | 73.2                          | 4.1                 | 71.1                | 6.2                          | .753                             | .18                                                   | .80                                                                 | .82                                                                 |
| 2              | 72.9                          | 3.9                 | 70.9                | 5.9                          | .748                             | .13                                                   | .70                                                                 | .83                                                                 |
| 3              | 72.7                          | 3.6                 | 70.9                | 5.4                          | .748                             | .15                                                   | .54                                                                 | .84                                                                 |
| 4              | 72.5                          | 3.4                 | 70.8                | 5.1                          | .746                             | .12                                                   | .45                                                                 | .85                                                                 |
| 5              | 72.4                          | 3.2                 | 70.8                | 4.8                          | .746                             | .12                                                   | .36                                                                 | .86                                                                 |
| 6              | 72.0                          | 3.0                 | 70.5                | 4.5                          | .739                             | .05                                                   | .26                                                                 | .87                                                                 |
| 7              | 71.9                          | 3.0                 | 70.4                | 4.5                          | .736                             | .02                                                   | .26                                                                 | .86                                                                 |
| 8              | 73.5                          | 4.6                 | 71.2                | 6.9                          | .756                             | .18                                                   | 2.04                                                                | .80                                                                 |
| 9              | 74.4                          | 6.8                 | 71.0                | 10.2                         | .751                             | .09                                                   | 3.11                                                                | .72                                                                 |
| 10             | 74.6                          | 9.7                 | 69.7                | 14.6                         | .720                             | 7.69                                                  | 4.59                                                                | .63                                                                 |
| 11             | 74.6                          | 12.5                | 68.3                | 18.8                         | .688                             | .31                                                   | 6.02                                                                | .55                                                                 |
| Noon.          | 74.6                          | 15.0                | 67.1                | 22.5                         | .661                             | 6.98                                                  | 7.35                                                                | .49                                                                 |
| 1              | 74.6                          | 17.1                | 66.0                | 25.7                         | .638                             | .72                                                   | 8.51                                                                | .44                                                                 |
| 2              | 74.6                          | 18.0                | 65.6                | 27.0                         | .630                             | .63                                                   | 9.00                                                                | .42                                                                 |
| 3              | 74.4                          | 18.5                | 65.1                | 27.8                         | .619                             | .51                                                   | .26                                                                 | .41                                                                 |
| 4              | 74.2                          | 18.1                | 65.1                | 27.2                         | .619                             | .52                                                   | 8.98                                                                | .42                                                                 |
| 5              | 74.6                          | 15.9                | 66.6                | 23.9                         | .651                             | .86                                                   | 7.86                                                                | .47                                                                 |
| 6              | 74.8                          | 12.5                | 68.5                | 18.8                         | .692                             | 7.36                                                  | 6.05                                                                | .55                                                                 |
| 7              | 74.7                          | 9.4                 | 70.0                | 14.1                         | .727                             | .78                                                   | 4.43                                                                | .64                                                                 |
| 8              | 74.3                          | 7.8                 | 70.4                | 11.7                         | .736                             | .91                                                   | 3.60                                                                | .69                                                                 |
| 9              | 74.0                          | 6.7                 | 70.6                | 10.1                         | .741                             | .99                                                   | .05                                                                 | .72                                                                 |
| 10             | 73.7                          | 5.8                 | 70.8                | 8.7                          | .746                             | 8.05                                                  | 2.61                                                                | .76                                                                 |
| 11             | 73.7                          | 5.3                 | 71.0                | 8.0                          | .751                             | .12                                                   | .38                                                                 | .77                                                                 |

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, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                      |
|-------|-----------------------|---------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------|
|       | o                     | Inches.                         |                                   |                                                                                                 |
| 1     | 137.2                 | ..                              | W. & S.                           | Cloudless.                                                                                      |
| 2     | 135.0                 | ..                              | S. W. & W. & S.                   | Cloudless.                                                                                      |
| 3     | 137.6                 | ..                              | S. & S. W. & W.                   | Cloudless.                                                                                      |
| 4     | <i>Sunday.</i>        |                                 |                                   |                                                                                                 |
| 5     | 138.4                 | ..                              | S. W. & S.                        | Cloudless till 2 A. M. Scatd. clouds till 11 A. M. cloudless till 6 P. M. Scatd. \i afterwards. |
| 6     | 139.0                 | ..                              | S. W. & N. W. & S. E.             | Cloudless.                                                                                      |
| 7     | 141.0                 | ..                              | S.                                | Scatd. clouds till 10 A. M. cloudless afterwards.                                               |
| 8     | 120.4                 | ..                              | S.                                | Cloudless till 9 A. M. Scatd. clouds till 3 P. M. cloudless afterwards.                         |
| 9     | 125.0                 | ..                              | S.                                | Scatd. clouds.                                                                                  |
| 10    | 134.2                 | ..                              | S. & S. E.                        | Cloudless till 7 A. M. Scatd. \i & \i till 4 P. M. cloudless afterwards.                        |
| 11    | <i>Sunday.</i>        |                                 |                                   |                                                                                                 |
| 12    | 141.2                 | ..                              | S. W. & W.                        | Cloudy till 7 A. M. cloudless afterwards.                                                       |
| 13    | 143.0                 | ..                              | S. & S. W.                        | Cloudless.                                                                                      |
| 14    | 133.8                 | ..                              | S. W. & S. E. & S.                | Cloudy till 9 A. M. cloudless afterwards.                                                       |
| 15    | 137.2                 | ..                              | S. & N.                           | Cloudless.                                                                                      |
| 16    | 138.0                 | ..                              | S. W. & S.                        | Cloudless till 5 P. M. cloudy afterwards.                                                       |
| 17    | 135.0                 | ..                              | N. W. & S. & N.                   | Cloudless till 7 A. M. cloudy till 7 P. M. cloudless afterwards.                                |
| 18    | <i>Sunday.</i>        |                                 |                                   |                                                                                                 |
| 19    | 135.0                 | ..                              | E. & S. E.                        | Cloudless till 2 P. M. Scatd. \i till 8 P. M. cloudless afterwards.                             |
| 20    | 140.0                 | ..                              | S. W. & S.                        | Cloudless.                                                                                      |
| 21    | ..                    | ..                              | S. & N. W.                        | Cloudy; also slightly drizzling at 8 P. M.                                                      |
| 22    | 138.0                 | ..                              | W. & N.                           | Cloudy till 8 A. M. cloudless afterwards.                                                       |
| 23    | 135.4                 | ..                              | W. & N. W. & S.                   | Cloudless till 11 A. M. Scatd. \i till 3 P. M. cloudless afterwards.                            |
| 24    | 136.0                 | ..                              | S. & S. W. & W.                   | Cloudless.                                                                                      |
| 25    | <i>Sunday.</i>        |                                 |                                   |                                                                                                 |
| 26    | 139.8                 | ..                              | S. & S. E.                        | Cloudless till 4 A. M. cloudy till 7 A. M. cloudless afterwards.                                |
| 27    | 137.0                 | ..                              | N. & W.                           | Cloudless till 4 A. M. cloudy till 7 A. M. cloudless afterwards.                                |
| 28    | 141.0                 | ..                              | S.                                | Cloudless.                                                                                      |
| 29    | 132.0                 | ..                              | S.                                | Cloudless.                                                                                      |
| 30    | 134.6                 | ..                              | S.                                | Cloudless till 4 A. M. cloudy till 10 A. M. cloudless afterwards.                               |
| 31    | 138.0                 | ..                              | S. & W.                           | Cloudless.                                                                                      |

\i Cirri, \i cirro strati, \i cumuli, \i cumulo strati, \i nimbi, —i strati, \i cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March, 1860.*

## MONTHLY RESULTS.

|                                                                         |    |    |             |
|-------------------------------------------------------------------------|----|----|-------------|
|                                                                         |    |    | Inches      |
| Mean height of the Barometer for the month,                             | .. | .. | 29.807      |
| Max. height of the Barometer, occurred at 9 A. M. on the 12th,          | .. | .. | 29.971      |
| Min. height of the Barometer, occurred at 5 P. M. on the 31st,          | .. | .. | 29.560      |
| <i>Extreme Range</i> of the Barometer during the month,                 | .. | .. | 0.411       |
| Mean of the Daily Max. Pressures,                                       | .. | .. | 29.888      |
| Ditto ditto Min. ditto,                                                 | .. | .. | 29.737      |
| <i>Mean daily range</i> of the Barometer during the month,              | .. | .. | 0.151       |
| —————                                                                   |    |    |             |
|                                                                         |    |    | o           |
| Mean Dry Bulb Thermometer for the month,                                | .. | .. | 82.6        |
| Max. Temperature occurred at 3 P. M. on the 31st,                       | .. | .. | 100.4       |
| Min. Temperature occurred at 6 & 7 A. M. on the 1st,                    | .. | .. | 64.8        |
| <i>Extreme range</i> of the Temperature during the month,               | .. | .. | 35.6        |
| Mean of the daily Max. Temperature,                                     | .. | .. | 93.1        |
| Ditto ditto Min. ditto,                                                 | .. | .. | 74.6        |
| <i>Mean daily range</i> of the Temperature during the month,            | .. | .. | 18.5        |
| —————                                                                   |    |    |             |
|                                                                         |    |    | o           |
| Mean Wet Bulb Thermometer for the month,                                | .. | .. | 73.8        |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer,              | .. | .. | 8.8         |
| Computed Mean Dew Point for the month,                                  | .. | .. | 69.4        |
| Mean Dry Bulb Thermometer above computed Mean Dew Point,                | .. | .. | 13.2        |
|                                                                         |    |    | Inches      |
| Mean Elastic force of vapour for the month,                             | .. | .. | 0.713       |
| —————                                                                   |    |    |             |
|                                                                         |    |    | Troy grains |
| Mean weight of vapour for the month,                                    | .. | .. | 7.66        |
| Additional weight of vapour required for complete saturation,           | .. | .. | 4.02        |
| Mean degree of humidity for the month, complete saturation being unity, | .. | .. | 0.66        |
| —————                                                                   |    |    |             |
|                                                                         |    |    | Inches      |
| Rained 1 day.—Max. fall of rain during 24 hours,                        | .. | .. | Nil.        |
| Total amount of rain during the month,                                  | .. | .. | Nil.        |
| Prevailing direction of the Wind,                                       | .. | .. | S. & S. W.  |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of March, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.       |              | N. E.    |              | E. | S. E.    |              | S. | S. W.    |              | W. | N. W.    |              | Calm. | Rain on. Missed. |
|-----------|----------|--------------|----------|--------------|----|----------|--------------|----|----------|--------------|----|----------|--------------|-------|------------------|
|           | Rain on. | No. of days. | Rain on. | No. of days. |       |                  |
| Midnight. |          |              |          |              |    |          |              |    |          |              |    |          |              |       |                  |
| 1         |          |              |          |              |    | 1        | 20           |    | 5        |              | 1  |          |              |       |                  |
| 2         |          |              |          |              |    | 1        | 20           |    | 5        |              | 1  |          |              |       |                  |
| 3         |          |              |          |              |    | 2        | 17           |    | 6        |              | 1  |          |              | 1     |                  |
| 4         |          |              |          |              |    | 2        | 17           |    | 6        |              | 1  |          |              | 1     |                  |
| 5         |          |              |          |              | 1  | 2        | 16           |    | 5        |              |    |          |              | 1     | 3                |
| 6         |          |              |          |              | 1  | 2        | 15           |    | 8        |              |    |          |              |       | 1                |
| 7         |          |              |          |              | 1  | 2        | 13           |    | 8        |              | 2  |          | 1            |       |                  |
| 8         | 2        |              |          |              | 1  | 4        | 13           |    | 5        |              | 3  |          | 1            |       |                  |
| 9         | 2        |              |          |              | 1  | 1        | 12           |    | 4        |              | 4  |          | 1            |       |                  |
| 10        | 2        | 1            |          |              |    | 1        | 15           |    | 6        |              | 5  |          |              |       |                  |
| 11        | 5        | 1            |          | 1            |    |          | 12           |    | 6        |              | 9  |          |              |       |                  |
| Noon.     |          |              |          |              |    |          |              |    |          |              |    |          |              |       |                  |
| 1         | 3        |              |          | 1            |    | 2        | 4            |    | 6        |              | 7  |          | 4            |       |                  |
| 2         | 4        |              |          | 1            |    | 2        | 3            |    | 6        |              | 7  |          | 3            |       | 1                |
| 3         | 1        |              |          | 1            |    | 1        | 5            |    | 6        |              | 8  |          | 5            |       |                  |
| 4         | 1        |              |          | 1            |    |          | 6            |    | 8        |              | 8  |          | 3            |       |                  |
| 5         | 2        |              |          | 1            |    |          | 8            |    | 4        |              | 8  |          | 3            |       | 1                |
| 6         | 3        |              |          | 1            |    | 2        | 8            |    | 4        |              | 7  |          | 2            |       |                  |
| 7         | 2        |              |          | 1            |    | 3        | 10           |    | 4        |              | 4  |          | 3            |       |                  |
| 8         | 1        |              |          | 1            |    | 4        | 10           |    | 3        |              | 5  |          | 3            |       |                  |
| 9         |          |              |          | 1            |    | 3        | 12           |    | 4        |              | 4  |          | 3            | 1     |                  |
| 10        |          |              |          | 1            |    | 3        | 15           |    | 3        |              | 3  |          | 2            |       |                  |
| 11        | 1        |              |          | 1            |    | 3        | 15           |    | 3        |              | 2  |          | 2            |       |                  |
|           | 1        |              |          | 1            |    | 3        | 15           |    | 2        |              | 2  |          | 2            |       | 1                |



Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April, 1860.

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 2     | .754                                            | 29.842                                    | 29.678  | 0.164   | 85.3                          | 97.6                                          | 74.8 | 22.8  |
| 3     | .782                                            | .872                                      | .721    | .151    | 85.7                          | 98.0                                          | 77.8 | 20.2  |
| 4     | .784                                            | .856                                      | .709    | .147    | 85.2                          | 94.6                                          | 79.5 | 15.1  |
| 5     | .768                                            | .829                                      | .681    | .148    | 85.4                          | 93.8                                          | 78.6 | 15.2  |
| 6     | .781                                            | .841                                      | .722    | .119    | 83.4                          | 93.6                                          | 73.6 | 20.0  |
| 7     | .810                                            | .869                                      | .752    | .117    | 82.5                          | 91.1                                          | 74.0 | 17.1  |
| 8     | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 9     | .769                                            | .846                                      | .686    | .160    | 84.1                          | 92.0                                          | 78.8 | 13.2  |
| 10    | .722                                            | .773                                      | .635    | .138    | 82.1                          | 88.0                                          | 76.8 | 11.2  |
| 11    | .734                                            | .783                                      | .676    | .107    | 82.2                          | 91.0                                          | 74.6 | 16.4  |
| 12    | .757                                            | .833                                      | .668    | .165    | 84.9                          | 94.6                                          | 76.4 | 18.2  |
| 13    | .760                                            | .840                                      | .668    | .172    | 84.4                          | 96.1                                          | 74.8 | 21.3  |
| 14    | .799                                            | .866                                      | .726    | .140    | 83.3                          | 92.0                                          | 75.2 | 16.8  |
| 15    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 16    | .795                                            | .849                                      | .717    | .132    | 83.6                          | 92.0                                          | 74.5 | 17.5  |
| 17    | .798                                            | .856                                      | .715    | .141    | 83.6                          | 93.0                                          | 72.3 | 20.7  |
| 18    | .847                                            | .921                                      | .770    | .151    | 80.8                          | 91.8                                          | 72.2 | 19.6  |
| 19    | .826                                            | .913                                      | .742    | .171    | 82.7                          | 92.2                                          | 74.0 | 18.2  |
| 20    | .790                                            | .868                                      | .690    | .178    | 85.4                          | 95.6                                          | 77.0 | 18.6  |
| 21    | .747                                            | .820                                      | .664    | .156    | 86.3                          | 95.0                                          | 80.2 | 14.8  |
| 22    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 23    | .692                                            | .732                                      | .627    | .105    | 85.7                          | 94.6                                          | 79.0 | 15.6  |
| 24    | .719                                            | .767                                      | .659    | .108    | 86.5                          | 94.0                                          | 80.3 | 13.7  |
| 25    | .749                                            | .826                                      | .669    | .157    | 86.6                          | 94.0                                          | 81.7 | 12.3  |
| 26    | .732                                            | .793                                      | .669    | .124    | 87.5                          | 95.2                                          | 81.8 | 13.4  |
| 27    | .693                                            | .760                                      | .618    | .142    | 87.9                          | 96.5                                          | 81.4 | 15.1  |
| 28    | .680                                            | .746                                      | .639    | .107    | 88.6                          | 98.2                                          | 81.6 | 16.6  |
| 29    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 30    | .678                                            | .753                                      | .608    | .145    | 89.1                          | 100.8                                         | 80.6 | 20.2  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermo-<br>meter. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of Air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humidity,<br>complete saturation be-<br>ing unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                   |
| 1     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 2     | 74.9                            | 10.4                | 69.7                | 15.6                         | 0.720                            | 7.68                                             | 4.96                                                                    | 0.61                                                              |
| 3     | 78.0                            | 7.7                 | 74.1                | 11.6                         | .830                             | 8.85                                             | 3.95                                                                    | .69                                                               |
| 4     | 78.4                            | 6.8                 | 75.0                | 10.2                         | .854                             | 9.12                                             | .49                                                                     | .72                                                               |
| 5     | 78.5                            | 6.9                 | 75.0                | 10.4                         | .854                             | .12                                              | .56                                                                     | .72                                                               |
| 6     | 77.4                            | 6.0                 | 74.4                | 9.0                          | .838                             | 8.99                                             | 2.97                                                                    | .75                                                               |
| 7     | 75.6                            | 6.9                 | 72.1                | 10.4                         | .778                             | .36                                              | 3.28                                                                    | .72                                                               |
| 8     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 9     | 77.3                            | 6.8                 | 73.9                | 10.2                         | .824                             | .83                                              | .38                                                                     | .72                                                               |
| 10    | 76.5                            | 5.6                 | 73.7                | 8.4                          | .819                             | .82                                              | 2.69                                                                    | .77                                                               |
| 11    | 75.7                            | 6.5                 | 72.4                | 9.8                          | .785                             | .43                                              | 3.11                                                                    | .73                                                               |
| 12    | 75.9                            | 9.0                 | 71.4                | 13.5                         | .761                             | .12                                              | 4.37                                                                    | .65                                                               |
| 13    | 77.1                            | 7.3                 | 73.4                | 11.0                         | .811                             | .67                                              | 3.64                                                                    | .70                                                               |
| 14    | 77.5                            | 5.8                 | 74.6                | 8.7                          | .843                             | 9.03                                             | 2.90                                                                    | .76                                                               |
| 15    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 16    | 78.3                            | 5.3                 | 75.6                | 8.0                          | .871                             | .33                                              | .70                                                                     | .78                                                               |
| 17    | 77.4                            | 6.2                 | 74.3                | 9.3                          | .835                             | 8.96                                             | 3.07                                                                    | .75                                                               |
| 18    | 75.1                            | 5.7                 | 72.2                | 8.6                          | .781                             | .40                                              | 2.67                                                                    | .76                                                               |
| 19    | 74.8                            | 7.9                 | 70.8                | 11.9                         | .746                             | .00                                              | 3.72                                                                    | .68                                                               |
| 20    | 77.5                            | 7.9                 | 73.5                | 11.9                         | .814                             | .69                                              | .99                                                                     | .69                                                               |
| 21    | 80.4                            | 5.9                 | 77.4                | 8.9                          | .922                             | 9.83                                             | .19                                                                     | .76                                                               |
| 22    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 23    | 79.6                            | 6.1                 | 76.5                | 9.2                          | .896                             | .57                                              | .23                                                                     | .75                                                               |
| 24    | 80.9                            | 5.6                 | 78.1                | 8.4                          | .943                             | 10.06                                            | .04                                                                     | .77                                                               |
| 25    | 80.8                            | 5.8                 | 77.9                | 8.7                          | .937                             | 9.98                                             | .16                                                                     | .76                                                               |
| 26    | 81.7                            | 5.8                 | 78.8                | 8.7                          | .964                             | 10.25                                            | .24                                                                     | .76                                                               |
| 27    | 81.8                            | 6.1                 | 78.7                | 9.2                          | .961                             | .22                                              | .42                                                                     | .75                                                               |
| 28    | 81.8                            | 6.8                 | 78.4                | 10.2                         | .952                             | .10                                              | .82                                                                     | .73                                                               |
| 29    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 30    | 81.3                            | 7.8                 | 77.4                | 11.7                         | .922                             | 9.77                                             | 4.35                                                                    | .69                                                               |

All the Hygrometrical elements are computed by the Greenwich constants.

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.766                                    | 29.881                                                 | 29.657  | 0.224   | 80.0                       | 84.8                                                     | 72.8 | 12.0  |
| 1          | .759                                      | .837                                                   | .657    | .180    | 79.8                       | 84.2                                                     | 72.4 | 11.8  |
| 2          | .747                                      | .812                                                   | .653    | .159    | 74.9                       | 83.6                                                     | 72.2 | 11.4  |
| 3          | .742                                      | .809                                                   | .651    | .158    | 78.9                       | 82.8                                                     | 72.2 | 10.6  |
| 4          | .737                                      | .823                                                   | .639    | .184    | 78.5                       | 82.2                                                     | 72.4 | 9.8   |
| 5          | .754                                      | .831                                                   | .648    | .183    | 78.4                       | 82.0                                                     | 72.2 | 9.8   |
| 6          | .772                                      | .843                                                   | .670    | .173    | 78.4                       | 82.2                                                     | 72.2 | 10.0  |
| 7          | .793                                      | .868                                                   | .696    | .172    | 79.2                       | 83.2                                                     | 74.2 | 9.0   |
| 8          | .814                                      | .912                                                   | .720    | .192    | 82.3                       | 86.6                                                     | 76.6 | 10.0  |
| 9          | .823                                      | .911                                                   | .724    | .187    | 85.2                       | 89.8                                                     | 79.8 | 10.0  |
| 10         | .822                                      | .915                                                   | .732    | .183    | 87.8                       | 93.2                                                     | 82.6 | 10.6  |
| 11         | .809                                      | .897                                                   | .711    | .186    | 90.2                       | 96.6                                                     | 84.6 | 12.0  |
| Noon.      | .791                                      | .884                                                   | .700    | .184    | 92.1                       | 98.8                                                     | 86.0 | 12.8  |
| 1          | .765                                      | .857                                                   | .675    | .182    | 93.3                       | 99.2                                                     | 86.8 | 12.4  |
| 2          | .737                                      | .828                                                   | .651    | .177    | 94.0                       | 100.8                                                    | 88.0 | 12.8  |
| 3          | .709                                      | .803                                                   | .630    | .173    | 93.8                       | 100.7                                                    | 87.6 | 13.1  |
| 4          | .691                                      | .785                                                   | .608    | .177    | 92.7                       | 98.0                                                     | 87.6 | 10.4  |
| 5          | .689                                      | .770                                                   | .614    | .156    | 90.8                       | 96.2                                                     | 87.0 | 9.2   |
| 6          | .701                                      | .777                                                   | .618    | .159    | 88.0                       | 92.0                                                     | 85.0 | 7.0   |
| 7          | .721                                      | .809                                                   | .632    | .177    | 86.0                       | 89.0                                                     | 83.2 | 5.8   |
| 8          | .746                                      | .861                                                   | .650    | .211    | 83.1                       | 86.4                                                     | 72.8 | 13.6  |
| 9          | .765                                      | .889                                                   | .654    | .235    | 82.0                       | 85.0                                                     | 72.3 | 12.7  |
| 10         | .775                                      | .892                                                   | .680    | .212    | 81.6                       | 84.8                                                     | 73.6 | 11.2  |
| 11         | .778                                      | .921                                                   | .675    | .246    | 81.0                       | 84.6                                                     | 73.7 | 10.9  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force<br>of Vapour. | Mean Weight of Va-<br>pour in a cubic<br>foot of Air. | Additional Weight of<br>Vapour required<br>for complete satu-<br>ration. | Mean degree of Hu-<br>midity, complete<br>saturation being<br>unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                                | T. gr.                                                                   |                                                                      |
| Mid-<br>night. | 76.0                            | 4.0                 | 74.0                | 6.0                          | 0.827                            | 8.93                                                  | 1.88                                                                     | 0.83                                                                 |
| 1              | 76.1                            | 3.7                 | 74.2                | 5.6                          | .832                             | .98                                                   | .77                                                                      | .84                                                                  |
| 2              | 76.0                            | 3.4                 | 74.3                | 5.1                          | .835                             | 9.03                                                  | .59                                                                      | .85                                                                  |
| 3              | 75.8                            | 3.1                 | 74.2                | 4.7                          | .832                             | .00                                                   | .47                                                                      | .86                                                                  |
| 4              | 75.8                            | 2.7                 | 74.4                | 4.1                          | .838                             | .08                                                   | .27                                                                      | .88                                                                  |
| 5              | 75.9                            | 2.5                 | 74.6                | 3.8                          | .843                             | .13                                                   | .18                                                                      | .89                                                                  |
| 6              | 75.9                            | 2.5                 | 74.6                | 3.8                          | .843                             | .13                                                   | .18                                                                      | .89                                                                  |
| 7              | 76.4                            | 2.8                 | 75.0                | 4.2                          | .854                             | .24                                                   | .32                                                                      | .88                                                                  |
| 8              | 78.0                            | 4.3                 | 75.8                | 6.5                          | .876                             | .41                                                   | 2.17                                                                     | .81                                                                  |
| 9              | 78.8                            | 6.4                 | 75.6                | 9.6                          | .871                             | .29                                                   | 3.32                                                                     | .74                                                                  |
| 10             | 79.6                            | 8.2                 | 75.5                | 12.3                         | .868                             | .23                                                   | 4.37                                                                     | .68                                                                  |
| 11             | 80.2                            | 10.0                | 75.2                | 15.0                         | .860                             | .09                                                   | 5.50                                                                     | .62                                                                  |
| Noon.          | 80.7                            | 11.4                | 75.0                | 17.1                         | .854                             | 8.99                                                  | 6.42                                                                     | .58                                                                  |
| 1              | 80.9                            | 12.4                | 74.7                | 18.6                         | .846                             | .88                                                   | 7.07                                                                     | .56                                                                  |
| 2              | 80.9                            | 13.1                | 74.3                | 19.7                         | .835                             | .76                                                   | .51                                                                      | .54                                                                  |
| 3              | 80.5                            | 13.3                | 73.8                | 20.0                         | .822                             | .62                                                   | .56                                                                      | .53                                                                  |
| 4              | 80.7                            | 12.0                | 74.7                | 18.0                         | .846                             | .90                                                   | 6.78                                                                     | .57                                                                  |
| 5              | 80.0                            | 10.8                | 74.6                | 16.2                         | .843                             | .91                                                   | 5.93                                                                     | .60                                                                  |
| 6              | 79.3                            | 8.7                 | 74.9                | 13.1                         | .851                             | 9.04                                                  | 4.64                                                                     | .66                                                                  |
| 7              | 79.1                            | 6.9                 | 75.6                | 10.4                         | .871                             | .29                                                   | 3.62                                                                     | .72                                                                  |
| 8              | 77.6                            | 5.5                 | 74.8                | 8.3                          | .849                             | .11                                                   | 2.75                                                                     | .77                                                                  |
| 9              | 77.1                            | 4.9                 | 74.6                | 7.4                          | .843                             | .07                                                   | .40                                                                      | .79                                                                  |
| 10             | 77.1                            | 4.5                 | 74.8                | 6.8                          | .849                             | .13                                                   | .21                                                                      | .81                                                                  |
| 11             | 76.8                            | 4.2                 | 74.7                | 6.3                          | .846                             | .12                                                   | .02                                                                      | .82                                                                  |

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, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                                                                                                |
|-------|-----------------------|---------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | o                     | Inches.                         |                                   |                                                                                                                                                                                           |
| 1     | <i>Sunday.</i>        |                                 |                                   |                                                                                                                                                                                           |
| 2     | 138.0                 | ..                              | S. & S. W.                        | Cloudless.                                                                                                                                                                                |
| 3     | 139.2                 | ..                              | S.                                | Cloudless.                                                                                                                                                                                |
| 4     | 137.0                 | ..                              | S. & S. E.                        | Flying clouds till 6 A. M. cloudless afterwards.                                                                                                                                          |
| 5     | 129.0                 | ..                              | S.                                | Cloudy till 8 A. M. cloudless till 4 P. M. cloudy afterwards.                                                                                                                             |
| 6     | 128.0                 | 0.90                            | S. & S. E.                        | Scatd. clouds till 7 A. M. Scatd. $\searrow$ till 5 P. M. cloudy with thunder & lightning till 8 P. M.; also rain at 8 P. M. Scatd. $\searrow$ afterwards.                                |
| 7     | 132.0                 | ..                              | S.                                | Scatd. $\searrow$ till 7 A. M. cloudless till 3 P. M. Scatd. $\searrow$ till 7 P. M. cloudless afterwards.                                                                                |
| 8     | <i>Sunday.</i>        |                                 |                                   |                                                                                                                                                                                           |
| 9     | 121.7                 | ..                              | S.                                | Scatd. $\searrow$ till 7 A. M. Scatd. clouds afterwards.                                                                                                                                  |
| 10    | ..                    | ..                              | E. & S. E.                        | Cloudy till 7 P. M. Scatd. $\searrow$ afterwards.                                                                                                                                         |
| 11    | 131.0                 | ..                              | E. & S. E.                        | Scatd. clouds till 4 P. M. cloudless afterwards.                                                                                                                                          |
| 12    | 140.4                 | ..                              | N. E. & S. E. & S. W.             | Cloudless.                                                                                                                                                                                |
| 13    | 136.0                 | 0.16                            | S. & S. W.                        | Cloudless till 10 A. M. Scatd. $\searrow$ till 4 P. M. cloudy afterwards; also lightning & thundering & raining between 8 & 9 P. M.                                                       |
| 14    | 125.5                 | ..                              | S. E. & S.                        | Cloudless till 6 A. M. Scatd. clouds afterwards.                                                                                                                                          |
| 15    | <i>Sunday.</i>        | 0.39                            |                                   |                                                                                                                                                                                           |
| 16    | 134.0                 | ..                              | S.                                | Cloudless till 7 A. M. Scatd. clouds afterwards.                                                                                                                                          |
| 17    | 133.6                 | 1.02                            | S. & S. E.                        | Cloudy till 2 A. M. cloudless till 8 A. M. cloudy afterwards; also thundering, lightning & raining between 8 & 9 P. M.                                                                    |
| 18    | 129.0                 | ..                              | S.                                | Cloudless till 5 A. M. Scatd. $\searrow$ & $\swarrow$ till 5 P. M. cloudy afterwards; also slightly drizzling at 8 & at 11 P. M. during which constant flashes of lightning were visible. |
| 19    | 135.4                 | ..                              | S. E. & E. & S.                   | Scatd. clouds till 7 A. M. cloudless afterwards.                                                                                                                                          |

$\searrow$  Ciirri,  $\searrow$  Cirro strati,  $\swarrow$  Cumuli,  $\swarrow$  Cumulo strati,  $\searrow$  Nimbi,  $\swarrow$  Strati,  $\searrow$  Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April, 1860.  
Solar Radiation, Weather, &c.*

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                           |
|-------|-----------------------|---------------------------------|-----------------------------------|----------------------------------------------------------------------|
| 20    | o<br>135.0            | Inches.<br>..                   | S. & S. W.                        | Scatd. $\searrow$ i till 7 A. M. cloudless afterwards.               |
| 21    | 136.4                 | ..                              | S. & S. E.                        | Scatd. clouds.                                                       |
| 22    | <i>Sunday.</i>        |                                 |                                   |                                                                      |
| 23    | 124.0                 | ..                              | S.                                | Scatd. clouds ; also drizzling between 6 & 7 P. M.                   |
| 24    | 128.0                 | ..                              | S. & S. E.                        | Scatd. clouds ; also drizzling at 7 A. M.                            |
| 25    | 130.0                 | ..                              | S. & S. E. & S. W.                | Cloudy.                                                              |
| 26    | 133.0                 | ..                              | S.                                | Scatd. clouds till 4 P. M. cloudless afterwards.                     |
| 27    | 136.0                 | ..                              | S.                                | Scatd. clouds till 7 A. M. cloudless afterwards.                     |
| 28    | 138.0                 | ..                              | S.                                | Cloudy till 10 A. M. cloudless afterwards.                           |
| 29    | <i>Sunday.</i>        |                                 |                                   |                                                                      |
| 30    | 136.6                 | ..                              | S.                                | Cloudy till 9 A. M. cloudless till 5 P. M. Scatd. clouds afterwards. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April, 1860.*

MONTHLY RESULTS.

|                                                                         |    |    |             |
|-------------------------------------------------------------------------|----|----|-------------|
|                                                                         |    |    | Inches      |
| Mean height of the Barometer for the month,                             | .. | .. | 29.759      |
| Max. height of the Barometer occurred at 11 P. M. on the 18th,          | .. | .. | 29.921      |
| Min. height of the Barometer occurred at 4 P. M. on the 30th,           | .. | .. | 29.608      |
| <i>Extreme range</i> of the Barometer during the month,                 | .. | .. | 0.313       |
| Mean of the daily Max. Pressures,                                       | .. | .. | 29.826      |
| Ditto ditto Min. ditto,                                                 | .. | .. | 29.684      |
| <i>Mean daily range</i> of the Barometer during the month,              | .. | .. | 0.142       |
| —————                                                                   |    |    |             |
|                                                                         |    |    | o           |
| Mean Dry Bulb Thermometer for the month,                                | .. | .. | 84.9        |
| Max. Temperature occurred at 2 P. M. on the 30th,                       | .. | .. | 100.8       |
| Min. Temperature occurred at 6 A. M. on the 18th,                       | .. | .. | 72.2        |
| <i>Extreme range</i> of the Temperature during the month,               | .. | .. | 28.6        |
| Mean of the daily Max. Temperature,                                     | .. | .. | 94.2        |
| Ditto ditto Min. ditto,                                                 | .. | .. | 77.3        |
| <i>Mean daily range</i> of the Temperature during the month,            | .. | .. | 16.9        |
| —————                                                                   |    |    |             |
|                                                                         |    |    | o           |
| Mean Wet Bulb Thermometer for the month,                                | .. | .. | 78.2        |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer,              | .. | .. | 6.7         |
| Computed Mean Dew-point for the month,                                  | .. | .. | 74.8        |
| Mean Dry Bulb Thermometer above computed Mean Dew-point,                | .. | .. | 10.1        |
|                                                                         |    |    | Inches      |
| Mean Elastic force of Vapour for the month,                             | .. | .. | 0.849       |
| —————                                                                   |    |    |             |
|                                                                         |    |    | Troy grains |
| Mean Weight of Vapour for the month,                                    | .. | .. | 9.07        |
| Additional Weight of Vapour required for complete saturation,           | .. | .. | 3.42        |
| Mean degree of humidity for the month, complete saturation being unity, | .. | .. | 0.73        |
| —————                                                                   |    |    |             |
|                                                                         |    |    | Inches      |
| Rained 8 days, Max. fall of rain during 24 hours,                       | .. | .. | 1.02        |
| Total amount of rain during the month,                                  | .. | .. | 2.47        |
| Prevailing direction of the Wind,                                       | .. | .. | S. & S. E.  |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of April, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.           | Rain on.<br>N. E. | Rain on. | E. | Rain on.<br>S. E. | Rain on. | S. | Rain on. | S. W. | Rain on. | W. | Rain on. | N. W. | Rain on.<br>Calm. | Rain on. | Missed. |
|-----------|--------------|-------------------|----------|----|-------------------|----------|----|----------|-------|----------|----|----------|-------|-------------------|----------|---------|
|           | No. of days. |                   |          |    |                   |          |    |          |       |          |    |          |       |                   |          |         |
| Midnight. |              | 1                 |          |    | 6                 |          | 15 |          |       |          |    |          |       |                   |          | 3       |
| 1         |              | 1                 |          | 1  | 6                 |          | 17 | 1        |       |          |    |          |       |                   |          |         |
| 2         |              |                   |          | 1  | 7                 |          | 17 | 1        |       |          |    |          |       |                   |          |         |
| 3         |              |                   |          | 1  | 7                 |          | 16 |          |       |          |    |          |       |                   |          | 1       |
| 4         |              |                   |          | 1  | 6                 |          | 14 |          |       |          |    |          |       |                   |          | 4       |
| 5         |              |                   |          | 3  | 6                 |          | 15 |          | 1     |          |    |          |       |                   |          |         |
| 6         |              |                   |          | 4  | 5                 |          | 15 |          |       |          |    |          | 1     |                   |          |         |
| 7         |              |                   | 2        | 3  | 7                 | 1        | 13 |          | 1     |          |    |          | 1     |                   |          |         |
| 8         | 1            |                   |          | 1  | 2                 |          | 15 |          | 3     |          |    |          | 1     |                   |          |         |
| 9         | 2            |                   |          | 1  | 5                 |          | 14 |          | 3     |          |    |          |       |                   |          |         |
| 10        | 2            |                   |          | 1  | 3                 |          | 17 |          | 1     |          | 1  |          |       |                   |          |         |
| 11        | 1            |                   |          | 1  | 3                 |          | 15 |          | 4     |          |    |          | 1     |                   |          |         |
| Noon.     |              | 1                 |          | 2  | 3                 |          | 12 |          | 6     |          |    |          | 1     |                   |          |         |
| 1         |              | 1                 |          | 2  | 2                 |          | 15 |          | 4     |          |    |          | 1     |                   |          |         |
| 2         |              | 1                 |          | 2  | 1                 |          | 16 |          | 4     |          |    |          | 1     |                   |          |         |
| 3         |              |                   |          | 3  | 1                 |          | 17 |          | 3     |          |    |          | 1     |                   |          |         |
| 4         |              |                   |          | 2  | 3                 |          | 12 |          | 4     |          | 1  |          | 1     |                   |          | 2       |
| 5         |              |                   |          | 2  | 5                 |          | 14 |          | 2     |          | 1  |          | 1     |                   |          |         |
| 6         |              |                   |          | 1  | 5                 | 1        | 15 |          | 2     |          | 1  |          | 1     |                   |          |         |
| 7         |              |                   |          | 1  | 5                 |          | 13 |          | 4     | 1        | 1  |          |       |                   |          |         |
| 8         | 1            |                   |          | 1  | 5                 |          | 14 | 1        | 3     | 1        | 1  | 1        |       |                   |          |         |
| 9         | 1            |                   | 1        | 1  | 5                 |          | 14 |          | 2     |          |    |          |       |                   |          | 1       |
| 10        |              | 1                 |          | 1  | 4                 |          | 17 |          | 2     |          |    |          |       |                   |          |         |
| 11        |              | 1                 |          | 3  | 2                 |          | 17 |          | 2     |          |    |          |       |                   |          |         |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May, 1860.

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11 Feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Faht. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.670                                          | 29.736                                    | 29.586  | 0.150   | 89.1                          | 98.6                                          | 82.3 | 16.3  |
| 2     | .619                                            | .702                                      | .506    | .196    | 88.7                          | 97.6                                          | 82.8 | 14.8  |
| 3     | .655                                            | .694                                      | .596    | .098    | 84.0                          | 95.6                                          | 72.9 | 22.7  |
| 4     | .694                                            | .807                                      | .633    | .174    | 82.4                          | 93.0                                          | 72.8 | 20.2  |
| 5     | .752                                            | .845                                      | .676    | .169    | 83.5                          | 90.1                                          | 78.4 | 11.7  |
| 6     | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 7     | .753                                            | .812                                      | .661    | .151    | 84.7                          | 95.0                                          | 74.8 | 20.2  |
| 8     | .719                                            | .786                                      | .612    | .174    | 84.2                          | 93.1                                          | 75.0 | 18.1  |
| 9     | .626                                            | .697                                      | .544    | .153    | 85.6                          | 95.3                                          | 76.4 | 18.9  |
| 10    | .624                                            | .683                                      | .540    | .143    | 87.9                          | 94.8                                          | 83.6 | 11.2  |
| 11    | .652                                            | .705                                      | .576    | .129    | 86.8                          | 97.0                                          | 77.4 | 19.6  |
| 12    | .665                                            | .738                                      | .580    | .158    | 86.6                          | 96.8                                          | 77.2 | 19.6  |
| 13    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 14    | .600                                            | .654                                      | .532    | .122    | 91.1                          | 102.8                                         | 82.4 | 20.4  |
| 15    | .625                                            | .715                                      | .560    | .155    | 93.0                          | 103.5                                         | 84.2 | 19.3  |
| 16    | .628                                            | .697                                      | .566    | .131    | 92.0                          | 104.0                                         | 84.0 | 20.0  |
| 17    | .636                                            | .691                                      | .574    | .117    | 90.3                          | 100.6                                         | 83.8 | 16.8  |
| 18    | .650                                            | .722                                      | .585    | .137    | 90.3                          | 100.1                                         | 84.2 | 15.9  |
| 19    | .672                                            | .755                                      | .621    | .134    | 90.3                          | 100.4                                         | 83.2 | 17.2  |
| 20    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 21    | .613                                            | .691                                      | .523    | .168    | 93.2                          | 105.8                                         | 84.2 | 21.6  |
| 22    | .561                                            | .627                                      | .477    | .150    | 93.2                          | 105.2                                         | 84.8 | 20.4  |
| 23    | .524                                            | .594                                      | .447    | .147    | 91.6                          | 102.8                                         | 85.0 | 17.8  |
| 24    | .529                                            | .579                                      | .452    | .127    | 90.3                          | 100.2                                         | 83.8 | 16.4  |
| 25    | .528                                            | .580                                      | .447    | .133    | 89.6                          | 98.6                                          | 84.0 | 14.6  |
| 26    | .507                                            | .557                                      | .434    | .123    | 89.8                          | 100.2                                         | 83.6 | 16.6  |
| 27    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 28    | .535                                            | .602                                      | .477    | .125    | 88.2                          | 100.8                                         | 80.0 | 20.8  |
| 29    | .517                                            | .583                                      | .443    | .140    | 88.6                          | 97.6                                          | 80.8 | 16.8  |
| 30    | .490                                            | .563                                      | .428    | .135    | 90.1                          | 97.4                                          | 84.8 | 12.6  |
| 31    | .507                                            | .590                                      | .417    | .173    | 89.8                          | 99.0                                          | 81.2 | 17.8  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May, 1860.*

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. |
|-------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
|       | °                          | °                   | °                   | °                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                           |
| 1     | 81.8                       | 7.3                 | 78.1                | 11.0                      | 0.943                         | 10.00                                         | 4.12                                                          | 0.71                                                      |
| 2     | 81.3                       | 7.4                 | 77.6                | 11.1                      | .928                          | 9.85                                          | .11                                                           | .71                                                       |
| 3     | 76.5                       | 7.5                 | 72.7                | 11.3                      | .792                          | 8.49                                          | 3.68                                                          | .70                                                       |
| 4     | 76.8                       | 5.6                 | 74.0                | 8.4                       | .827                          | .90                                           | 2.71                                                          | .77                                                       |
| 5     | 78.2                       | 5.3                 | 75.5                | 8.0                       | .868                          | 9.31                                          | .69                                                           | .78                                                       |
| 6     | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 7     | 79.2                       | 5.5                 | 76.4                | 8.3                       | .893                          | .56                                           | .86                                                           | .77                                                       |
| 8     | 79.2                       | 5.0                 | 76.7                | 7.5                       | .902                          | .64                                           | .60                                                           | .79                                                       |
| 9     | 79.6                       | 6.0                 | 76.6                | 9.0                       | .899                          | .59                                           | 3.17                                                          | .75                                                       |
| 10    | 81.7                       | 6.2                 | 78.6                | 9.3                       | .958                          | 10.19                                         | .45                                                           | .75                                                       |
| 11    | 80.5                       | 6.3                 | 77.3                | 9.5                       | .919                          | 9.78                                          | .43                                                           | .74                                                       |
| 12    | 80.7                       | 5.9                 | 77.7                | 8.9                       | .931                          | .92                                           | .22                                                           | .76                                                       |
| 13    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 14    | 83.4                       | 7.7                 | 79.5                | 11.6                      | .986                          | 10.40                                         | 4.57                                                          | .70                                                       |
| 15    | 81.1                       | 11.9                | 75.1                | 17.9                      | .857                          | 9.00                                          | 6.81                                                          | .57                                                       |
| 16    | 83.8                       | 8.2                 | 79.7                | 12.3                      | .992                          | 10.46                                         | 4.90                                                          | .68                                                       |
| 17    | 83.2                       | 7.1                 | 79.6                | 10.7                      | .989                          | .45                                           | .18                                                           | .71                                                       |
| 18    | 83.5                       | 6.8                 | 80.1                | 10.2                      | 1.005                         | .62                                           | .01                                                           | .73                                                       |
| 19    | 83.5                       | 6.8                 | 80.1                | 10.2                      | .005                          | .62                                           | .01                                                           | .73                                                       |
| 20    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 21    | 82.9                       | 10.3                | 77.7                | 15.5                      | 0.931                         | 9.78                                          | 6.12                                                          | .62                                                       |
| 22    | 83.2                       | 10.0                | 78.2                | 15.0                      | .946                          | .94                                           | 5.96                                                          | .63                                                       |
| 23    | 83.5                       | 8.1                 | 79.4                | 12.2                      | .983                          | 10.37                                         | 4.82                                                          | .68                                                       |
| 24    | 83.0                       | 7.3                 | 79.3                | 11.0                      | .979                          | .36                                           | .27                                                           | .71                                                       |
| 25    | 82.1                       | 7.5                 | 78.3                | 11.3                      | .949                          | .05                                           | .28                                                           | .70                                                       |
| 26    | 81.3                       | 8.5                 | 77.0                | 12.8                      | .910                          | 9.63                                          | .79                                                           | .67                                                       |
| 27    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 28    | 80.1                       | 8.1                 | 76.0                | 12.2                      | .882                          | .37                                           | .39                                                           | .68                                                       |
| 29    | 81.6                       | 7.0                 | 78.1                | 10.5                      | .943                          | 10.00                                         | 3.92                                                          | .72                                                       |
| 30    | 83.3                       | 6.8                 | 79.9                | 10.2                      | .998                          | .56                                           | .98                                                           | .73                                                       |
| 31    | 83.0                       | 6.8                 | 79.6                | 10.2                      | .989                          | .48                                           | .94                                                           | .73                                                       |

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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.617                                    | 29.776                                                 | 29.461  | 0.315   | 83.5                       | 87.6                                                     | 72.9 | 14.7  |
| 1          | .607                                      | .756                                                   | .461    | .295    | 83.0                       | 87.0                                                     | 72.8 | 14.2  |
| 2          | .590                                      | .736                                                   | .453    | .283    | 83.0                       | 86.8                                                     | 73.2 | 13.6  |
| 3          | .592                                      | .729                                                   | .449    | .280    | 82.6                       | 86.2                                                     | 73.2 | 13.0  |
| 4          | .602                                      | .738                                                   | .451    | .287    | 82.4                       | 86.0                                                     | 73.5 | 12.5  |
| 5          | .615                                      | .753                                                   | .473    | .280    | 82.3                       | 85.6                                                     | 74.2 | 11.4  |
| 6          | .630                                      | .763                                                   | .490    | .273    | 82.4                       | 86.0                                                     | 75.0 | 11.0  |
| 7          | .650                                      | .791                                                   | .533    | .258    | 83.6                       | 87.0                                                     | 76.8 | 10.2  |
| 8          | .668                                      | .831                                                   | .535    | .296    | 86.8                       | 90.6                                                     | 81.8 | 8.8   |
| 9          | .676                                      | .845                                                   | .546    | .299    | 89.5                       | 93.0                                                     | 85.0 | 8.0   |
| 10         | .674                                      | .835                                                   | .546    | .289    | 92.4                       | 95.8                                                     | 85.5 | 10.3  |
| 11         | .659                                      | .800                                                   | .531    | .269    | 94.6                       | 100.4                                                    | 81.6 | 18.8  |
| Noon.      | .646                                      | .792                                                   | .523    | .269    | 96.3                       | 102.6                                                    | 84.1 | 18.5  |
| 1          | .623                                      | .768                                                   | .495    | .273    | 97.8                       | 104.6                                                    | 85.7 | 18.9  |
| 2          | .596                                      | .745                                                   | .479    | .266    | 98.2                       | 105.1                                                    | 87.7 | 17.4  |
| 3          | .569                                      | .721                                                   | .460    | .261    | 98.3                       | 105.8                                                    | 90.0 | 15.8  |
| 4          | .547                                      | .703                                                   | .428    | .275    | 97.0                       | 104.8                                                    | 90.1 | 14.7  |
| 5          | .541                                      | .697                                                   | .417    | .280    | 95.0                       | 103.6                                                    | 89.8 | 13.8  |
| 6          | .555                                      | .756                                                   | .430    | .326    | 91.6                       | 100.6                                                    | 80.0 | 20.6  |
| 7          | .581                                      | .755                                                   | .464    | .291    | 87.9                       | 95.0                                                     | 75.0 | 20.0  |
| 8          | .599                                      | .758                                                   | .477    | .281    | 86.1                       | 92.2                                                     | 74.4 | 17.8  |
| 9          | .621                                      | .807                                                   | .498    | .309    | 84.5                       | 89.4                                                     | 74.3 | 15.1  |
| 10         | .625                                      | .778                                                   | .492    | .286    | 84.4                       | 88.6                                                     | 73.6 | 15.0  |
| 11         | .621                                      | .764                                                   | .452    | .312    | 83.9                       | 88.4                                                     | 72.9 | 15.5  |

The Mean Height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers 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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb<br>Thermometer. | Dry Bulb above Wet. | Computed Dew point. | Dry Bulb above Dew<br>point. | Mean Elastic force of<br>Vapour. | Mean Weight of Va-<br>pour in a Cubic foot<br>of Air. | Additional Weight of<br>vapour required for<br>complete saturation. | Mean degree of Hu-<br>midity, complete satu-<br>ration being unity. |
|----------------|-------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                             | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                           |                                                                     |
| Mid-<br>night. | 79.5                          | 4.0                 | 77.5                | 6.0                          | 0.925                            | 9.92                                                  | 2.08                                                                | 0.83                                                                |
| 1              | 79.2                          | 3.8                 | 77.3                | 5.7                          | .919                             | .86                                                   | 1.96                                                                | .83                                                                 |
| 2              | 79.4                          | 3.6                 | 77.6                | 5.4                          | .928                             | .97                                                   | .85                                                                 | .84                                                                 |
| 3              | 79.3                          | 3.3                 | 77.6                | 5.0                          | .928                             | .97                                                   | .71                                                                 | .85                                                                 |
| 4              | 79.2                          | 3.2                 | 77.6                | 4.8                          | .928                             | .97                                                   | .64                                                                 | .86                                                                 |
| 5              | 79.4                          | 2.9                 | 77.9                | 4.4                          | .937                             | 10.08                                                 | .50                                                                 | .87                                                                 |
| 6              | 79.5                          | 2.9                 | 78.0                | 4.4                          | .940                             | .11                                                   | .50                                                                 | .87                                                                 |
| 7              | 80.4                          | 3.2                 | 78.8                | 4.8                          | .964                             | .34                                                   | .69                                                                 | .86                                                                 |
| 8              | 81.9                          | 4.9                 | 79.4                | 7.4                          | .983                             | .47                                                   | 2.74                                                                | .79                                                                 |
| 9              | 82.8                          | 6.7                 | 79.4                | 10.1                         | .983                             | .41                                                   | 3.88                                                                | .73                                                                 |
| 10             | 83.4                          | 9.0                 | 78.9                | 13.5                         | .967                             | .18                                                   | 5.36                                                                | .66                                                                 |
| 11             | 83.7                          | 10.9                | 78.2                | 16.4                         | .946                             | 9.92                                                  | 6.63                                                                | .60                                                                 |
| Noon.          | 83.9                          | 12.4                | 77.7                | 18.6                         | .931                             | .72                                                   | 7.66                                                                | .56                                                                 |
| 1              | 84.5                          | 13.3                | 77.8                | 20.0                         | .934                             | .72                                                   | 8.41                                                                | .54                                                                 |
| 2              | 84.7                          | 13.5                | 77.9                | 20.3                         | .937                             | .75                                                   | .58                                                                 | .53                                                                 |
| 3              | 84.8                          | 13.5                | 78.0                | 20.3                         | .940                             | .78                                                   | .61                                                                 | .53                                                                 |
| 4              | 84.6                          | 12.4                | 78.4                | 18.6                         | .952                             | .92                                                   | 7.80                                                                | .56                                                                 |
| 5              | 83.3                          | 11.7                | 77.4                | 17.6                         | .922                             | .65                                                   | .09                                                                 | .58                                                                 |
| 6              | 82.2                          | 9.4                 | 77.5                | 14.1                         | .925                             | .76                                                   | 5.43                                                                | .64                                                                 |
| 7              | 80.7                          | 7.2                 | 77.1                | 10.8                         | .913                             | .70                                                   | 3.94                                                                | .71                                                                 |
| 8              | 80.1                          | 6.0                 | 77.1                | 9.0                          | .913                             | .74                                                   | .21                                                                 | .75                                                                 |
| 9              | 79.3                          | 5.2                 | 76.7                | 7.8                          | .902                             | .64                                                   | 2.71                                                                | .78                                                                 |
| 10             | 78.9                          | 5.5                 | 76.1                | 8.3                          | .885                             | .48                                                   | .83                                                                 | .77                                                                 |
| 11             | 78.9                          | 5.0                 | 76.4                | 7.5                          | .893                             | .56                                                   | .57                                                                 | .79                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

Meteorological Observations.

v

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                                                         |
|-------|-----------------------|---------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | o<br>1380.            | Inches.<br>..                   | S. & S. W.                        | Scatd. clouds till 8 A. M. cloudless afterwards.                                                                                                   |
| 2     | 137.0                 | ..                              | S.                                | Scatd. clouds till 1 P. M. cloudless till 7 P. M. cloudy afterwards.                                                                               |
| 3     | 135.0                 | 0.86                            | S. & S. W.                        | Cloudless till 9 A. M. Scatd. $\sim$ i & $\cap$ i till 4 P. M. cloudy afterwards; also raining between 6 & 8 P. M.                                 |
| 4     | 132.0                 | ..                              | S. & S. E.                        | Cloudless till 4 A. M. Scatd. clouds till 7 P. M. cloudy afterwards; also thunder and lightning, accompanied with little rain between 9 & 11 P. M. |
| 5     | 124.5                 | ..                              | S.                                | Scatd. clouds till 5 P. M. cloudless till 9 P. M. cloudy afterwards.                                                                               |
| 6     | <i>Sunday.</i>        |                                 |                                   |                                                                                                                                                    |
| 7     | 128.2                 | 0.94                            | S. & S. E.                        | Scatd. clouds till 4 P. M. cloudy afterwards; also raining between 6 & 8 P. M.                                                                     |
| 8     | 128.0                 | 0.09                            | S. & S. E.                        | Scatd. clouds till 6 P. M. cloudy afterwards; also thunder & lightning & a little rain between 7 & 9 P. M.                                         |
| 9     | 133.0                 | ..                              | S. & S. E.                        | Cloudless till 4 A. M. Scatd. $\sim$ i till 1 P. M. cloudless afterwards.                                                                          |
| 10    | 129.8                 | ..                              | S. E. & S.                        | Cloudy till 10 A. M. cloudless till 5 P. M. Scatd. clouds afterwards.                                                                              |
| 11    | 135.0                 | 0.32                            | S. & S. E.                        | Cloudy; also rain accompanied with thunder & lightning between 7 & 8 P. M.                                                                         |
| 12    | 137.0                 | ..                              | S. & S. E.                        | Cloudless till 3 A. M. Scatd. clouds till 7 P. M. cloudless afterwards.                                                                            |
| 13    | <i>Sunday.</i>        |                                 |                                   |                                                                                                                                                    |
| 14    | 140.0                 | ..                              | S. & S. W.                        | Cloudless.                                                                                                                                         |
| 15    | 143.9                 | ..                              | S. & S. W.                        | Cloudless.                                                                                                                                         |
| 16    | 144.0                 | ..                              | S. & N. E.                        | Cloudless.                                                                                                                                         |
| 17    | 139.0                 | ..                              | S.                                | Cloudless till 3 P. M. cloudy till 7 P. M. cloudless afterwards.                                                                                   |
| 18    | 141.0                 | ..                              | S.                                | Cloudless till 11 A. M. Scatd. $\sim$ i till 6 P. M. cloudless afterwards.                                                                         |
| 19    | 142.6                 | ..                              | S.                                | Cloudless.                                                                                                                                         |
| 20    | <i>Sunday.</i>        |                                 |                                   |                                                                                                                                                    |
| 21    | 144.8                 | ..                              | S.                                | Cloudless.                                                                                                                                         |
| 22    | 146.8                 | ..                              | S. & S. E.                        | Cloudless.                                                                                                                                         |
| 23    | 136.0                 | ..                              | S. & S. E.                        | Cloudless till 4 A. M. Scatd. $\sim$ i till 5 P. M. cloudy till 9 P. M. cloudless afterwards.                                                      |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                            |
|-------|-----------------------|---------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 24    | 135.0                 | ..                              | S. & S. E. & E.                   | Cloudless till 4 A. M. Scatd. clouds till 8 P. M. cloudless afterwards; also thunder & lightning at 5 P. M.           |
| 25    | 133.0                 | ..                              | S. & S. E.                        | Cloudless till 7 A. M. Scatd. $\text{Ci}$ afterwards; also lightning at 8 P. M.                                       |
| 26    | 134.5                 | ..                              | S. & S. E.                        | Cloudless till 7 A. M. Scatd. clouds afterwards; also slightly drizzling at 6 P. M.                                   |
| 27    | <i>Sunday.</i>        |                                 |                                   |                                                                                                                       |
| 28    | 136.4                 | ..                              | S. & N. E.                        | Cloudless till 4 A. M. Scatd. $\text{Ni}$ till 3 P. M. cloudy afterwards; also slightly drizzling between 8 & 9 P. M. |
| 29    | 132.0                 | ..                              | S. & S. E.                        | Scatd. clouds; also lightning at 7 P. M.                                                                              |
| 30    | 133.4                 | ..                              | S.                                | Cloudless till 4 A. M. Scatd. clouds afterwards.                                                                      |
| 31    | 135.0                 | ..                              | S. E. & S.                        | Scatd. $\text{Ni}$ & $\text{Ci}$ ; also slightly drizzling at 8 P. M.                                                 |

$\text{Ci}$  Cirri,  $\text{Ni}$  Cirro strati,  $\text{Ci}$  Cumuli,  $\text{Ni}$  Cumulo strati,  $\text{Ni}$  Nimbi,  $\text{Ni}$  Strati,  $\text{Ni}$  Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May, 1860.*

MONTHLY RESULTS.

|                                                                |    |    | Inches |
|----------------------------------------------------------------|----|----|--------|
| Mean height of the Barometer for the month,                    | .. | .. | 29.613 |
| Max. height of the Barometer, occurred at 9 A. M. on the 5th,  | .. | .. | 29.845 |
| Min. height of the Barometer, occurred at 5 P. M. on the 31st, | .. | .. | 29.417 |
| <i>Extreme Range</i> of the Barometer during the month,        | .. | .. | 0.428  |
| Mean of the Daily Max. Pressures,                              | .. | .. | 29.682 |
| Ditto ditto Min. ditto,                                        | .. | .. | 29.537 |
| <i>Mean daily range</i> of the Barometer during the month,     | .. | .. | 0.145  |

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|                                                              |    |    | °     |
|--------------------------------------------------------------|----|----|-------|
| Mean Dry Bulb Thermometer for the month,                     | .. | .. | 88.7  |
| Max. Temperature occurred at 3 P. M. on the 21st,            | .. | .. | 105.8 |
| Min. Temperature occurred at 1 A. M. on the 4th,             | .. | .. | 72.8  |
| <i>Extreme range</i> of the Temperature during the month,    | .. | .. | 33.0  |
| Mean of the daily Max. Temperature,                          | .. | .. | 98.7  |
| Ditto ditto Min. ditto,                                      | .. | .. | 81.0  |
| <i>Mean daily range</i> of the Temperature during the month, | .. | .. | 17.7  |

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|                                                            |    |    | °      |
|------------------------------------------------------------|----|----|--------|
| Mean Wet Bulb Thermometer for the month,                   | .. | .. | 81.4   |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, | .. | .. | 7.3    |
| Computed Mean Dew Point for the month,                     | .. | .. | 77.7   |
| Mean Dry Bulb Thermometer above computed Mean Dew Point,   | .. | .. | 11.0   |
|                                                            |    |    | Inches |
| Mean Elastic force of vapour for the month,                | .. | .. | 0.931  |

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|                                                                         |    |    | Troy grains |
|-------------------------------------------------------------------------|----|----|-------------|
| Mean weight of Vapour for the month,                                    | .. | .. | 9.88        |
| Additional weight of Vapour required for complete saturation,           | .. | .. | 4.08        |
| Mean degree of humidity for the month, complete saturation being unity, | .. | .. | 0.71        |

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|                                                   |    |    | Inches     |
|---------------------------------------------------|----|----|------------|
| Rained 8 days,—Max. fall of rain during 24 hours, | .. | .. | 0.94       |
| Total amount of rain during the month,            | .. | .. | 2.21       |
| Prevailing direction of the Wind,                 | .. | .. | S. & S. E. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May, 1860.*

## MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour,  
when any particular wind was blowing, it rained.

| Hour.     | N.           | Rain on.<br>N. E. | Rain on. | E. | Rain on.<br>S. E. | Rain on.<br>S. | Rain on.<br>S. W. | Rain on.<br>W. | Rain on.<br>N. W. | Rain on.<br>Calm. | Rain on. | Missed. |
|-----------|--------------|-------------------|----------|----|-------------------|----------------|-------------------|----------------|-------------------|-------------------|----------|---------|
|           | No. of days. |                   |          |    |                   |                |                   |                |                   |                   |          |         |
| Midnight. |              |                   |          |    | 7                 | 19             |                   |                |                   |                   |          | 1       |
| 1         |              |                   |          |    | 7                 | 19             |                   |                |                   |                   |          | 1       |
| 2         |              |                   |          |    | 7                 | 18             |                   |                |                   |                   |          | 2       |
| 3         |              |                   |          |    | 8                 | 18             | 1                 |                |                   |                   |          | 2       |
| 4         |              |                   |          |    | 9                 | 14             | 1                 |                |                   |                   |          | 3       |
| 5         |              |                   |          | 1  | 8                 | 17             | 1                 |                |                   |                   |          |         |
| 6         |              |                   |          | 4  | 8                 | 14             | 1                 |                |                   |                   |          |         |
| 7         |              | 1                 |          | 4  | 6                 | 15             | 1                 |                |                   |                   |          |         |
| 8         |              |                   |          | 1  | 5                 | 21             |                   |                |                   |                   |          |         |
| 9         |              |                   |          | 1  | 1                 | 25             |                   |                |                   |                   |          |         |
| 10        |              |                   |          |    | 1                 | 23             | 3                 |                |                   |                   |          |         |
| 11        | 1            |                   |          |    | 3                 | 18             | 3                 | 1              | 1                 |                   |          |         |
| Noon.     | 1            |                   |          |    | 1                 | 19             | 4                 | 2              | 1                 |                   |          |         |
| 1         | 1            | 2                 |          |    | 4                 | 13             | 5                 | 1              |                   | 1                 |          |         |
| 2         |              | 1                 |          |    | 6                 | 10             | 6                 | 1              | 3                 |                   |          |         |
| 3         | 2            | 2                 |          |    | 8                 | 11             | 2                 | 2              |                   |                   |          |         |
| 4         | 2            | 3                 |          |    | 4                 | 15             | 3                 | 3              |                   |                   |          |         |
| 5         | 3            | 1                 |          | 1  | 4                 | 15             | 2                 | 2              |                   |                   |          | 1       |
| 6         | 2            | 1                 |          | 3  | 5                 | 13             | 2                 | 1              | 1                 |                   |          |         |
| 7         |              |                   |          | 2  | 4                 | 18             | 1                 | 1              | 1                 | 1                 |          |         |
| 8         |              | 1                 |          | 2  | 5                 | 17             | 2                 | 1              | 1                 | 1                 |          |         |
| 9         |              | 1                 |          | 2  | 8                 | 12             | 1                 | 2              |                   |                   | 1        | 1       |
| 10        |              | 1                 |          | 4  | 7                 | 13             | 1                 | 1              |                   |                   | 1        |         |
| 11        |              | 1                 |          | 3  | 7                 | 14             | 1                 |                |                   |                   | 1        |         |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | o                             | o                                             | o    | o     |
| 1     | 29.575                                          | 29.621                                    | 29.499  | 0.122   | 88.0                          | 99.2                                          | 79.2 | 20.0  |
| 2     | .615                                            | .681                                      | .550    | .131    | 88.8                          | 98.9                                          | 78.8 | 20.1  |
| 3     | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 4     | .610                                            | .677                                      | .523    | .154    | 88.2                          | 98.6                                          | 79.0 | 19.6  |
| 5     | .602                                            | .665                                      | .545    | .120    | 86.5                          | 95.6                                          | 82.0 | 13.6  |
| 6     | .637                                            | .691                                      | .586    | .105    | 84.3                          | 91.3                                          | 81.0 | 10.3  |
| 7     | .670                                            | .742                                      | .620    | .122    | 82.3                          | 87.4                                          | 79.2 | 8.2   |
| 8     | .627                                            | .673                                      | .575    | .098    | 82.2                          | 86.4                                          | 79.8 | 6.6   |
| 9     | .608                                            | .657                                      | .555    | .102    | 84.6                          | 92.3                                          | 78.5 | 13.8  |
| 10    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 11    | .597                                            | .643                                      | .521    | .122    | 86.1                          | 93.4                                          | 81.2 | 12.2  |
| 12    | .572                                            | .631                                      | .510    | .121    | 83.9                          | 91.0                                          | 80.4 | 10.6  |
| 13    | .507                                            | .554                                      | .446    | .108    | 81.4                          | 84.8                                          | 79.4 | 5.4   |
| 14    | .442                                            | .484                                      | .368    | .116    | 81.8                          | 85.5                                          | 79.2 | 6.3   |
| 15    | .386                                            | .448                                      | .319    | .129    | 83.4                          | 88.8                                          | 79.3 | 9.5   |
| 16    | .337                                            | .385                                      | .293    | .092    | 84.4                          | 91.5                                          | 80.2 | 11.3  |
| 17    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 18    | .454                                            | .513                                      | .402    | .111    | 89.4                          | 96.4                                          | 83.4 | 13.0  |
| 19    | .539                                            | .608                                      | .479    | .129    | 83.8                          | 94.5                                          | 77.0 | 17.5  |
| 20    | .615                                            | .663                                      | .560    | .103    | 82.7                          | 90.5                                          | 77.6 | 12.9  |
| 21    | .629                                            | .676                                      | .558    | .118    | 85.3                          | 91.0                                          | 80.6 | 10.4  |
| 22    | .624                                            | .674                                      | .574    | .100    | 84.4                          | 89.0                                          | 81.2 | 7.8   |
| 23    | .594                                            | .645                                      | .534    | .111    | 86.1                          | 92.6                                          | 81.3 | 11.3  |
| 24    | <i>Sunday.</i>                                  |                                           |         |         |                               |                                               |      |       |
| 25    | .480                                            | .574                                      | .413    | .161    | 84.2                          | 87.4                                          | 78.2 | 9.2   |
| 26    | .423                                            | .458                                      | .380    | .078    | 85.1                          | 92.6                                          | 77.6 | 15.0  |
| 27    | .506                                            | .559                                      | .416    | .143    | 84.8                          | 90.6                                          | 80.6 | 10.0  |
| 28    | .529                                            | .597                                      | .469    | .128    | 86.1                          | 93.8                                          | 80.8 | 13.0  |
| 29    | .497                                            | .556                                      | .413    | .143    | 85.5                          | 92.0                                          | 80.8 | 11.2  |
| 30    | .478                                            | .549                                      | .436    | .113    | 84.1                          | 89.2                                          | 81.0 | 8.2   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.*

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 |
|-------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------|
|       | °                          | °                   | °                   | °                         | Inches.                       | T. gr.                                        | T. gr.                                                        |                                                          |
| 1     | 81.1                       | 6.9                 | 77.6                | 10.4                      | 0.928                         | 9.87                                          | 3.81                                                          | 0.72                                                     |
| 2     | 81.0                       | 7.8                 | 77.1                | 11.7                      | .913                          | .68                                           | 4.32                                                          | .69                                                      |
| 3     | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                          |
| 4     | 80.0                       | 8.2                 | 75.9                | 12.3                      | .879                          | .34                                           | .42                                                           | .68                                                      |
| 5     | 80.3                       | 6.2                 | 77.2                | 9.3                       | .916                          | .77                                           | 3.33                                                          | .75                                                      |
| 6     | 80.1                       | 4.2                 | 78.0                | 6.3                       | .940                          | 10.07                                         | 2.21                                                          | .82                                                      |
| 7     | 79.4                       | 2.9                 | 77.9                | 4.4                       | .937                          | .08                                           | 1.50                                                          | .87                                                      |
| 8     | 79.6                       | 2.6                 | 78.3                | 3.9                       | .949                          | .20                                           | .34                                                           | .88                                                      |
| 9     | 80.1                       | 4.5                 | 77.8                | 6.8                       | .934                          | 9.99                                          | 2.40                                                          | .81                                                      |
| 10    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                          |
| 11    | 80.5                       | 5.6                 | 77.7                | 8.4                       | .931                          | .94                                           | 3.01                                                          | .77                                                      |
| 12    | 80.0                       | 3.9                 | 78.0                | 5.9                       | .940                          | 10.07                                         | 2.06                                                          | .83                                                      |
| 13    | 79.2                       | 2.2                 | 78.1                | 3.3                       | .943                          | .16                                           | 1.11                                                          | .90                                                      |
| 14    | 79.3                       | 2.5                 | 78.0                | 3.8                       | .940                          | .11                                           | .29                                                           | .89                                                      |
| 15    | 80.2                       | 3.2                 | 78.6                | 4.8                       | .958                          | .28                                           | .68                                                           | .86                                                      |
| 16    | 80.6                       | 3.8                 | 78.7                | 5.7                       | .961                          | .29                                           | 2.02                                                          | .84                                                      |
| 17    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                          |
| 18    | 82.7                       | 6.7                 | 79.3                | 10.1                      | .979                          | .38                                           | 3.87                                                          | .73                                                      |
| 19    | 80.5                       | 3.3                 | 78.8                | 5.0                       | .964                          | .34                                           | 1.76                                                          | .86                                                      |
| 20    | 79.6                       | 3.1                 | 78.0                | 4.7                       | .940                          | .09                                           | .63                                                           | .86                                                      |
| 21    | 80.6                       | 4.7                 | 78.2                | 7.1                       | .946                          | .11                                           | 2.53                                                          | .80                                                      |
| 22    | 80.6                       | 3.8                 | 78.7                | 5.7                       | .961                          | .29                                           | .02                                                           | .84                                                      |
| 23    | 81.6                       | 4.5                 | 79.3                | 6.8                       | .979                          | .44                                           | .51                                                           | .81                                                      |
| 24    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                          |
| 25    | 81.4                       | 2.8                 | 80.0                | 4.2                       | 1.001                         | .72                                           | 1.52                                                          | .88                                                      |
| 26    | 81.0                       | 4.1                 | 78.9                | 6.2                       | 0.967                         | .34                                           | 2.23                                                          | .82                                                      |
| 27    | 81.3                       | 3.5                 | 79.5                | 5.3                       | .986                          | .55                                           | 1.91                                                          | .85                                                      |
| 28    | 81.5                       | 4.6                 | 79.2                | 6.9                       | .976                          | .41                                           | 2.54                                                          | .80                                                      |
| 29    | 81.2                       | 4.3                 | 79.0                | 6.5                       | .970                          | .35                                           | .37                                                           | .81                                                      |
| 30    | 80.8                       | 3.3                 | 79.1                | 5.0                       | .973                          | .42                                           | 1.79                                                          | .85                                                      |

All the Hygrometrical elements are computed by the Greenwich constants.

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of June, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fabt. | 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. | 29.555                                    | 29.742                                                 | 29.369  | 0.373   | 81.8                       | 85.6                                                     | 77.7 | 7.9   |
| 1          | .541                                      | .712                                                   | .349    | .363    | 81.5                       | 85.4                                                     | 77.7 | 7.7   |
| 2          | .531                                      | .682                                                   | .310    | .372    | 81.2                       | 85.3                                                     | 77.6 | 7.7   |
| 3          | .530                                      | .628                                                   | .390    | .238    | 81.2                       | 85.2                                                     | 77.6 | 7.6   |
| 4          | .532                                      | .650                                                   | .301    | .349    | 80.8                       | 85.0                                                     | 78.0 | 7.0   |
| 5          | .537                                      | .647                                                   | .302    | .345    | 80.9                       | 84.2                                                     | 77.8 | 6.4   |
| 6          | .554                                      | .665                                                   | .317    | .348    | 81.1                       | 84.6                                                     | 78.0 | 6.6   |
| 7          | .569                                      | .679                                                   | .344    | .335    | 82.0                       | 85.6                                                     | 79.4 | 6.2   |
| 8          | .582                                      | .688                                                   | .356    | .332    | 84.5                       | 89.0                                                     | 79.6 | 9.4   |
| 9          | .587                                      | .692                                                   | .360    | .332    | 86.2                       | 90.8                                                     | 79.8 | 11.0  |
| 10         | .586                                      | .691                                                   | .363    | .328    | 88.2                       | 93.2                                                     | 81.4 | 11.8  |
| 11         | .579                                      | .684                                                   | .364    | .320    | 89.5                       | 96.4                                                     | 81.8 | 14.6  |
| Noon.      | .564                                      | .690                                                   | .346    | .344    | 90.2                       | 99.0                                                     | 81.9 | 17.1  |
| 1          | .547                                      | .677                                                   | .325    | .352    | 89.8                       | 99.2                                                     | 81.4 | 17.8  |
| 2          | .526                                      | .647                                                   | .315    | .332    | 89.7                       | 99.0                                                     | 81.2 | 17.8  |
| 3          | .509                                      | .640                                                   | .297    | .343    | 89.4                       | 98.9                                                     | 77.0 | 21.9  |
| 4          | .490                                      | .634                                                   | .293    | .341    | 88.7                       | 97.8                                                     | 77.6 | 20.2  |
| 5          | .494                                      | .620                                                   | .300    | .320    | 87.8                       | 97.2                                                     | 77.7 | 19.5  |
| 6          | .501                                      | .629                                                   | .324    | .305    | 85.8                       | 94.0                                                     | 77.6 | 16.4  |
| 7          | .522                                      | .650                                                   | .332    | .318    | 84.4                       | 91.0                                                     | 78.0 | 13.0  |
| 8          | .538                                      | .658                                                   | .347    | .311    | 83.7                       | 90.0                                                     | 77.8 | 12.2  |
| 9          | .556                                      | .678                                                   | .367    | .311    | 83.3                       | 88.6                                                     | 77.8 | 10.8  |
| 10         | .569                                      | .687                                                   | .367    | .320    | 82.9                       | 87.8                                                     | 77.8 | 10.0  |
| 11         | .561                                      | .691                                                   | .374    | .317    | 82.3                       | 86.6                                                     | 78.4 | 8.2   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force<br>of Vapour. | Mean Weight of Va-<br>pour in a Cubic<br>foot of Air. | Additional Weight of<br>Vapour required<br>for complete satu-<br>ration. | Mean degree of Hu-<br>midity, complete<br>saturation being<br>unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                                | T. gr.                                                                   |                                                                      |
| Mid-<br>night. | 79.0                            | 2.8                 | 77.6                | 4.2                          | 0.928                            | 9.99                                                  | 1.41                                                                     | 0.88                                                                 |
| 1              | 78.8                            | 2.7                 | 77.4                | 4.1                          | .922                             | .93                                                   | .38                                                                      | .88                                                                  |
| 2              | 78.8                            | 2.4                 | 77.6                | 3.6                          | .928                             | .99                                                   | .22                                                                      | .89                                                                  |
| 3              | 79.0                            | 2.2                 | 77.9                | 3.3                          | .937                             | 10.10                                                 | .11                                                                      | .90                                                                  |
| 4              | 78.6                            | 2.2                 | 77.5                | 3.3                          | .925                             | 9.98                                                  | .09                                                                      | .90                                                                  |
| 5              | 78.8                            | 2.1                 | 77.7                | 3.2                          | .931                             | 10.04                                                 | .06                                                                      | .91                                                                  |
| 6              | 79.0                            | 2.1                 | 77.9                | 3.2                          | .937                             | .10                                                   | .07                                                                      | .90                                                                  |
| 7              | 79.7                            | 2.3                 | 78.5                | 3.5                          | .955                             | .27                                                   | .20                                                                      | .90                                                                  |
| 8              | 80.9                            | 3.6                 | 79.1                | 5.4                          | .973                             | .42                                                   | .93                                                                      | .84                                                                  |
| 9              | 81.4                            | 4.8                 | 79.0                | 7.2                          | .970                             | .35                                                   | 2.64                                                                     | .80                                                                  |
| 10             | 82.1                            | 6.1                 | 79.0                | 9.2                          | .970                             | .31                                                   | 3.45                                                                     | .75                                                                  |
| 11             | 82.4                            | 7.1                 | 78.8                | 10.7                         | .964                             | .21                                                   | 4.08                                                                     | .71                                                                  |
|                |                                 |                     |                     |                              |                                  |                                                       |                                                                          |                                                                      |
| Noon.          | 82.6                            | 7.6                 | 78.8                | 11.4                         | .964                             | .21                                                   | .38                                                                      | .70                                                                  |
| 1              | 82.3                            | 7.5                 | 78.5                | 11.3                         | .955                             | .12                                                   | .30                                                                      | .70                                                                  |
| 2              | 82.4                            | 7.3                 | 78.7                | 11.0                         | .961                             | .18                                                   | .19                                                                      | .71                                                                  |
| 3              | 82.2                            | 7.2                 | 78.6                | 10.8                         | .958                             | .15                                                   | .10                                                                      | .71                                                                  |
| 4              | 82.0                            | 6.7                 | 78.6                | 10.1                         | .958                             | .17                                                   | 3.79                                                                     | .73                                                                  |
| 5              | 81.9                            | 5.9                 | 78.9                | 8.9                          | .967                             | .28                                                   | .32                                                                      | .76                                                                  |
| 6              | 81.2                            | 4.6                 | 78.9                | 6.9                          | .967                             | .32                                                   | 2.51                                                                     | .80                                                                  |
| 7              | 80.2                            | 4.2                 | 78.1                | 6.3                          | .943                             | .10                                                   | .21                                                                      | .82                                                                  |
| 8              | 80.1                            | 3.6                 | 78.3                | 5.4                          | .949                             | .18                                                   | 1.89                                                                     | .84                                                                  |
| 9              | 80.0                            | 3.3                 | 78.3                | 5.0                          | .949                             | .18                                                   | .75                                                                      | .85                                                                  |
| 10             | 79.9                            | 3.0                 | 78.4                | 4.5                          | .952                             | .21                                                   | .58                                                                      | .87                                                                  |
| 11             | 79.6                            | 2.7                 | 78.2                | 4.1                          | .946                             | .17                                                   | .41                                                                      | .88                                                                  |

All the Hygrometrical elements are computed by the Greenwich constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.  
Solar Radiation, Weather, &c.*

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                           |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------|
| 1     | 134.0                 | Inches.<br>..                   | S. & E. & S. E.                   | Scatd. clouds; also very slightly drizzling at 7 P. M.                                               |
| 2     | 137.9                 | ..                              | S. & S. W.                        | Cloudless till 3 A. M. cloudy till 11 A. M. Scatd. ~i till 5 P. M. cloudless afterwards.             |
| 3     | <i>Sunday.</i>        |                                 |                                   |                                                                                                      |
| 4     | 133.6                 | ..                              | N. E.                             | Scatd. clouds till 4 A. M. cloudless till 10 A. M. Scatd. ~i afterwards.                             |
| 5     | 127.0                 | ..                              | S.                                | Scatd. ~i & ^i till 1 P. M. cloudy afterwards; also very slightly drizzling at 5 P. M.               |
| 6     | ..                    | ..                              | E. & S. E.                        | Scatd. ~i till 6 A. M. cloudy afterwards; also drizzling after intervals between 1 P. M. & midnight. |
| 7     | ..                    | 0.15                            | E.                                | Cloudy; also constantly drizzling between Noon & 6 P. M.                                             |
| 8     | ..                    | ..                              | E. & S.                           | Cloudy; also constantly drizzling.                                                                   |
| 9     | 124.0                 | 0.34                            | S. & E.                           | Scatd. ~i & ^i till 6 P. M. cloudless afterwards; also raining between 5 & 6 P. M.                   |
| 10    | <i>Sunday.</i>        |                                 |                                   |                                                                                                      |
| 11    | ..                    | 0.32                            | N. E. & S. E. & E.                | Scatd. ~i till 6 A. M. cloudy afterwards; also raining between 6 & 7 P. M.                           |
| 12    | ..                    | ..                              | E. & S.                           | Cloudy; also drizzling at 1 & 5 & 6 P. M.                                                            |
| 13    | ..                    | 1.16                            | S. & S. W.                        | Cloudy; also constantly raining or drizzling.                                                        |
| 14    | ..                    | 0.28                            | S. W. & W.                        | Cloudy; also occasionally drizzling.                                                                 |
| 15    | ..                    | 0.34                            | S. W. & calm.                     | Cloudy; also raining between Noon & 1 P. M. & drizzling between 8 & 11 P. M.                         |
| 16    | ..                    | 0.39                            | S. W. & S.                        | Cloudy; also drizzling at 11 A. M. & between 5 & 9 P. M.                                             |
| 17    | <i>Sunday.</i>        |                                 |                                   |                                                                                                      |
| 18    | 137.0                 | ..                              | S. W. & S.                        | Cloudy till 8 A. M. cloudless till 3 P. M. cloudy till 8 P. M. cloudless afterwards.                 |
| 19    | 120.5                 | 1.18                            | S. & E. & S. E.                   | Cloudless till 3 A. M. cloudy afterwards; also raining between 2 & 6 P. M.                           |
| 20    | 112.0                 | 0.14                            | S. & S. E. & E.                   | Cloudless till 8 A. M. Scatd. ~i till 1 P. M. cloudy afterwards; also raining at 2 P. M.             |
| 21    | 135.0                 | ..                              | S. E. & E. & S.                   | Cloudless till 10 A. M. Scatd. ^i & ~i till 7 P. M. cloudless afterwards.                            |

~i Cirri, ~i Cirro strati, ^i Cumuli, ~i Cumulo strati, ~i Nimbi, —i Strati, ~i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                                               |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 22    | o<br>..               | Inches.<br>..                   | S.                                | Cloudless till 7 A. M. cloudy till 2 P. M. Scatd. $\curvearrowright$ & $\curvearrowleft$ afterwards; also drizzling between 9 & 10 A. M. |
| 23    | 132.0                 | ..                              | S.                                | Cloudless till 4 A. M. Scatd. $\curvearrowleft$ & $\curvearrowright$ till 11 A. M. cloudy till 7 P. M. cloudless afterwards.             |
| 24    | Sunday.               | 1.32                            |                                   |                                                                                                                                          |
| 25    | ..                    | 0.21                            | S. & S. W.                        | Cloudy; also drizzling between midnight & 2 A. M.; also slightly raining at noon & at 11 P. M.                                           |
| 26    | 126.0                 | 0.46                            | S. & S. W.                        | Cloudy till 9 A. M. Scatd. $\curvearrowleft$ afterwards; also raining between midnight & 2 A. M.                                         |
| 27    | ..                    | ..                              | S. & E.                           | Cloudy; also drizzling between 3 & 7 A. M.                                                                                               |
| 28    | 127.0                 | ..                              | S. & N. E.                        | Scatd. clouds till 3 P. M. Scatd. $\curvearrowleft$ afterwards.                                                                          |
| 29    | 132.4                 | 0.10                            | N. E. & E.                        | Cloudy; also drizzling at noon & between 4 & 6 P. M.                                                                                     |
| 30    | 126.0                 | 0.07                            | S. & N.                           | Cloudy; also drizzling at 1 & 5 & 6 A. M. & also at Noon.                                                                                |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.*

MONTHLY RESULTS.

|                                                               |    |    |        |
|---------------------------------------------------------------|----|----|--------|
|                                                               |    |    | Inches |
| Mean height of the Barometer for the month,                   | .. | .. | 29.544 |
| Max. height of the Barometer occurred at Midnight on the 7th, | .. | .. | 29.742 |
| Min. height of the Barometer occurred at 4 P. M. on the 16th, | .. | .. | 29.293 |
| <i>Extreme range</i> of the Barometer during the month,       | .. | .. | 0.449  |
| Mean of the daily Max. Pressures,                             | .. | .. | 29.601 |
| Ditto ditto Min. ditto,                                       | .. | .. | 29.482 |
| <i>Mean daily range</i> of the Barometer during the month,    | .. | .. | 0.119  |

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|                                                              |    |    |      |
|--------------------------------------------------------------|----|----|------|
|                                                              |    |    | °    |
| Mean Dry Bulb Thermometer for the month,                     | .. | .. | 84.9 |
| Max. Temperature occurred at 1 P. M. on the 1st,             | .. | .. | 99.2 |
| Min. Temperature occurred at 3 P. M. on the 19th,            | .. | .. | 77.0 |
| <i>Extreme range</i> of the Temperature during the month,    | .. | .. | 22.2 |
| Mean of the daily Max. Temperature,                          | .. | .. | 91.7 |
| Ditto ditto Min. ditto,                                      | .. | .. | 79.9 |
| <i>Mean daily range</i> of the Temperature during the month, | .. | .. | 11.8 |

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|                                                            |    |    |      |
|------------------------------------------------------------|----|----|------|
|                                                            |    |    | °    |
| Mean Wet Bulb Thermometer for the month,                   | .. | .. | 80.6 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, | .. | .. | 4.3  |
| Computed Mean Dew-point for the month,                     | .. | .. | 78.4 |
| Mean Dry Bulb Thermometer above computed Mean Dew-point,   | .. | .. | 6.5  |

|                                             |    |    |        |
|---------------------------------------------|----|----|--------|
|                                             |    |    | Inches |
| Mean Elastic force of Vapour for the month, | .. | .. | 0.952  |

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|                                                                         |    |    |             |
|-------------------------------------------------------------------------|----|----|-------------|
|                                                                         |    |    | Troy grains |
| Mean Weight of Vapour for the month,                                    | .. | .. | 10.17       |
| Additional Weight of Vapour required for complete saturation,           | .. | .. | 2.32        |
| Mean degree of humidity for the month, complete saturation being unity, | .. | .. | 0.81        |

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|                                                    |    |    |         |
|----------------------------------------------------|----|----|---------|
|                                                    |    |    | Inches  |
| Rained 21 days, Max. fall of rain during 24 hours, | .. | .. | 1.32    |
| Total amount of rain during the month,             | .. | .. | 6.46    |
| Prevailing direction of the Wind,                  | .. | .. | S. & E. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June, 1860.*

## MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.           |          | N. E.    |          | E.       |          | S. E.    |          | S.       |          | S. W.    |          | W.       |          | N. W.    |          | Calm.    |          | Missed.  |          |
|-----------|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|           | Rain on.     | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. |
|           | No. of days. |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Midnight. | 1            | 1        | 6        | 1        | 3        | 10       | 2        | 3        |          |          |          |          |          |          |          |          |          | 1        | 3        | 1        |
| 1         | 1            | 1        | 6        | 3        | 3        | 10       | 2        | 2        | 2        | 1        |          |          |          |          |          |          |          | 3        | 3        |          |
| 2         | 1            | 1        | 6        | 3        | 3        | 10       | 2        | 2        | 2        | 1        |          |          |          |          |          |          |          | 3        | 3        |          |
| 3         | 2            | 2        | 6        | 1        | 1        | 9        | 2        | 1        | 1        |          | 1        | 1        |          |          |          |          |          |          |          | 4        |
| 4         | 2            | 2        | 8        | 1        | 1        | 10       | 2        | 1        | 1        |          | 1        | 1        | 1        |          |          |          |          |          |          | 1        |
| 5         | 3            | 1        | 6        | 1        | 2        | 9        | 1        | 2        | 2        |          | 2        | 2        | 2        |          |          |          |          |          |          |          |
| 6         | 3            | 3        | 7        | 1        | 2        | 8        | 1        | 2        | 1        |          | 1        | 1        | 2        |          |          |          |          |          |          |          |
| 7         | 1            | 5        | 7        | 2        | 3        | 6        | 1        | 4        | 6        |          | 1        | 4        | 1        |          |          |          |          |          |          |          |
| 8         |              | 3        | 8        | 2        | 2        | 9        | 2        | 4        | 7        |          | 2        | 4        |          |          |          |          |          |          |          |          |
| 9         |              | 1        | 10       | 2        | 2        | 7        | 1        | 6        | 6        |          | 2        | 6        | 2        |          |          |          |          |          |          |          |
| 10        |              | 1        | 9        | 3        | 3        | 6        | 1        | 6        | 6        |          | 1        | 6        | 1        |          |          |          |          |          |          |          |
| 11        |              | 5        | 5        | 2        | 2        | 5        | 1        | 6        | 9        |          | 1        | 9        | 1        |          |          |          |          |          |          |          |
| Noon.     | 1            | 2        | 4        | 1        | 4        | 6        | 1        | 6        | 1        | 6        | 1        | 3        | 3        | 1        |          |          |          |          |          |          |
| 1         |              | 3        | 3        | 2        | 4        | 7        | 2        | 8        | 8        | 2        | 2        | 1        | 1        | 1        |          |          |          |          |          |          |
| 2         | 1            | 2        | 5        | 2        | 3        | 7        | 2        | 7        | 7        | 1        | 1        | 1        | 2        |          |          |          |          |          |          |          |
| 3         | 1            | 2        | 4        | 1        | 4        | 7        | 1        | 6        | 6        | 1        | 1        | 1        | 2        | 1        |          |          |          |          |          |          |
| 4         |              | 2        | 3        | 1        | 5        | 12       | 1        | 1        | 2        | 1        | 1        | 1        | 1        |          |          |          |          |          |          | 1        |
| 5         |              | 2        | 4        | 1        | 2        | 15       | 5        | 2        | 2        | 2        | 2        | 2        |          |          |          |          |          | 1        | 1        |          |
| 6         |              | 1        | 5        | 3        | 3        | 12       | 2        | 4        | 1        | 1        | 1        | 1        | 1        |          |          |          |          | 1        | 1        |          |
| 7         |              | 1        | 3        | 1        | 2        | 14       | 1        | 3        | 3        | 1        | 1        | 1        | 1        | 1        |          |          |          | 2        | 2        | 1        |
| 8         |              | 2        | 3        | 1        | 2        | 13       |          | 3        | 3        | 1        | 1        | 1        | 1        | 1        |          |          |          | 2        | 2        | 1        |
| 9         |              | 2        | 3        | 1        | 2        | 13       |          | 3        | 3        | 1        | 1        | 1        | 1        | 1        |          |          |          | 2        | 2        | 1        |
| 10        |              | 2        | 3        | 3        | 3        | 13       |          | 3        | 3        | 1        | 1        | 1        | 1        | 1        |          |          |          | 2        | 2        | 1        |
| 11        |              | 2        | 2        | 1        | 3        | 11       | 1        | 3        | 11       | 1        | 3        | 1        | 1        | 1        |          |          |          | 3        | 3        | 2        |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July, 1860.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 2     | 29.530                                    | 29.584                                 | 29.462  | 0.122   | 85.3                       | 91.4                                     | 81.0 | 10.4  |
| 3     | .521                                      | .558                                   | .457    | .101    | 85.5                       | 91.3                                     | 78.6 | 12.7  |
| 4     | .524                                      | .561                                   | .458    | .103    | 85.0                       | 89.6                                     | 82.2 | 7.4   |
| 5     | .539                                      | .586                                   | .488    | .098    | 85.3                       | 90.6                                     | 81.4 | 9.2   |
| 6     | .532                                      | .569                                   | .478    | .091    | 85.5                       | 90.6                                     | 82.5 | 8.1   |
| 7     | .500                                      | .537                                   | .434    | .103    | 85.3                       | 90.4                                     | 82.0 | 8.4   |
| 8     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 9     | .526                                      | .561                                   | .482    | .079    | 85.7                       | 90.8                                     | 81.6 | 9.2   |
| 10    | .505                                      | .566                                   | .468    | .098    | 87.3                       | 93.8                                     | 82.8 | 11.0  |
| 11    | .446                                      | .494                                   | .373    | .121    | 88.8                       | 96.8                                     | 82.0 | 14.8  |
| 12    | .456                                      | .519                                   | .401    | .118    | 87.0                       | 96.4                                     | 83.4 | 13.0  |
| 13    | .511                                      | .575                                   | .458    | .117    | 87.0                       | 94.0                                     | 81.4 | 12.6  |
| 14    | .534                                      | .574                                   | .486    | .088    | 85.4                       | 89.8                                     | 82.0 | 7.8   |
| 15    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 16    | .561                                      | .622                                   | .515    | .107    | 82.6                       | 87.4                                     | 79.8 | 7.6   |
| 17    | .584                                      | .624                                   | .527    | .097    | 83.2                       | 88.8                                     | 80.0 | 8.8   |
| 18    | .599                                      | .644                                   | .537    | .107    | 83.7                       | 88.6                                     | 80.0 | 8.6   |
| 19    | .567                                      | .605                                   | .514    | .091    | 83.7                       | 87.2                                     | 80.7 | 6.5   |
| 20    | .578                                      | .619                                   | .502    | .117    | 83.0                       | 84.8                                     | 80.6 | 4.2   |
| 21    | .552                                      | .592                                   | .491    | .101    | 83.3                       | 87.8                                     | 80.6 | 7.2   |
| 22    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 23    | .579                                      | .637                                   | .536    | .101    | 79.4                       | 81.6                                     | 77.0 | 4.6   |
| 24    | .592                                      | .635                                   | .532    | .103    | 80.7                       | 87.2                                     | 77.8 | 9.4   |
| 25    | .532                                      | .573                                   | .476    | .097    | 80.7                       | 83.4                                     | 78.0 | 5.4   |
| 26    | .496                                      | .546                                   | .434    | .112    | 79.6                       | 80.6                                     | 77.9 | 2.7   |
| 27    | .508                                      | .561                                   | .460    | .101    | 81.6                       | 84.1                                     | 78.4 | 5.7   |
| 28    | .511                                      | .545                                   | .464    | .081    | 81.8                       | 87.2                                     | 77.6 | 9.6   |
| 29    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 30    | .512                                      | .574                                   | .451    | .123    | 82.3                       | 85.7                                     | 79.0 | 6.7   |
| 31    | .537                                      | .586                                   | .471    | .115    | 82.9                       | 89.0                                     | 79.2 | 9.8   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four 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, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                     |
| 1     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 2     | 81.4                            | 3.9                 | 79.4                | 5.9                          | 0.983                            | 10.49                                            | 2.15                                                                    | 0.83                                                                |
| 3     | 81.4                            | 4.1                 | 79.3                | 6.2                          | .979                             | .46                                              | .26                                                                     | .82                                                                 |
| 4     | 81.8                            | 3.2                 | 80.2                | 4.8                          | 1.008                            | .77                                              | 1.76                                                                    | .86                                                                 |
| 5     | 82.1                            | 3.2                 | 80.5                | 4.8                          | .017                             | .87                                              | .77                                                                     | .86                                                                 |
| 6     | 81.8                            | 3.7                 | 79.9                | 5.6                          | 0.998                            | .65                                              | 2.07                                                                    | .84                                                                 |
| 7     | 81.7                            | 3.6                 | 79.9                | 5.4                          | .998                             | .67                                              | 1.97                                                                    | .84                                                                 |
| 8     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 9     | 82.0                            | 3.7                 | 80.1                | 5.6                          | 1.005                            | .71                                              | 2.09                                                                    | .84                                                                 |
| 10    | 82.5                            | 4.8                 | 80.1                | 7.2                          | .005                             | .69                                              | .72                                                                     | .80                                                                 |
| 11    | 83.1                            | 5.7                 | 80.2                | 8.6                          | .008                             | .68                                              | 3.32                                                                    | .76                                                                 |
| 12    | 82.4                            | 4.6                 | 80.1                | 6.9                          | .005                             | .69                                              | 2.60                                                                    | .80                                                                 |
| 13    | 81.6                            | 5.4                 | 78.9                | 8.1                          | 0.967                            | .30                                              | .99                                                                     | .78                                                                 |
| 14    | 80.7                            | 4.7                 | 78.3                | 7.1                          | .949                             | .14                                              | .54                                                                     | .80                                                                 |
| 15    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 16    | 79.8                            | 2.8                 | 78.4                | 4.2                          | .952                             | .23                                              | 1.45                                                                    | .88                                                                 |
| 17    | 80.3                            | 2.9                 | 78.8                | 4.4                          | .964                             | .36                                              | .53                                                                     | .87                                                                 |
| 18    | 80.5                            | 3.2                 | 78.9                | 4.8                          | .967                             | .37                                              | .70                                                                     | .86                                                                 |
| 19    | 80.2                            | 3.5                 | 78.4                | 5.3                          | .952                             | .21                                              | .86                                                                     | .85                                                                 |
| 20    | 80.4                            | 2.6                 | 79.1                | 3.9                          | .973                             | .45                                              | .37                                                                     | .88                                                                 |
| 21    | 80.8                            | 2.5                 | 79.5                | 3.8                          | .986                             | .57                                              | .36                                                                     | .89                                                                 |
| 22    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 23    | 77.8                            | 1.6                 | 77.0                | 2.4                          | .910                             | 9.85                                             | 0.77                                                                    | .93                                                                 |
| 24    | 78.5                            | 2.2                 | 77.4                | 3.3                          | .922                             | .95                                              | 1.09                                                                    | .90                                                                 |
| 25    | 79.2                            | 1.5                 | 78.4                | 2.3                          | .952                             | 10.27                                            | 0.77                                                                    | .93                                                                 |
| 26    | 78.7                            | 0.9                 | 78.2                | 1.4                          | .946                             | .24                                              | .45                                                                     | .96                                                                 |
| 27    | 79.5                            | 2.1                 | 78.4                | 3.2                          | .952                             | .25                                              | 1.09                                                                    | .90                                                                 |
| 28    | 79.2                            | 2.6                 | 77.9                | 3.9                          | .937                             | .08                                              | .32                                                                     | .88                                                                 |
| 29    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 30    | 79.7                            | 2.6                 | 78.4                | 3.9                          | .952                             | .23                                              | .35                                                                     | .88                                                                 |
| 31    | 80.3                            | 2.6                 | 79.0                | 3.9                          | .970                             | .42                                              | .37                                                                     | .88                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of July, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.549                                    | 29.630                                                 | 29.459  | 0.171   | 82.1                       | 86.0                                                     | 78.4 | 7.6   |
| 1          | .537                                      | .609                                                   | .447    | .162    | 81.7                       | 85.8                                                     | 77.3 | 8.5   |
| 2          | .530                                      | .605                                                   | .436    | .169    | 81.4                       | 85.4                                                     | 77.8 | 7.6   |
| 3          | .519                                      | .602                                                   | .420    | .182    | 81.2                       | 84.8                                                     | 77.6 | 7.2   |
| 4          | .518                                      | .597                                                   | .421    | .176    | 80.7                       | 84.6                                                     | 77.0 | 7.6   |
| 5          | .524                                      | .600                                                   | .431    | .169    | 80.7                       | 84.4                                                     | 77.6 | 6.8   |
| 6          | .537                                      | .608                                                   | .450    | .158    | 80.6                       | 84.2                                                     | 77.8 | 6.4   |
| 7          | .551                                      | .623                                                   | .469    | .154    | 81.3                       | 85.2                                                     | 78.2 | 7.0   |
| 8          | .564                                      | .644                                                   | .479    | .165    | 83.4                       | 87.8                                                     | 78.6 | 9.2   |
| 9          | .569                                      | .643                                                   | .490    | .153    | 84.6                       | 89.4                                                     | 78.0 | 11.4  |
| 10         | .568                                      | .631                                                   | .484    | .147    | 86.1                       | 91.6                                                     | 78.6 | 13.0  |
| 11         | .563                                      | .637                                                   | .477    | .160    | 87.0                       | 93.7                                                     | 79.6 | 14.1  |
| Noon.      | .547                                      | .616                                                   | .457    | .159    | 87.6                       | 95.0                                                     | 79.5 | 15.5  |
| 1          | .531                                      | .613                                                   | .437    | .176    | 87.6                       | 96.4                                                     | 79.6 | 16.8  |
| 2          | .508                                      | .588                                                   | .414    | .174    | 87.3                       | 96.8                                                     | 80.4 | 16.4  |
| 3          | .493                                      | .569                                                   | .401    | .168    | 86.7                       | 96.8                                                     | 80.4 | 16.4  |
| 4          | .479                                      | .547                                                   | .373    | .174    | 86.4                       | 96.8                                                     | 80.4 | 16.4  |
| 5          | .479                                      | .541                                                   | .376    | .165    | 85.9                       | 94.4                                                     | 80.6 | 13.8  |
| 6          | .490                                      | .552                                                   | .392    | .160    | 85.0                       | 92.2                                                     | 80.6 | 11.6  |
| 7          | .509                                      | .579                                                   | .398    | .181    | 84.1                       | 91.4                                                     | 78.8 | 12.6  |
| 8          | .529                                      | .597                                                   | .436    | .161    | 83.6                       | 88.8                                                     | 79.3 | 9.5   |
| 9          | .548                                      | .616                                                   | .458    | .158    | 83.0                       | 86.6                                                     | 79.6 | 7.0   |
| 10         | .558                                      | .637                                                   | .472    | .165    | 82.7                       | 86.4                                                     | 79.0 | 7.4   |
| 11         | .560                                      | .637                                                   | .469    | .168    | 82.4                       | 86.0                                                     | 78.8 | 7.2   |

The Mean Height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb<br>Thermometer. | Dry Bulb above Wet. | Computed Dew point. | Dry Bulb above Dew<br>point. | Mean Elastic force of<br>Vapour. | Mean Weight of Va-<br>pour in a Cubic foot<br>of Air. | Additional Weight of<br>vapour required for<br>complete saturation. | Mean degree of Hu-<br>midity, complete satu-<br>ration being unity. |
|----------------|-------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                             | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                           |                                                                     |
| Mid-<br>night. | 80.0                          | 2.1                 | 78.9                | 3.2                          | .967                             | 10.41                                                 | 1.10                                                                | 0.90                                                                |
| 1              | 79.7                          | 2.0                 | 78.7                | 3.0                          | .961                             | .35                                                   | .02                                                                 | .91                                                                 |
| 2              | 79.5                          | 1.9                 | 78.5                | 2.9                          | .955                             | .29                                                   | 0.98                                                                | .91                                                                 |
| 3              | 79.3                          | 1.9                 | 78.3                | 2.9                          | .949                             | .22                                                   | .99                                                                 | .91                                                                 |
| 4              | 79.0                          | 1.7                 | 78.1                | 2.6                          | .943                             | .16                                                   | .88                                                                 | .92                                                                 |
| 5              | 79.0                          | 1.7                 | 78.1                | 2.6                          | .943                             | .16                                                   | .88                                                                 | .92                                                                 |
| 6              | 79.0                          | 1.6                 | 78.2                | 2.4                          | .946                             | .21                                                   | .80                                                                 | .93                                                                 |
| 7              | 79.6                          | 1.7                 | 78.7                | 2.6                          | .961                             | .35                                                   | .89                                                                 | .92                                                                 |
| 8              | 80.7                          | 2.7                 | 79.3                | 4.1                          | .979                             | .51                                                   | 1.45                                                                | .88                                                                 |
| 9              | 81.3                          | 3.3                 | 79.6                | 5.0                          | .989                             | .58                                                   | .81                                                                 | .85                                                                 |
| 10             | 81.9                          | 4.2                 | 79.8                | 6.3                          | .995                             | .62                                                   | 2.33                                                                | .82                                                                 |
| 11             | 82.3                          | 4.7                 | 79.9                | 7.1                          | .998                             | .63                                                   | .66                                                                 | .80                                                                 |
| Noon.          | 82.5                          | 5.1                 | 79.9                | 7.7                          | .998                             | .61                                                   | .91                                                                 | .79                                                                 |
| 1              | 82.4                          | 5.2                 | 79.8                | 7.8                          | .995                             | .58                                                   | .94                                                                 | .78                                                                 |
| 2              | 82.4                          | 4.9                 | 79.9                | 7.4                          | .998                             | .63                                                   | .78                                                                 | .79                                                                 |
| 3              | 81.7                          | 5.0                 | 79.2                | 7.5                          | .976                             | .39                                                   | .79                                                                 | .79                                                                 |
| 4              | 81.7                          | 4.7                 | 79.3                | 7.1                          | .979                             | .44                                                   | .62                                                                 | .80                                                                 |
| 5              | 81.5                          | 4.4                 | 79.3                | 6.6                          | .979                             | .44                                                   | .43                                                                 | .81                                                                 |
| 6              | 80.9                          | 4.1                 | 78.8                | 6.2                          | .964                             | .31                                                   | .22                                                                 | .82                                                                 |
| 7              | 80.7                          | 3.4                 | 79.0                | 5.1                          | .970                             | .40                                                   | 1.81                                                                | .85                                                                 |
| 8              | 80.5                          | 3.1                 | 78.9                | 4.7                          | .967                             | .37                                                   | .66                                                                 | .86                                                                 |
| 9              | 80.2                          | 2.8                 | 78.8                | 4.2                          | .964                             | .36                                                   | .46                                                                 | .88                                                                 |
| 10             | 80.2                          | 2.5                 | 78.9                | 3.8                          | .967                             | .39                                                   | .33                                                                 | .89                                                                 |
| 11             | 80.1                          | 2.3                 | 78.9                | 3.5                          | .967                             | .39                                                   | .22                                                                 | .90                                                                 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                      |
|-------|-----------------------|---------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------|
| 1     | o                     | Inches.                         |                                   |                                                                                                 |
| 2     | Sunday.<br>130.8      | 0.80                            | S. & S. E.                        | Cloudless till 6 A. M. Scatd. \i & \j afterwards; also drizzling at 1 & at 5 P. M.              |
| 3     | ..                    | 0.86                            | S.                                | Scatd. \i & \j till 6 P. M. cloudless afterwards; also raining at 4 A. M.                       |
| 4     | ..                    | 0.09                            | S. & S. E.                        | Cloudless till 4 A. M. cloudy afterwards; also constantly drizzling between 2 & 8 P. M.         |
| 5     | ..                    | 0.60                            | S.                                | Cloudy; also raining between 8 A. M. & 1 P. M.                                                  |
| 6     | 115.0                 | ..                              | S.                                | Cloudy; also slightly raining at 4 A. M.                                                        |
| 7     | ..                    | 1.38                            | S.                                | Scatd. \i till 5 A. M. cloudy afterwards; also raining after intervals between 1 & 10 P. M.     |
| 8     | Sunday.               |                                 |                                   |                                                                                                 |
| 9     | ..                    | ..                              | S. & S. W.                        | Cloudy.                                                                                         |
| 10    | 120.0                 | ..                              | S. & S. W.                        | Scatd. \i till 1 P. M. Scatd. clouds till 7 P. M. cloudless afterwards.                         |
| 11    | 135.0                 | ..                              | S. W. & S.                        | Scatd. \i & \j till 7 A. M. cloudless till 1 P. M. Scatd. \i till 7 P. M. cloudless afterwards. |
| 12    | 123.7                 | ..                              | S.                                | Cloudy.                                                                                         |
| 13    | 128.0                 | ..                              | S. E. & S.                        | Cloudless till 9 A. M. Scatd. \i & \j afterwards.                                               |
| 14    | ..                    | ..                              | S. E. & S. & E.                   | Cloudless till 4 A. M. cloudy till 7 P. M. cloudless afterwards.                                |
| 15    | Sunday.               | 1.60                            |                                   |                                                                                                 |
| 16    | ..                    | 0.22                            | S. & S. E.                        | Scatd. \i till 10 A. M. cloudy afterwards; also drizzling at Noon & 3 P. M.                     |
| 17    | ..                    | 0.42                            | S. & S. E.                        | Cloudy; also raining at Midnight & between 10 A. M. & 1 P. M.                                   |
| 18    | ..                    | 0.26                            | S. & S. E.                        | Cloudy; also raining at 1 A. M. & 10 & 11 A. M.                                                 |
| 19    | ..                    | ..                              | S. & S. W.                        | Cloudless till 7 A. M. Scatd. \i till 6 P. M. Scatd. \i & \j afterwards.                        |
| 20    | ..                    | ..                              | S. E.                             | Cloudy till 7 P. M. cloudless afterwards; also drizzling at 9 A. M.                             |
| 21    | ..                    | 0.15                            | S. & S. W. & S. E.                | Cloudless till 8 A. M. cloudy afterwards; also raining at 10 A. M.                              |
| 22    | Sunday.               | 1.86                            |                                   |                                                                                                 |
| 23    | ..                    | 1.85                            | S. & S. E.                        | Cloudy; also constantly raining before 1 P. M.                                                  |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                            |
|-------|-----------------------|---------------------------------|-----------------------------------|-------------------------------------------------------|
| 24    | ..                    | 0.12                            | S. E. & S.                        | Cloudy ; also constantly raining.                     |
| 25    | ..                    | 2.84                            | S. E. & W. & S.                   | Cloudy ; also constantly raining.                     |
| 26    | ..                    | 2.02                            | S.                                | Cloudy, with rain the whole day.                      |
| 27    | ..                    | ..                              | S. & S. E.                        | Cloudy ; also drizzling at 6 A. M.                    |
| 28    | ..                    | 1.10                            | S. & S. E.                        | Cloudy ; also incessantly raining between 2 & 8 A. M. |
| 29    | <i>Sunday.</i>        | 0.28                            |                                   |                                                       |
| 30    | ..                    | 0.49                            | S. & S. E.                        | Cloudy ; also occasionally drizzling.                 |
| 31    | 117.0                 | 0.98                            | E. & S.                           | Cloudy ; also raining at 3 & 7 P. M.                  |

∩ i Cirri, ∪ i Cirro strati, ∪ i Cumuli, ∩ l Cumulo strati, ∪ i Nimbi, — i Strati,  
∪ i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July, 1860.*

MONTHLY RESULTS.

|                                                               |    |    | Inches |
|---------------------------------------------------------------|----|----|--------|
| Mean height of the Barometer for the month,                   | .. | .. | 29.532 |
| Max. height of the Barometer occurred at 8 A. M. on the 18th, | .. | .. | 29.644 |
| Min. height of the Barometer occurred at 4 P. M. on the 11th, | .. | .. | 29.373 |
| <i>Extreme range</i> of the Barometer during the month,       | .. | .. | 0.271  |
| Mean of the Daily Max. Pressures,                             | .. | .. | 29.579 |
| Ditto ditto Min. ditto,                                       | .. | .. | 29.475 |
| <i>Mean daily range</i> of the Barometer during the month,    | .. | .. | 0.104  |

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|                                                              |    |    | o    |
|--------------------------------------------------------------|----|----|------|
| Mean Dry Bulb Thermometer for the month,                     | .. | .. | 83.9 |
| Max. Temperature occurred at 2 & 3 P. M. on the 11th,        | .. | .. | 96.8 |
| Min. Temperature occurred at 4 A. M. on the 23rd,            | .. | .. | 77.0 |
| <i>Extreme range</i> of the Temperature during the month,    | .. | .. | 19.8 |
| Mean of the daily Max. Temperature,                          | .. | .. | 88.8 |
| Ditto ditto Min. ditto,                                      | .. | .. | 80.3 |
| <i>Mean daily range</i> of the Temperature during the month, | .. | .. | 8.5  |
| Mean Wet bulb Thermometer for the month,                     | .. | .. | 80.7 |
| Mean Dry bulb Thermometer above mean Wet bulb Thermometer,   | .. | .. | 3.2  |
| Computed Mean-Dew point for the month,                       | .. | .. | 79.1 |
| Mean Dry bulb Thermometer above computed mean Dew-point,     | .. | .. | 4.8  |

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|                                             |    |    | Inches |
|---------------------------------------------|----|----|--------|
| Mean Elastic force of Vapour for the month, | .. | .. | 0.973  |

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|                                                                         |    |    | Troy grains |
|-------------------------------------------------------------------------|----|----|-------------|
| Mean Weight of Vapour for the month,                                    | .. | .. | 10.42       |
| Additional Weight of Vapour required for complete saturation,           | .. | .. | 1.71        |
| Mean degree of humidity for the month, complete saturation being unity, | .. | .. | 0.86        |

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|                                                    |    |    | Inches     |
|----------------------------------------------------|----|----|------------|
| Rained 23 days, Max. fall of rain during 24 hours, | .. | .. | 2.84       |
| Total amount of rain during the month,             | .. | .. | 17.92      |
| Prevailing direction of the Wind,                  | .. | .. | S. & S. E. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July, 1860.*

## MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour,  
when any particular wind was blowing, it rained.

| Hour.     | N. | Rain on.     | N. E. | Rain on.     | E. | Rain on.     | S. E. | Rain on.     | S. | Rain on.     | S. W. | Rain on.     | W. | Rain on.     | N. W. | Rain on.     | Calm. | Rain on.     | Missed. |
|-----------|----|--------------|-------|--------------|----|--------------|-------|--------------|----|--------------|-------|--------------|----|--------------|-------|--------------|-------|--------------|---------|
|           |    | No. of days. |       | No. of days. |    | No. of days. |       | No. of days. |    | No. of days. |       | No. of days. |    | No. of days. |       | No. of days. |       | No. of days. |         |
| Midnight. |    |              |       |              |    |              |       |              |    |              |       |              |    |              |       |              |       |              |         |
| 1         |    |              |       |              | 1  |              |       | 8            | 2  | 16           | 1     | 1            |    |              |       |              |       |              | 1       |
| 2         |    |              |       |              | 1  |              |       | 9            | 2  | 15           | 3     | 1            |    |              |       |              |       |              |         |
| 3         |    |              |       |              | 2  |              |       | 9            | 1  | 15           | 3     | 1            |    |              |       |              |       |              |         |
| 4         |    |              |       |              | 2  |              |       | 8            | 2  | 14           | 2     | 1            |    |              |       |              |       |              | 1       |
| 5         |    |              |       |              | 2  |              | 1     | 8            | 3  | 12           | 2     | 2            |    |              |       |              |       |              | 2       |
| 6         |    |              |       | 1            | 1  |              |       | 6            | 2  | 14           | 1     | 2            |    |              |       |              |       |              | 3       |
| 7         |    |              |       | 1            | 3  |              |       | 8            | 2  | 14           | 2     | 2            |    |              |       |              |       |              |         |
| 8         |    |              |       |              | 4  |              |       | 7            | 2  | 13           | 1     | 2            |    |              |       |              |       |              |         |
| 9         |    |              |       |              | 4  |              | 1     | 4            | 4  | 16           | 1     | 1            |    | 1            | 1     |              |       |              |         |
| 10        |    |              |       |              | 3  |              |       | 6            | 1  | 12           | 2     | 4            |    | 1            | 1     | 1            |       |              |         |
| 11        |    |              |       |              | 1  |              |       | 3            |    | 15           | 4     | 6            |    | 1            | 1     | 1            |       |              |         |
|           |    |              |       |              | 1  |              |       | 5            |    | 15           | 5     | 3            |    | 2            | 1     |              |       |              |         |
| Noon.     |    |              |       | 1            |    |              |       | 7            |    | 13           | 4     | 3            |    | 2            | 1     |              |       |              |         |
| 1         |    |              |       | 1            | 1  |              |       | 7            | 1  | 11           | 4     | 5            |    | 1            | 1     |              |       |              |         |
| 2         |    |              |       |              | 3  |              |       | 5            |    | 11           | 2     | 6            |    | 2            |       |              |       |              |         |
| 3         |    |              |       |              | 2  |              | 1     | 6            | 2  | 11           | 2     | 6            |    | 2            |       |              |       |              |         |
| 4         |    |              |       |              | 2  |              | 1     | 3            |    | 15           | 1     | 4            |    | 2            | 1     |              |       |              |         |
| 5         |    |              |       |              | 1  |              |       | 3            |    | 20           | 4     | 1            |    |              |       |              |       |              | 1       |
| 6         |    |              |       |              | 1  |              |       | 5            |    | 19           | 3     | 1            |    |              |       |              |       |              |         |
| 7         |    |              |       |              | 1  |              | 1     | 7            | 1  | 15           | 1     | 3            |    |              |       |              |       |              |         |
| 8         |    |              |       |              |    |              |       | 8            | 2  | 17           | 2     | 1            |    |              |       |              |       |              |         |
| 9         |    |              |       |              |    |              |       | 7            | 1  | 18           | 2     | 1            |    |              |       |              |       |              |         |
| 10        |    |              |       |              |    |              |       | 7            | 1  | 17           | 3     | 1            |    |              |       |              |       |              | 1       |
| 11        |    |              |       |              |    |              |       | 7            | 1  | 16           | 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 August, 1860.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | 29.536                                    | 29.571                                 | 29.479  | 0.092   | 82.6                       | 87.0                                     | 79.6 | 7.4   |
| 2     | .454                                      | .546                                   | .365    | .181    | 83.5                       | 88.2                                     | 80.8 | 7.4   |
| 3     | .403                                      | .455                                   | .363    | .092    | 81.6                       | 85.4                                     | 79.2 | 6.2   |
| 4     | .471                                      | .549                                   | .409    | .140    | 82.4                       | 85.8                                     | 79.2 | 6.6   |
| 5     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 6     | .539                                      | .583                                   | .483    | .100    | 84.1                       | 88.4                                     | 81.0 | 7.4   |
| 7     | .594                                      | .644                                   | .548    | .096    | 82.1                       | 85.7                                     | 79.8 | 5.9   |
| 8     | .621                                      | .661                                   | .573    | .088    | 81.6                       | 84.8                                     | 79.0 | 5.8   |
| 9     | .627                                      | .681                                   | .541    | .140    | 85.3                       | 92.0                                     | 79.4 | 12.6  |
| 10    | .603                                      | .678                                   | .524    | .154    | 87.2                       | 92.8                                     | 82.6 | 10.2  |
| 11    | .515                                      | .564                                   | .424    | .140    | 88.5                       | 95.6                                     | 84.2 | 11.4  |
| 12    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 13    | .514                                      | .573                                   | .470    | .103    | 83.5                       | 87.4                                     | 80.6 | 6.8   |
| 14    | .565                                      | .613                                   | .511    | .102    | 83.5                       | 88.0                                     | 80.6 | 7.4   |
| 15    | .587                                      | .645                                   | .526    | .119    | 83.9                       | 87.6                                     | 80.6 | 7.0   |
| 16    | .558                                      | .600                                   | .486    | .114    | 84.1                       | 88.8                                     | 81.2 | 7.6   |
| 17    | .575                                      | .630                                   | .530    | .100    | 81.5                       | 82.7                                     | 79.8 | 2.9   |
| 18    | .664                                      | .722                                   | .607    | .115    | 80.7                       | 83.5                                     | 78.8 | 4.7   |
| 19    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 20    | .701                                      | .748                                   | .653    | .095    | 82.7                       | 86.8                                     | 79.4 | 7.4   |
| 21    | .652                                      | .710                                   | .583    | .127    | 80.8                       | 82.6                                     | 78.7 | 3.9   |
| 22    | .635                                      | .678                                   | .591    | .087    | 82.4                       | 86.2                                     | 79.2 | 7.0   |
| 23    | .663                                      | .696                                   | .605    | .091    | 82.3                       | 88.6                                     | 79.2 | 9.4   |
| 24    | .675                                      | .745                                   | .617    | .128    | 83.2                       | 88.4                                     | 79.6 | 8.8   |
| 25    | .719                                      | .777                                   | .667    | .110    | 82.5                       | 85.1                                     | 80.0 | 5.1   |
| 26    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 27    | .751                                      | .826                                   | .702    | .124    | 82.6                       | 86.0                                     | 79.0 | 7.0   |
| 28    | .722                                      | .784                                   | .640    | .144    | 85.5                       | 92.6                                     | 81.0 | 11.6  |
| 29    | .669                                      | .734                                   | .585    | .149    | 86.4                       | 93.0                                     | 82.2 | 10.8  |
| 30    | .652                                      | .708                                   | .580    | .128    | 86.6                       | 91.8                                     | 82.8 | 9.0   |
| 31    | .683                                      | .748                                   | .615    | .133    | 86.3                       | 91.5                                     | 82.6 | 8.9   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four 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, 1860.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermo-<br>meter. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of Air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humidity,<br>complete saturation be-<br>ing unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                   |
| 1     | 80.3                            | 2.3                 | 79.1                | 3.5                          | .0973                            | 10.45                                            | 1.23                                                                    | .90                                                               |
| 2     | 80.9                            | 2.6                 | 79.6                | 3.9                          | .989                             | .60                                              | .40                                                                     | .88                                                               |
| 3     | 79.3                            | 2.3                 | 78.1                | 3.5                          | .943                             | .14                                              | .20                                                                     | .89                                                               |
| 4     | 79.8                            | 2.6                 | 78.5                | 3.9                          | .955                             | .27                                              | .34                                                                     | .89                                                               |
| 5     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 6     | 80.0                            | 4.1                 | 77.9                | 6.2                          | .937                             | .04                                              | 2.17                                                                    | .82                                                               |
| 7     | 79.2                            | 2.9                 | 77.7                | 4.4                          | .931                             | .02                                              | 1.49                                                                    | .87                                                               |
| 8     | 79.2                            | 2.4                 | 78.0                | 3.6                          | .940                             | .11                                              | .23                                                                     | .89                                                               |
| 9     | 81.1                            | 4.2                 | 79.0                | 6.3                          | .970                             | .37                                              | 2.27                                                                    | .82                                                               |
| 10    | 82.3                            | 4.9                 | 79.8                | 7.4                          | .995                             | .60                                              | .77                                                                     | .79                                                               |
| 11    | 83.4                            | 5.1                 | 80.8                | 7.7                          | 1.027                            | .89                                              | .99                                                                     | .79                                                               |
| 12    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 13    | 80.5                            | 3.0                 | 79.0                | 4.5                          | 0.970                            | .40                                              | 1.60                                                                    | .87                                                               |
| 14    | 80.4                            | 3.1                 | 78.8                | 4.7                          | .964                             | .34                                              | .66                                                                     | .86                                                               |
| 15    | 80.9                            | 3.0                 | 79.4                | 4.5                          | .983                             | .51                                              | .62                                                                     | .87                                                               |
| 16    | 81.1                            | 3.0                 | 79.6                | 4.5                          | .989                             | .58                                              | .63                                                                     | .87                                                               |
| 17    | 80.0                            | 1.5                 | 79.2                | 2.3                          | .976                             | .52                                              | 0.79                                                                    | .93                                                               |
| 18    | 79.2                            | 1.5                 | 78.4                | 2.3                          | .952                             | .27                                              | .77                                                                     | .93                                                               |
| 19    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 20    | 80.4                            | 2.3                 | 79.2                | 3.5                          | .976                             | .48                                              | 1.24                                                                    | .89                                                               |
| 21    | 79.5                            | 1.3                 | 78.8                | 2.0                          | .964                             | .40                                              | 0.67                                                                    | .94                                                               |
| 22    | 78.7                            | 3.7                 | 76.8                | 5.6                          | .905                             | 9.71                                             | 1.90                                                                    | .84                                                               |
| 23    | 79.1                            | 3.2                 | 77.5                | 4.8                          | .925                             | .94                                              | .64                                                                     | .86                                                               |
| 24    | 80.0                            | 3.2                 | 78.4                | 4.8                          | .952                             | 10.21                                            | .68                                                                     | .86                                                               |
| 25    | 80.1                            | 2.4                 | 78.9                | 3.6                          | .967                             | .39                                              | .25                                                                     | .89                                                               |
| 26    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 27    | 80.8                            | 1.8                 | 79.9                | 2.7                          | .998                             | .72                                              | 0.96                                                                    | .92                                                               |
| 28    | 82.0                            | 3.5                 | 80.2                | 5.3                          | 1.008                            | .77                                              | 1.95                                                                    | .85                                                               |
| 29    | 81.9                            | 4.5                 | 79.6                | 6.8                          | 0.989                            | .54                                              | 2.52                                                                    | .81                                                               |
| 30    | 82.3                            | 4.3                 | 80.1                | 6.5                          | 1.005                            | .69                                              | .45                                                                     | .81                                                               |
| 31    | 82.1                            | 4.2                 | 80.0                | 6.3                          | .001                             | .68                                              | .34                                                                     | .82                                                               |

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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.621                                    | 29.750                                                 | 29.407  | 0.343   | 81.9                       | 85.0                                                     | 79.6 | 5.4   |
| 1          | .606                                      | .750                                                   | .403    | .347    | 81.7                       | 84.8                                                     | 79.4 | 5.4   |
| 2          | .596                                      | .724                                                   | .398    | .326    | 81.4                       | 84.7                                                     | 79.2 | 5.5   |
| 3          | .589                                      | .724                                                   | .385    | .339    | 81.2                       | 84.6                                                     | 79.0 | 5.6   |
| 4          | .591                                      | .726                                                   | .378    | .348    | 80.7                       | 83.4                                                     | 78.7 | 4.7   |
| 5          | .592                                      | .741                                                   | .396    | .345    | 80.8                       | 84.2                                                     | 79.0 | 5.2   |
| 6          | .609                                      | .745                                                   | .397    | .348    | 80.6                       | 84.2                                                     | 78.8 | 5.4   |
| 7          | .625                                      | .763                                                   | .416    | .347    | 81.2                       | 84.8                                                     | 78.8 | 6.0   |
| 8          | .640                                      | .794                                                   | .423    | .371    | 82.6                       | 86.2                                                     | 79.0 | 7.2   |
| 9          | .651                                      | .816                                                   | .435    | .381    | 84.1                       | 88.2                                                     | 79.3 | 8.9   |
| 10         | .652                                      | .826                                                   | .430    | .396    | 85.2                       | 90.4                                                     | 79.2 | 11.2  |
| 11         | .645                                      | .816                                                   | .426    | .390    | 86.0                       | 92.2                                                     | 79.8 | 12.4  |
| Noon.      | .631                                      | .796                                                   | .410    | .386    | 86.3                       | 93.6                                                     | 80.6 | 13.0  |
| 1          | .610                                      | .778                                                   | .389    | .389    | 86.6                       | 94.4                                                     | 80.4 | 14.0  |
| 2          | .586                                      | .746                                                   | .377    | .369    | 87.2                       | 95.6                                                     | 79.6 | 16.0  |
| 3          | .565                                      | .724                                                   | .363    | .361    | 87.1                       | 94.0                                                     | 81.2 | 12.8  |
| 4          | .554                                      | .716                                                   | .369    | .347    | 86.7                       | 95.4                                                     | 80.2 | 15.2  |
| 5          | .549                                      | .702                                                   | .365    | .337    | 85.9                       | 94.2                                                     | 80.4 | 13.8  |
| 6          | .559                                      | .709                                                   | .372    | .337    | 84.7                       | 92.4                                                     | 79.7 | 12.7  |
| 7          | .576                                      | .718                                                   | .383    | .335    | 83.5                       | 88.0                                                     | 79.4 | 8.6   |
| 8          | .602                                      | .752                                                   | .405    | .347    | 82.9                       | 87.0                                                     | 79.2 | 7.8   |
| 9          | .621                                      | .767                                                   | .425    | .342    | 82.7                       | 86.8                                                     | 79.4 | 7.4   |
| 10         | .636                                      | .768                                                   | .434    | .334    | 82.2                       | 86.0                                                     | 79.2 | 6.8   |
| 11         | .626                                      | .767                                                   | .429    | .338    | 82.2                       | 85.6                                                     | 79.2 | 6.4   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force<br>of Vapour. | Mean Weight of Va-<br>pour in a Cubic<br>foot of Air. | Additional Weight of<br>Vapour required<br>for complete satu-<br>ration. | Mean degree of Hu-<br>midity, complete<br>saturation being<br>unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                                |                                                                      |
| Mid-<br>night. | 80.0                            | 1.9                 | 79.0                | 2.9                          | 0.970                            | 10.44                                                 | 1.00                                                                     | 0.91                                                                 |
| 1              | 79.8                            | 1.9                 | 78.8                | 2.9                          | .964                             | .38                                                   | 0.99                                                                     | .91                                                                  |
| 2              | 79.6                            | 1.8                 | 78.7                | 2.7                          | .961                             | .35                                                   | .92                                                                      | .92                                                                  |
| 3              | 79.5                            | 1.7                 | 78.6                | 2.6                          | .958                             | .32                                                   | .89                                                                      | .92                                                                  |
| 4              | 79.2                            | 1.5                 | 78.4                | 2.3                          | .952                             | .27                                                   | .77                                                                      | .93                                                                  |
| 5              | 79.2                            | 1.6                 | 78.4                | 2.4                          | .952                             | .27                                                   | .80                                                                      | .93                                                                  |
| 6              | 79.1                            | 1.5                 | 78.3                | 2.3                          | .949                             | .24                                                   | .77                                                                      | .93                                                                  |
| 7              | 79.4                            | 1.8                 | 78.5                | 2.7                          | .955                             | .29                                                   | .92                                                                      | .92                                                                  |
| 8              | 80.0                            | 2.6                 | 78.7                | 3.9                          | .961                             | .33                                                   | 1.35                                                                     | .88                                                                  |
| 9              | 80.9                            | 3.2                 | 79.3                | 4.8                          | .979                             | .48                                                   | .73                                                                      | .86                                                                  |
| 10             | 81.2                            | 4.0                 | 79.2                | 6.0                          | .976                             | .43                                                   | 2.18                                                                     | .83                                                                  |
| 11             | 81.5                            | 4.5                 | 79.2                | 6.8                          | .976                             | .41                                                   | .50                                                                      | .81                                                                  |
| Noon.          | 81.6                            | 4.7                 | 79.2                | 7.1                          | .976                             | .41                                                   | .61                                                                      | .80                                                                  |
| 1              | 81.8                            | 4.8                 | 79.4                | 7.2                          | .983                             | .47                                                   | .67                                                                      | .80                                                                  |
| 2              | 82.1                            | 5.1                 | 79.5                | 7.7                          | .986                             | .49                                                   | .88                                                                      | .79                                                                  |
| 3              | 81.9                            | 5.2                 | 79.3                | 7.8                          | .979                             | .42                                                   | .91                                                                      | .78                                                                  |
| 4              | 81.7                            | 5.0                 | 79.2                | 7.5                          | .976                             | .39                                                   | .79                                                                      | .79                                                                  |
| 5              | 81.5                            | 4.4                 | 79.3                | 6.6                          | .979                             | .44                                                   | .43                                                                      | .81                                                                  |
| 6              | 81.2                            | 3.5                 | 79.4                | 5.3                          | .983                             | .51                                                   | 1.91                                                                     | .85                                                                  |
| 7              | 80.5                            | 3.0                 | 79.0                | 4.5                          | .970                             | .40                                                   | .60                                                                      | .87                                                                  |
| 8              | 80.2                            | 2.7                 | 78.8                | 4.1                          | .964                             | .36                                                   | .43                                                                      | .83                                                                  |
| 9              | 80.3                            | 2.4                 | 79.1                | 3.6                          | .973                             | .45                                                   | .27                                                                      | .89                                                                  |
| 10             | 80.1                            | 2.1                 | 79.0                | 3.2                          | .970                             | .44                                                   | .10                                                                      | .91                                                                  |
| 11             | 80.1                            | 2.1                 | 79.0                | 3.2                          | .970                             | .44                                                   | .10                                                                      | .91                                                                  |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                                 |
|-------|-----------------------|---------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|
|       | 0                     | Inches                          |                                   |                                                                                                                            |
| 1     | ...                   | 2.13                            | S. & E.                           | Cloudy and heavy rain in the morning.                                                                                      |
| 2     | ...                   | ..                              | N. & E. & S.                      | Scatd. clouds with slight drizzling between 5 & 6 P. M.                                                                    |
| 3     | ...                   | 0.35                            | N. E. & S. & E.                   | Scatd. clouds & occasionally drizzling.                                                                                    |
| 4     | ...                   | 0.38                            | S. & E.                           | Cloudy with rain between 2 & 5 A. M.                                                                                       |
| 5     | Sunday.               |                                 |                                   |                                                                                                                            |
| 6     | 121.0                 | ..                              | N. E. & E.                        | Cloudy with slight drizzling at 11 A. M. & 7 P. M.                                                                         |
| 7     | 112.0                 | 0.12                            | E. & S. E.                        | Cloudy & occasionally drizzling.                                                                                           |
| 8     | ...                   | 0.29                            | E. & S.                           | Cloudy with occasional drizzling.                                                                                          |
| 9     | 135.8                 | 0.05                            | S & S. E.                         | Scatd. $\searrow$ i & $\swarrow$ i.                                                                                        |
| 10    | 129.5                 | ..                              | W. & S. W.                        | Scatd. clouds of various kinds till 6 P. M. cloudless afterwards.                                                          |
| 11    | 139.0                 | 1.29                            | W. & E.                           | Cloudless till 5 A. M. Scatd. $\searrow$ i & $\swarrow$ i till 6 P. M. cloudy afterwards; also raining between 7 & 9 P. M. |
| 12    | Sunday.               | 1.16                            |                                   |                                                                                                                            |
| 13    | ...                   | 0.15                            | S. & E.                           | Cloudy; also drizzling at 2 & 7 & 8 P. M.                                                                                  |
| 14    | ...                   | 0.26                            | S. & S. E.                        | Scatd. clouds; also drizzling at 1 & 11 A. M.; also raining at 10 P. M.                                                    |
| 15    | ...                   | ..                              | S. & S. E.                        | Cloudy till 7 P. M. cloudless afterwards; also drizzling at 1 & 2 & 10 A. M.                                               |
| 16    | ...                   | 1.18                            | S. & S. E.                        | Cloudy; also drizzling between Midnight & 3 A. M.; also raining between 8 & 11 P. M.                                       |
| 17    | ...                   | 1.09                            | S. & S. E.                        | Cloudy; also constantly raining between 3 A. M. & 3 P. M.                                                                  |
| 18    | ...                   | 0.43                            | S. & E.                           | Cloudy; also constantly raining.                                                                                           |
| 19    | Sunday.               |                                 |                                   |                                                                                                                            |
| 20    | ...                   | 1.12                            | S. & E.                           | Cloudy; also raining between 3 & 6 P. M.                                                                                   |
| 21    | ...                   | 0.87                            | S. W. & S.                        | Cloudy; also constantly raining between 1 A. M. & 4 P. M.                                                                  |
| 22    | ...                   | 0.27                            | W. & S. & S. W.                   | Cloudy; also drizzling at 4 & 5 A. M. & at Noon.                                                                           |
| 23    | ...                   | 0.93                            | S. & S. W.                        | Cloudless till 5 A. M. cloudy afterwards between 4 & 11 P. M.                                                              |
| 24    | ...                   | ..                              | S. & S. W.                        | Cloudy; also drizzling at midnight; also constantly raining.                                                               |
| 25    | ...                   | ..                              | N. W. & S. E.                     | Cloudy & drizzling occasionally.                                                                                           |
| 26    | Sunday.               | 1.76                            |                                   |                                                                                                                            |
| 27    | ..                    | 0.57                            | E. & S.                           | Cloudy; also constantly raining between 3 & 6 A. M.; also drizzling at 10 A. M.                                            |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge<br>5 feet above<br>Ground.<br><br>Inches. | Prevailing direction<br>of the Wind. | General Aspect of the Sky.                                         |
|-------|-----------------------|------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------|
| 28    | 135.8                 | ..                                                   | S. E. & S.                           | Scatd. $\searrow$ i & $\circ$ i till 7 p. m. cloudless afterwards. |
| 29    | 134.0                 | ..                                                   | S. & W.                              | Scatd. $\searrow$ i & $\circ$ i.                                   |
| 30    | 132.8                 | ..                                                   | S. & S. W.                           | Scatd. $\searrow$ i & $\searrow$ i.                                |
| 31    | 140.4                 | 0.25                                                 | S. & S. E. & E.                      | Scatd. $\searrow$ i & $\circ$ i.                                   |

$\searrow$ i Cirri,  $\searrow$ i Cirro strati,  $\circ$ i Cumuli,  $\circ$ i Cumulo strati,  $\searrow$ i Nimbi,—i Strati,  
 $\searrow$ i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August, 1860.*

MONTHLY RESULTS.

|                                                                 |    |    | Inches |
|-----------------------------------------------------------------|----|----|--------|
| Mean height of the Barometer for the month,                     | .. | .. | 29.605 |
| Max. height of the Barometer, occurred at 10 A. M. on the 27th, | .. | .. | 29.826 |
| Min. height of the Barometer, occurred at 3 P. M. on the 3rd,   | .. | .. | 29.363 |
| <i>Extreme range</i> of the Barometer during the month,         | .. | .. | 0.463  |
| Mean of the Daily Max. Pressures,                               | .. | .. | 29.662 |
| Ditto ditto Min. ditto,                                         | .. | .. | 29.544 |
| <i>Mean daily range</i> of the Barometer during the month,      | .. | .. | 0.118  |

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|                                                              |    |    | °    |
|--------------------------------------------------------------|----|----|------|
| Mean Dry Bulb Thermometer for the month,                     | .. | .. | 83.6 |
| Max. Temperature occurred at 2 P. M. on the 11th,            | .. | .. | 95.6 |
| Min. Temperature occurred at 4 A. M. on the 21st,            | .. | .. | 78.7 |
| <i>Extreme range</i> of the Temperature during the month,    | .. | .. | 16.9 |
| Mean of the daily Max. Temperature,                          | .. | .. | 88.0 |
| Ditto ditto Min. ditto,                                      | .. | .. | 80.4 |
| <i>Mean daily range</i> of the Temperature during the month, | .. | .. | 7.6  |

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|                                                               |    |    | °      |
|---------------------------------------------------------------|----|----|--------|
| Mean Wet Bulb Thermometer for the month,                      | .. | .. | 80.5   |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, .. |    |    | 3.1    |
| Computed Mean Dew Point for the month,                        | .. | .. | 78.9   |
| Mean Dry Bulb Thermometer above computed Mean Dew-point, ..   |    |    | 4.7    |
|                                                               |    |    | Inches |
| Mean Elastic force of vapour for the month, ..                | .. | .. | 0.967  |

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|                                                                         |    |    | Troy grains |
|-------------------------------------------------------------------------|----|----|-------------|
| Mean weight of Vapour for the month, ..                                 | .. | .. | 10.37       |
| Additional weight of Vapour required for complete saturation, ..        |    |    | 1.66        |
| Mean degree of humidity for the month, complete saturation being unity, |    |    | 0.86        |

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|                                                       |    |    | Inches  |
|-------------------------------------------------------|----|----|---------|
| Rained 25 days, Max. fall of rain during 24 hours, .. | .. | .. | 2.13    |
| Total amount of rain during the month, ..             | .. | .. | 14.65   |
| Prevailing direction of the Wind, ..                  | .. | .. | S. & E. |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of August, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | N.           |          | N. E.    |          | E.       |          | S. E.    |          | S.       |          | S. W.    |          | W.       |          | N. W.    |          | Calm.    |          | Missed.  |   |
|-----------|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---|
|           | Rain on.     | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. | Rain on. |   |
|           | No. of days. |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |   |
| Midnight. | 1            |          | 3        |          | 6        | 1        | 11       | 2        | 1        | 11       | 2        | 1        |          |          |          | 1        |          | 2        |          | 2 |
| 1         | 1            |          | 5        | 1        | 5        | 1        | 11       | 2        | 1        | 11       | 2        | 1        |          |          |          | 1        |          | 2        |          |   |
| 2         | 1            |          | 5        | 2        | 5        | 1        | 12       | 3        | 1        | 12       | 3        | 1        | 1        |          | 1        |          | 1        |          | 2        |   |
| 3         | 1            |          | 5        | 3        | 5        | 1        | 10       | 2        | 2        | 10       | 2        | 2        |          |          |          | 1        |          | 2        |          | 1 |
| 4         | 1            |          | 5        | 3        | 4        | 1        | 9        | 2        | 2        | 9        | 2        | 2        | 1        |          | 1        |          | 1        |          | 5        |   |
| 5         |              | 1        | 5        | 2        | 7        | 1        | 8        | 3        | 3        | 8        | 3        | 3        |          |          |          | 1        |          | 2        |          | 1 |
| 6         |              | 2        | 7        | 1        | 3        |          | 8        |          | 3        | 8        |          | 6        | 2        |          | 2        |          | 1        |          | 1        |   |
| 7         | 1            |          | 7        |          | 3        | 1        | 6        |          | 1        | 6        |          | 7        | 2        |          | 2        |          | 1        |          | 1        |   |
| 8         | 2            |          | 8        |          | 1        |          | 8        | 1        | 1        | 8        | 1        | 5        | 1        | 1        | 3        |          | 1        |          | 1        | 1 |
| 9         | 1            |          | 7        |          | 1        |          | 8        | 1        | 1        | 8        | 1        | 6        | 1        | 1        | 3        |          | 1        |          | 1        |   |
| 10        | 1            | 1        | 6        | 3        |          |          | 9        | 2        | 2        | 9        | 2        | 4        | 1        | 5        | 5        |          | 1        |          | 1        |   |
| 11        | 1            | 1        | 4        | 2        | 2        |          | 9        | 3        | 3        | 9        | 3        | 4        | 1        | 5        | 5        | 1        | 1        |          | 1        |   |
| Noon.     | 1            | 2        | 1        | 1        | 2        | 2        | 11       | 2        | 5        | 11       | 2        | 5        | 2        | 5        | 1        |          |          |          |          |   |
| 1         | 1            | 1        | 2        |          | 2        | 2        | 1        | 10       | 3        | 10       | 3        | 6        | 2        | 5        | 1        |          |          |          |          |   |
| 2         | 1            | 1        | 1        | 1        | 3        | 1        | 2        | 10       | 2        | 10       | 2        | 5        | 2        | 6        |          |          |          |          |          |   |
| 3         | 1            | 1        | 2        |          | 1        | 1        | 13       | 2        | 2        | 13       | 2        | 4        | 2        | 2        |          | 3        |          |          |          |   |
| 4         | 1            | 2        | 1        | 1        | 3        | 1        | 12       | 2        | 2        | 12       | 2        | 2        | 1        | 4        |          | 2        | 1        |          |          |   |
| 5         |              | 1        | 2        | 2        | 2        | 2        | 14       | 2        | 2        | 14       | 2        | 4        | 2        | 2        |          | 1        |          |          |          | 1 |
| 6         |              | 1        | 3        | 2        | 4        | 2        | 14       | 3        | 3        | 14       | 3        | 2        | 2        | 3        |          | 1        |          |          |          |   |
| 7         |              | 1        | 5        | 1        | 2        | 1        | 15       | 2        | 2        | 15       | 2        | 2        | 1        | 2        |          |          |          |          |          |   |
| 8         |              | 1        | 5        |          | 3        | 1        | 15       | 4        | 4        | 15       | 4        | 1        | 2        | 2        |          |          |          |          |          |   |
| 9         |              | 2        | 4        | 1        | 4        | 1        | 14       | 1        | 1        | 14       | 1        | 2        | 1        | 1        |          |          |          |          |          |   |
| 10        |              | 2        | 2        |          | 4        | 1        | 15       | 2        | 2        | 15       | 2        | 2        | 1        | 1        |          |          |          |          |          | 1 |
| 11        |              | 3        | 1        |          | 4        | 1        | 14       | 1        | 1        | 14       | 1        | 2        | 1        | 1        |          |          |          |          |          | 2 |

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September, 1860.

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahl. | 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. | °                          | °                                        | °    | °     |
| 1     | 29.687                                    | 29.737                                 | 29.611  | 0.126   | 84.2                       | 89.6                                     | 81.5 | 8.1   |
| 2     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 3     | .686                                      | .740                                   | .640    | .100    | 84.0                       | 89.6                                     | 80.8 | 8.8   |
| 4     | .691                                      | .752                                   | .625    | .127    | 84.5                       | 89.4                                     | 80.8 | 8.6   |
| 5     | .712                                      | .762                                   | .666    | .096    | 83.5                       | 87.4                                     | 81.2 | 6.2   |
| 6     | .724                                      | .791                                   | .669    | .122    | 83.2                       | 88.6                                     | 81.2 | 7.4   |
| 7     | .660                                      | .724                                   | .574    | .150    | 83.9                       | 89.5                                     | 80.2 | 9.3   |
| 8     | .586                                      | .643                                   | .507    | .136    | 82.2                       | 86.0                                     | 79.4 | 6.6   |
| 9     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 10    | .724                                      | .794                                   | .658    | .136    | 81.9                       | 83.8                                     | 81.0 | 2.8   |
| 11    | .706                                      | .774                                   | .621    | .153    | 83.6                       | 89.2                                     | 80.0 | 9.2   |
| 12    | .684                                      | .736                                   | .613    | .123    | 84.6                       | 91.0                                     | 81.0 | 10.0  |
| 13    | .710                                      | .767                                   | .660    | .107    | 84.5                       | 89.6                                     | 80.8 | 8.8   |
| 14    | .701                                      | .766                                   | .641    | .125    | 84.1                       | 89.0                                     | 80.4 | 8.6   |
| 15    | .627                                      | .683                                   | .567    | .116    | 83.2                       | 88.4                                     | 80.6 | 7.8   |
| 16    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 17    | .588                                      | .650                                   | .536    | .114    | 84.2                       | 89.1                                     | 81.4 | 7.7   |
| 18    | .563                                      | .610                                   | .504    | .106    | 83.1                       | 90.0                                     | 80.0 | 10.0  |
| 19    | .509                                      | .558                                   | .443    | .115    | 81.6                       | 85.6                                     | 79.4 | 6.2   |
| 20    | .505                                      | .608                                   | .417    | .191    | 80.6                       | 82.8                                     | 78.2 | 4.6   |
| 21    | .653                                      | .717                                   | .563    | .154    | 81.0                       | 86.2                                     | 77.2 | 9.0   |
| 22    | .694                                      | .745                                   | .635    | .110    | 85.0                       | 91.2                                     | 79.0 | 12.2  |
| 23    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 24    | .694                                      | .756                                   | .620    | .136    | 84.7                       | 89.2                                     | 82.4 | 6.8   |
| 25    | .718                                      | .787                                   | .635    | .152    | 84.9                       | 91.1                                     | 81.3 | 9.8   |
| 26    | .725                                      | .793                                   | .671    | .122    | 82.2                       | 88.4                                     | 80.4 | 8.0   |
| 27    | .714                                      | .772                                   | .653    | .119    | 82.5                       | 89.8                                     | 79.6 | 10.2  |
| 28    | .719                                      | .796                                   | .642    | .154    | 83.2                       | 88.2                                     | 79.8 | 8.4   |
| 29    | .703                                      | .777                                   | .630    | .147    | 84.2                       | 91.2                                     | 80.4 | 10.8  |
| 30    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four 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, 1860.*

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. |
|-------|----------------------------|---------------------|---------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
| 1     | 80.9                       | 3.3                 | 79.2                | 5.0                       | Inches.<br>0.976              | T. gr.<br>10.45                               | T. gr.<br>1.79                                                | 0.85                                                      |
| 2     | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 3     | 81.1                       | 2.9                 | 79.6                | 4.4                       | .989                          | .60                                           | .57                                                           | .87                                                       |
| 4     | 80.8                       | 3.7                 | 78.9                | 5.6                       | .967                          | .34                                           | 2.01                                                          | .84                                                       |
| 5     | 80.7                       | 2.8                 | 79.3                | 4.2                       | .979                          | .51                                           | 1.49                                                          | .88                                                       |
| 6     | 80.9                       | 2.3                 | 79.7                | 3.5                       | .992                          | .63                                           | .26                                                           | .89                                                       |
| 7     | 80.6                       | 3.3                 | 78.9                | 5.0                       | .967                          | .37                                           | .76                                                           | .86                                                       |
| 8     | 79.6                       | 2.6                 | 78.3                | 3.9                       | .949                          | .20                                           | .34                                                           | .88                                                       |
| 9     | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 10    | 80.4                       | 1.5                 | 79.6                | 2.3                       | .989                          | .65                                           | 0.79                                                          | .93                                                       |
| 11    | 81.0                       | 2.6                 | 79.7                | 3.9                       | .992                          | .63                                           | 1.40                                                          | .88                                                       |
| 12    | 81.3                       | 3.3                 | 79.6                | 5.0                       | .989                          | .58                                           | .81                                                           | .85                                                       |
| 13    | 80.7                       | 3.8                 | 78.8                | 5.7                       | .964                          | .31                                           | 2.04                                                          | .84                                                       |
| 14    | 80.8                       | 3.3                 | 79.1                | 5.0                       | .973                          | .42                                           | 1.79                                                          | .85                                                       |
| 15    | 80.5                       | 2.7                 | 79.1                | 4.1                       | .973                          | .45                                           | .44                                                           | .88                                                       |
| 16    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 17    | 81.2                       | 3.0                 | 79.7                | 4.5                       | .992                          | .61                                           | .63                                                           | .87                                                       |
| 18    | 80.4                       | 2.7                 | 79.0                | 4.1                       | .970                          | .42                                           | .44                                                           | .88                                                       |
| 19    | 79.5                       | 2.1                 | 78.4                | 3.2                       | .952                          | .25                                           | .09                                                           | .90                                                       |
| 20    | 78.8                       | 1.8                 | 77.9                | 2.7                       | .937                          | .10                                           | 0.91                                                          | .92                                                       |
| 21    | 77.9                       | 3.1                 | 76.3                | 4.7                       | .890                          | 9.59                                          | 1.55                                                          | .86                                                       |
| 22    | 80.9                       | 4.1                 | 78.8                | 6.2                       | .964                          | 10.31                                         | 2.22                                                          | .82                                                       |
| 23    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |
| 24    | 81.7                       | 3.0                 | 80.2                | 4.5                       | 1.008                         | .77                                           | 1.65                                                          | .87                                                       |
| 25    | 81.1                       | 3.8                 | 79.2                | 5.7                       | 0.976                         | .43                                           | 2.06                                                          | .84                                                       |
| 26    | 79.7                       | 2.5                 | 78.4                | 3.8                       | .952                          | .23                                           | 1.31                                                          | .89                                                       |
| 27    | 79.8                       | 2.7                 | 78.4                | 4.1                       | .952                          | .23                                           | .41                                                           | .88                                                       |
| 28    | 80.2                       | 3.0                 | 78.7                | 4.5                       | .961                          | .31                                           | .58                                                           | .87                                                       |
| 29    | 80.9                       | 3.3                 | 79.2                | 5.0                       | .976                          | .45                                           | .79                                                           | .85                                                       |
| 30    | <i>Sunday.</i>             |                     |                     |                           |                               |                                               |                                                               |                                                           |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
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in the month of September, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

| Hour.          | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>for each hour during<br>the month. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Temperature<br>for each hour during<br>the month. |      |       |
|----------------|-------------------------------------------------|--------------------------------------------------------------|---------|---------|-------------------------------|----------------------------------------------------------------|------|-------|
|                |                                                 | Max.                                                         | Min.    | Diff.   |                               | Max.                                                           | Min. | Diff. |
|                | Inches.                                         | Inches.                                                      | Inches. | Inches. | o                             | o                                                              | o    | o     |
| Mid-<br>night. | 29.683                                          | 29.740                                                       | 29.543  | 0.197   | 81.7                          | 84.6                                                           | 78.0 | 6.6   |
| 1              | .666                                            | .724                                                         | .454    | .270    | 81.4                          | 84.2                                                           | 77.8 | 6.4   |
| 2              | .656                                            | .718                                                         | .442    | .276    | 81.2                          | 84.7                                                           | 77.4 | 7.3   |
| 3              | .648                                            | .715                                                         | .427    | .288    | 80.9                          | 84.4                                                           | 77.2 | 7.2   |
| 4              | .647                                            | .711                                                         | .417    | .294    | 80.7                          | 84.0                                                           | 77.2 | 6.8   |
| 5              | .653                                            | .724                                                         | .442    | .282    | 80.7                          | 83.8                                                           | 77.6 | 6.2   |
| 6              | .671                                            | .750                                                         | .444    | .306    | 80.6                          | 83.6                                                           | 77.2 | 6.4   |
| 7              | .690                                            | .764                                                         | .464    | .300    | 81.3                          | 84.2                                                           | 77.8 | 6.4   |
| 8              | .710                                            | .790                                                         | .513    | .277    | 83.1                          | 85.6                                                           | 79.8 | 5.8   |
| 9              | .722                                            | .794                                                         | .516    | .278    | 84.4                          | 87.2                                                           | 80.0 | 7.2   |
| 10             | .723                                            | .796                                                         | .523    | .273    | 85.5                          | 88.2                                                           | 81.0 | 7.2   |
| 11             | .712                                            | .780                                                         | .530    | .250    | 86.3                          | 89.6                                                           | 81.0 | 8.6   |
| Noon.          | .691                                            | .761                                                         | .513    | .248    | 86.9                          | 89.6                                                           | 81.8 | 7.8   |
| 1              | .664                                            | .743                                                         | .497    | .246    | 87.0                          | 91.0                                                           | 81.6 | 9.4   |
| 2              | .641                                            | .725                                                         | .467    | .258    | 86.9                          | 91.2                                                           | 81.2 | 10.0  |
| 3              | .619                                            | .720                                                         | .444    | .276    | 86.1                          | 91.2                                                           | 80.6 | 10.6  |
| 4              | .610                                            | .700                                                         | .450    | .250    | 85.5                          | 91.0                                                           | 80.0 | 11.0  |
| 5              | .613                                            | .705                                                         | .443    | .262    | 84.6                          | 89.8                                                           | 79.8 | 10.0  |
| 6              | .626                                            | .709                                                         | .450    | .259    | 83.6                          | 86.5                                                           | 79.6 | 6.9   |
| 7              | .644                                            | .728                                                         | .461    | .267    | 83.0                          | 86.4                                                           | 79.4 | 7.0   |
| 8              | .668                                            | .746                                                         | .488    | .258    | 82.6                          | 85.8                                                           | 79.6 | 6.2   |
| 9              | .685                                            | .746                                                         | .499    | .247    | 82.4                          | 85.0                                                           | 79.6 | 5.4   |
| 10             | .687                                            | .752                                                         | .521    | .231    | 82.0                          | 84.6                                                           | 78.8 | 5.8   |
| 11             | .683                                            | .761                                                         | .502    | .259    | 81.8                          | 84.2                                                           | 78.2 | 6.0   |

The Mean Height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers 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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb<br>Thermometer. | Dry Bulb above Wet. | Computed Dew point. | Dry Bulb above Dew<br>point. | Mean Elastic force of<br>Vapour. | Mean Weight of Va-<br>pour in a Cubic foot<br>of Air. | Additional Weight of<br>vapour required for<br>complete saturation. | Mean degree of Hu-<br>midity, complete satu-<br>ration being unit <sup>r</sup> . |
|----------------|-------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------|
|                | o                             | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                           |                                                                                  |
| Mid-<br>night. | 79.9                          | 1.8                 | 79.0                | 2.7                          | 0.970                            | 10.44                                                 | 0.93                                                                | 0.92                                                                             |
| 1              | 79.8                          | 1.6                 | 79.0                | 2.4                          | .970                             | .46                                                   | .81                                                                 | .93                                                                              |
| 2              | 79.6                          | 1.6                 | 78.8                | 2.4                          | .964                             | .40                                                   | .81                                                                 | .93                                                                              |
| 3              | 79.5                          | 1.4                 | 78.8                | 2.1                          | .964                             | .40                                                   | .70                                                                 | .94                                                                              |
| 4              | 79.4                          | 1.3                 | 78.7                | 2.0                          | .961                             | .37                                                   | .67                                                                 | .94                                                                              |
| 5              | 79.4                          | 1.3                 | 78.7                | 2.0                          | .961                             | .37                                                   | .67                                                                 | .94                                                                              |
| 6              | 79.3                          | 1.3                 | 78.6                | 2.0                          | .958                             | .34                                                   | .67                                                                 | .94                                                                              |
| 7              | 79.8                          | 1.5                 | 79.0                | 2.3                          | .970                             | .46                                                   | .78                                                                 | .93                                                                              |
| 8              | 80.5                          | 2.6                 | 79.2                | 3.9                          | .976                             | .48                                                   | 1.38                                                                | .88                                                                              |
| 9              | 81.0                          | 3.4                 | 79.3                | 5.1                          | .979                             | .48                                                   | .83                                                                 | .85                                                                              |
| 10             | 81.3                          | 4.2                 | 79.2                | 6.3                          | .976                             | .48                                                   | 2.29                                                                | .82                                                                              |
| 11             | 81.4                          | 4.9                 | 78.9                | 7.4                          | .967                             | .32                                                   | .70                                                                 | .79                                                                              |
| Noon.          | 81.6                          | 5.3                 | 78.9                | 8.0                          | .967                             | .30                                                   | .95                                                                 | .78                                                                              |
| 1              | 81.5                          | 5.5                 | 78.7                | 8.3                          | .961                             | .24                                                   | 3.05                                                                | .77                                                                              |
| 2              | 81.6                          | 5.3                 | 78.9                | 8.0                          | .967                             | .30                                                   | 2.95                                                                | .78                                                                              |
| 3              | 81.2                          | 4.9                 | 78.7                | 7.4                          | .961                             | .26                                                   | .69                                                                 | .79                                                                              |
| 4              | 81.1                          | 4.4                 | 78.9                | 6.6                          | .967                             | .32                                                   | .40                                                                 | .81                                                                              |
| 5              | 80.9                          | 3.7                 | 79.0                | 5.6                          | .970                             | .37                                                   | .02                                                                 | .84                                                                              |
| 6              | 80.6                          | 3.0                 | 79.1                | 4.5                          | .973                             | .42                                                   | 1.61                                                                | .87                                                                              |
| 7              | 80.5                          | 2.5                 | 79.2                | 3.8                          | .976                             | .48                                                   | .34                                                                 | .89                                                                              |
| 8              | 80.3                          | 2.3                 | 79.1                | 3.5                          | .973                             | .45                                                   | .23                                                                 | .90                                                                              |
| 9              | 80.3                          | 2.1                 | 79.2                | 3.2                          | .976                             | .50                                                   | .11                                                                 | .90                                                                              |
| 10             | 80.2                          | 1.8                 | 79.3                | 2.7                          | .979                             | .53                                                   | 0.94                                                                | .92                                                                              |
| 11             | 80.0                          | 1.8                 | 79.1                | 2.7                          | .973                             | .47                                                   | .93                                                                 | .92                                                                              |

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, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                                  |
|-------|-----------------------|---------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1     | o                     | Inches.<br>..                   | S. & E.                           | Scatd. \i & \-i till 1 P. M. cloudy afterwards; also drizzling at 3 & 5 P. M.                                               |
| 2     | Sunday.               | 0.44                            |                                   |                                                                                                                             |
| 3     | 131.4                 | ..                              | S. & S. E.                        | Scatd. clouds; also drizzling at 1 P. M.                                                                                    |
| 4     | 127.0                 | ..                              | S. & S. E.                        | Scatd. \-i & \i.                                                                                                            |
| 5     | ..                    | 0.12                            | S. E. & S.                        | Scatd. \i & \-i till 6 P. M. cloudless afterwards.                                                                          |
| 6     | ..                    | 0.15                            | E. & S.                           | Scatd. \i & \-i till 9 A. M. cloudy till 6 P. M. cloudless afterwards; also constantly drizzling between 10 A. M. & 5 P. M. |
| 7     | ..                    | ..                              | S.                                | Cloudless till 6 A. M. Scatd. clouds till 7 P. M. cloudless afterwards.                                                     |
| 8     | ..                    | 0.35                            | E. & W.                           | Cloudy & constantly raining in the afternoon.                                                                               |
| 9     | Sunday.               | 1.25                            |                                   |                                                                                                                             |
| 10    | ..                    | ..                              | S. E. & S.                        | Cloudy, & slightly drizzling between 3 & 4 A. M. & also at 9 A. M.                                                          |
| 11    | ..                    | ..                              | S.                                | Scatd. clouds till 6 P. M. cloudless afterwards.                                                                            |
| 12    | 130.4                 | ..                              | S.                                | Cloudless till 8 A. M. Scatd. clouds till 6 P. M. cloudless afterwards.                                                     |
| 13    | ..                    | ..                              | S. & S. E. & S. W.                | Cloudless till 5 A. M. Scatd. \-i till 9 A. M. cloudy till 9 P. M. cloudless afterwards; also drizzling between 4 & 5 P. M. |
| 14    | ..                    | ..                              | S.                                | Cloudless till 6 A. M. Scatd. clouds till 6 P. M. cloudless afterwards.                                                     |
| 15    | ..                    | 1.02                            | S. E. & S.                        | Cloudy till 7 P. M. cloudless afterwards; also raining at 1 & 3 & 4 P. M.                                                   |
| 16    | Sunday.               |                                 |                                   |                                                                                                                             |
| 17    | ..                    | ..                              | S. E. & S.                        | Cloudy till 7 P. M. cloudless afterwards; also slightly drizzling at 1 P. M.                                                |
| 18    | ..                    | 0.21                            | E.                                | Cloudless till 5 A. M. cloudy afterwards; also constantly drizzling between 2 & 8 P. M.                                     |
| 19    | ..                    | 0.58                            | E. & N. E.                        | Cloudy; also constantly raining between 1 & 9 P. M.                                                                         |
| 20    | ..                    | 0.30                            | S. W. & S. & E.                   | Cloudy; also constantly drizzling between 1 & 4 A. M. & also at 4 P. M.                                                     |
| 21    | ..                    | ..                              | S. W. & W. & N.                   | Scatd. clouds till 4 P. M. Scatd. \-i afterwards.                                                                           |
| 22    | 139.7                 | ..                              | N. & S.                           | Cloudless till 8 A. M. Scatd. \i till 8 P. M. cloudless afterwards.                                                         |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                               |
|-------|-----------------------|---------------------------------|-----------------------------------|------------------------------------------------------------------------------------------|
| 23    | <i>Sunday.</i>        |                                 |                                   |                                                                                          |
| 24    | 125.0                 | 0.09                            | S.                                | Cloudy, also drizzling at 9 A. M. & 5 & 6 P. M.                                          |
| 25    | 135.0                 | ..                              | S. & S. E.                        | Scatd. clouds; also slightly drizzling at 10 A. M.                                       |
| 26    | ..                    | 1.07                            | S. W. & E. & N.                   | Cloudless till 8 A. M. cloudy afterwards; also raining at 11 A. M. & between 1 & 3 P. M. |
| 27    | ..                    | 0.09                            | S. & E.                           | Cloudy; also drizzling at 2 & 6 & 7 P. M.                                                |
| 28    | ..                    | 1.46                            | E. & S. W. & S. E.                | Scatd. clouds; also raining between 8 & 9 P. M.                                          |
| 29    | ..                    | ..                              | E. & S. E. & S.                   | Cloudless till 5 A. M. Scatd. clouds afterwards.                                         |
| 30    | <i>Sunday.</i>        |                                 |                                   |                                                                                          |

☉i Cirri, ☁i Cirro strati, ☁i Cumuli, ☁i Cumulo strati, ☁i Nimbi, —i Strati  
☁i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September, 1860.*

MONTHLY RESULTS.

|                                                                |    |    |        |
|----------------------------------------------------------------|----|----|--------|
|                                                                |    |    | Inches |
| Mean height of the Barometer for the month,                    | .. | .. | 29.667 |
| Max. height of the Barometer occurred at 10 A. M. on the 28th, | .. | .. | 29.796 |
| Min. height of the Barometer occurred at 4 A. M. on the 20th,  | .. | .. | 29.417 |
| <i>Extreme range</i> of the Barometer during the month,        | .. | .. | 0.379  |
| Mean of the Daily Max. Pressures,                              | .. | .. | 29.730 |
| Ditto ditto Min. ditto,                                        | .. | .. | 29.600 |
| <i>Mean daily range</i> of the Barometer during the month,     | .. | .. | 0.130  |

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|                                                               |    |    |      |
|---------------------------------------------------------------|----|----|------|
|                                                               |    |    | °    |
| Mean Dry Bulb Thermometer for the month,                      | .. | .. | 83.4 |
| Max. Temperature occurred at 2 & 3 P. M. on the 22nd & 29th,  | .. | .. | 91.2 |
| Min. Temperature occurred at 4 A. M. on the 21st,             | .. | .. | 77.2 |
| <i>Extreme range</i> of the Temperature during the month,     | .. | .. | 14.0 |
| Mean of the daily Max. Temperature,                           | .. | .. | 88.5 |
| Ditto ditto Min. ditto,                                       | .. | .. | 80.3 |
| <i>Mean daily range</i> of the Temperature during the month,  | .. | .. | 8.2  |
| Mean Wet Bulb Thermometer for the month, ..                   | .. | .. | 80.4 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, .. |    |    | 3.0  |
| Computed Mean Dew-point for the month, ..                     | .. | .. | 78.9 |
| Mean Dry Bulb Thermometer above computed Mean Dew-point,      | .. | .. | 4.5  |

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|                                                |    |    |        |
|------------------------------------------------|----|----|--------|
|                                                |    |    | Inches |
| Mean Elastic force of Vapour for the month, .. | .. | .. | 0.967  |

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|                                                                         |    |    |             |
|-------------------------------------------------------------------------|----|----|-------------|
|                                                                         |    |    | Troy grains |
| Mean Weight of Vapour for the month, ..                                 | .. | .. | 10.37       |
| Additional Weight of Vapour required for complete saturation, ..        | .. | .. | 1.59        |
| Mean degree of humidity for the month, complete saturation being unity, |    |    | 0.87        |

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|                                                       |    |    |                 |
|-------------------------------------------------------|----|----|-----------------|
|                                                       |    |    | Inches          |
| Rained 19 days, Max. fall of rain during 24 hours, .. | .. | .. | 1.46            |
| Total amount of rain during the month, ..             | .. | .. | 7.13            |
| Prevailing direction of the Wind, ..                  | .. | .. | S. & E. & S. E. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour,  
when any particular wind was blowing, it rained.

| Hour.     | No. of days. |                   |                |                   |                |                   |                |                   |                   |          |         |   |  |  |
|-----------|--------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|-------------------|----------|---------|---|--|--|
|           | N.           | Rain on.<br>N. E. | Rain on.<br>E. | Rain on.<br>S. E. | Rain on.<br>S. | Rain on.<br>S. W. | Rain on.<br>W. | Rain on.<br>N. W. | Rain on.<br>Calm. | Rain on. | Missed. |   |  |  |
| Midnight. | 1            |                   | 3              | 4                 | 12             | 2                 |                |                   |                   |          | 1       | 2 |  |  |
| 1         | 1            |                   | 3              | 1 4               | 14             | 2                 |                |                   |                   |          | 1       |   |  |  |
| 2         | 1            |                   | 3              | 1 4               | 13             | 2                 |                |                   |                   |          | 1       | 1 |  |  |
| 3         | 1            | 1                 | 4              | 1 2               | 1 15           | 2                 |                |                   |                   |          | 1       | 4 |  |  |
| 4         | 1            |                   | 4              | 1 2               | 1 13           | 1                 |                |                   |                   |          |         | 4 |  |  |
| 5         | 1            | 1                 | 4              | 2                 | 13             | 2                 |                |                   |                   |          |         | 2 |  |  |
| 6         | 1            | 3                 | 3              | 6                 | 11             |                   |                | 1                 |                   |          |         |   |  |  |
| 7         |              | 3                 | 7              | 6                 | 8              |                   |                | 1                 | 1                 |          |         |   |  |  |
| 8         |              | 1                 | 9              | 6                 | 5              |                   |                | 1                 | 1                 |          |         | 3 |  |  |
| 9         |              | 1                 | 9              | 7                 | 6              | 1                 | 1              |                   | 1                 |          |         |   |  |  |
| 10        |              | 1                 | 8              | 1 4               | 1 10           |                   |                |                   |                   |          |         |   |  |  |
| 11        |              | 1                 | 6              | 2 8               | 8              |                   |                |                   | 2                 |          |         |   |  |  |
| Noon.     |              | 2                 | 4              | 2 6               | 12             |                   |                |                   | 1                 |          |         |   |  |  |
| 1         | 1            | 3 2               | 5              | 5 2               | 8              | 1                 | 1              |                   | 1                 |          | 1       |   |  |  |
| 2         | 1            | 3 1               | 2              | 1 6               | 9              | 1                 | 2              |                   | 1                 | 1        |         |   |  |  |
| 3         | 1            | 2 1               | 3              | 1 5 2             | 8              |                   | 2              |                   | 1                 | 1        |         |   |  |  |
| 4         | 1            | 2 1               | 4              | 1 3 1             | 7              | 1                 | 3              |                   | 1                 | 2        |         | 2 |  |  |
| 5         |              | 1 1               | 7              | 3 3               | 7              |                   | 4              |                   | 1                 | 2        | 1       |   |  |  |
| 6         | 2            | 1                 | 6              | 1 4               | 7              | 1                 | 4              |                   | 1                 | 1        | 1       |   |  |  |
| 7         | 2            |                   | 5              | 1 4               | 9              | 1                 | 4              |                   | 1                 | 1        | 1       |   |  |  |
| 8         | 2            |                   | 4              | 2 4               | 10             |                   | 3              |                   | 1                 | 1        | 1       |   |  |  |
| 9         | 2            |                   | 3              | 1                 | 4              |                   | 3              |                   | 1                 | 1        | 1       |   |  |  |
| 10        | 2            |                   | 5              |                   | 4              |                   | 3              |                   | 1                 | 1        | 1       |   |  |  |
| 11        | 2            |                   | 5              |                   | 4              |                   | 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 October, 1860.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | 29.659                                    | 29.717                                 | 29.600  | 0.117   | 82.1                       | 88.2                                     | 80.0 | 8.2   |
| 2     | .632                                      | .679                                   | .570    | .109    | 80.8                       | 83.4                                     | 78.7 | 4.7   |
| 3     | .646                                      | .697                                   | .594    | .103    | 83.5                       | 87.8                                     | 80.0 | 7.8   |
| 4     | .712                                      | .766                                   | .655    | .111    | 82.9                       | 85.8                                     | 81.0 | 4.8   |
| 5     | .760                                      | .810                                   | .706    | .104    | 83.4                       | 88.5                                     | 79.6 | 8.9   |
| 6     | .831                                      | .883                                   | .786    | .097    | 84.5                       | 91.2                                     | 79.4 | 11.8  |
| 7     | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 8     | .851                                      | .927                                   | .810    | .117    | 84.1                       | 89.4                                     | 79.2 | 10.2  |
| 9     | .816                                      | .885                                   | .743    | .142    | 81.7                       | 84.6                                     | 79.6 | 5.0   |
| 10    | .807                                      | .872                                   | .760    | .112    | 80.0                       | 81.6                                     | 78.4 | 3.2   |
| 11    | .848                                      | .920                                   | .792    | .128    | 82.9                       | 88.3                                     | 78.8 | 9.5   |
| 12    | .874                                      | .940                                   | .811    | .129    | 82.9                       | 89.0                                     | 78.8 | 10.2  |
| 13    | .890                                      | .959                                   | .829    | .130    | 83.0                       | 90.4                                     | 79.0 | 11.4  |
| 14    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 15    | .848                                      | .925                                   | .794    | .131    | 82.7                       | 90.4                                     | 79.6 | 10.8  |
| 16    | .847                                      | .917                                   | .792    | .125    | 82.6                       | 87.6                                     | 79.2 | 8.4   |
| 17    | .849                                      | .916                                   | .801    | .115    | 83.2                       | 89.4                                     | 79.0 | 10.4  |
| 18    | .872                                      | .946                                   | .817    | .129    | 82.5                       | 89.2                                     | 77.2 | 12.0  |
| 19    | .876                                      | .950                                   | .827    | .123    | 81.6                       | 88.4                                     | 75.4 | 13.0  |
| 20    | .855                                      | .921                                   | .811    | .110    | 81.5                       | 88.6                                     | 74.8 | 13.8  |
| 21    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 22    | .865                                      | .945                                   | .809    | .136    | 82.4                       | 89.0                                     | 76.4 | 12.6  |
| 23    | .857                                      | .933                                   | .802    | .131    | 81.3                       | 86.4                                     | 76.4 | 10.0  |
| 24    | .859                                      | .930                                   | .809    | .121    | 81.8                       | 88.8                                     | 75.4 | 13.4  |
| 25    | .854                                      | .933                                   | .791    | .142    | 82.0                       | 88.8                                     | 75.8 | 13.0  |
| 26    | .827                                      | .908                                   | .758    | .150    | 81.0                       | 87.8                                     | 76.0 | 11.8  |
| 27    | .801                                      | .870                                   | .737    | .133    | 78.8                       | 85.0                                     | 72.6 | 12.4  |
| 28    | <i>Sunday.</i>                            |                                        |         |         |                            |                                          |      |       |
| 29    | .749                                      | .802                                   | .702    | .100    | 79.3                       | 85.2                                     | 74.4 | 10.8  |
| 30    | .780                                      | .840                                   | .719    | .121    | 80.3                       | 87.2                                     | 74.6 | 12.6  |
| 31    | .800                                      | .871                                   | .741    | .130    | 79.1                       | 85.8                                     | 74.0 | 11.8  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four 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, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermo-<br>meter. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of Air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humidity,<br>complete saturation be-<br>ing unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|
|       | °                               | °                   | °                   | °                            | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                   |
| 1     | 80.0                            | 2.1                 | 78.9                | 3.2                          | 0.967                            | 10.41                                            | 1.10                                                                    | 0.90                                                              |
| 2     | 78.7                            | 2.1                 | 77.6                | 3.2                          | .928                             | .01                                              | .06                                                                     | .90                                                               |
| 3     | 79.5                            | 4.0                 | 77.5                | 6.0                          | .925                             | 9.92                                             | 2.08                                                                    | .83                                                               |
| 4     | 78.6                            | 4.3                 | 76.4                | 6.5                          | .893                             | .58                                              | .21                                                                     | .81                                                               |
| 5     | 79.3                            | 4.1                 | 77.2                | 6.2                          | .916                             | .83                                              | .13                                                                     | .82                                                               |
| 6     | 79.1                            | 5.4                 | 76.4                | 8.1                          | .893                             | .56                                              | .79                                                                     | .77                                                               |
| 7     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 8     | 78.9                            | 5.2                 | 76.3                | 7.8                          | .890                             | .53                                              | .68                                                                     | .78                                                               |
| 9     | 79.1                            | 2.6                 | 77.8                | 3.9                          | .934                             | 10.05                                            | 1.32                                                                    | .88                                                               |
| 10    | 77.9                            | 2.1                 | 76.8                | 3.2                          | .905                             | 9.77                                             | .04                                                                     | .90                                                               |
| 11    | 78.5                            | 4.4                 | 76.3                | 6.6                          | .890                             | .55                                              | 2.24                                                                    | .81                                                               |
| 12    | 78.6                            | 4.3                 | 76.4                | 6.5                          | .893                             | .58                                              | .21                                                                     | .81                                                               |
| 13    | 79.1                            | 3.9                 | 77.1                | 5.9                          | .913                             | .80                                              | .02                                                                     | .83                                                               |
| 14    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 15    | 78.8                            | 3.9                 | 76.8                | 5.9                          | .905                             | .71                                              | .01                                                                     | .83                                                               |
| 16    | 79.1                            | 3.5                 | 77.3                | 5.3                          | .919                             | .88                                              | 1.80                                                                    | .85                                                               |
| 17    | 78.2                            | 5.0                 | 75.7                | 7.5                          | .873                             | .36                                              | 2.53                                                                    | .79                                                               |
| 18    | 76.2                            | 6.3                 | 73.0                | 9.5                          | .801                             | 8.58                                             | 3.06                                                                    | .74                                                               |
| 19    | 74.7                            | 6.9                 | 71.2                | 10.4                         | .756                             | .13                                              | .21                                                                     | .72                                                               |
| 20    | 75.6                            | 5.9                 | 72.6                | 8.9                          | .790                             | .50                                              | 2.81                                                                    | .75                                                               |
| 21    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 22    | 75.9                            | 6.5                 | 72.6                | 9.8                          | .790                             | .49                                              | 3.12                                                                    | .73                                                               |
| 23    | 75.5                            | 5.8                 | 72.6                | 8.7                          | .790                             | .50                                              | 2.74                                                                    | .76                                                               |
| 24    | 75.7                            | 6.1                 | 72.6                | 9.2                          | .790                             | .50                                              | .90                                                                     | .75                                                               |
| 25    | 76.2                            | 5.8                 | 73.3                | 8.7                          | .809                             | .68                                              | .79                                                                     | .76                                                               |
| 26    | 73.2                            | 7.8                 | 69.3                | 11.7                         | .711                             | 7.64                                             | 3.50                                                                    | .69                                                               |
| 27    | 71.1                            | 7.7                 | 67.2                | 11.6                         | .664                             | .17                                              | .27                                                                     | .69                                                               |
| 28    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                   |
| 29    | 74.4                            | 4.9                 | 71.9                | 7.4                          | .773                             | 8.36                                             | 2.23                                                                    | .79                                                               |
| 30    | 74.7                            | 5.6                 | 71.9                | 8.4                          | .773                             | .34                                              | .57                                                                     | .76                                                               |
| 31    | 71.2                            | 7.9                 | 67.2                | 11.9                         | .664                             | 7.17                                             | 3.36                                                                    | .68                                                               |

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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.803                                    | 29.888                                                 | 29.655  | 0.233   | 79.6                       | 83.2                                                     | 76.6 | 6.6   |
| 1          | .795                                      | .880                                                   | .633    | .247    | 79.3                       | 82.8                                                     | 75.6 | 7.2   |
| 2          | .789                                      | .873                                                   | .621    | .252    | 78.8                       | 82.5                                                     | 74.6 | 7.9   |
| 3          | .788                                      | .850                                                   | .623    | .227    | 78.4                       | 82.3                                                     | 74.0 | 8.3   |
| 4          | .785                                      | .869                                                   | .613    | .256    | 78.3                       | 82.6                                                     | 73.5 | 9.1   |
| 5          | .810                                      | .884                                                   | .613    | .271    | 77.6                       | 81.2                                                     | 72.6 | 8.6   |
| 6          | .818                                      | .900                                                   | .635    | .265    | 77.8                       | 82.2                                                     | 72.8 | 9.4   |
| 7          | .839                                      | .919                                                   | .658    | .261    | 78.3                       | 81.8                                                     | 73.2 | 8.6   |
| 8          | .857                                      | .945                                                   | .682    | .263    | 80.4                       | 84.0                                                     | 75.4 | 8.6   |
| 9          | .875                                      | .956                                                   | .679    | .277    | 82.4                       | 85.4                                                     | 78.4 | 7.0   |
| 10         | .873                                      | .959                                                   | .671    | .288    | 83.7                       | 87.0                                                     | 79.2 | 7.8   |
| 11         | .855                                      | .944                                                   | .663    | .281    | 85.2                       | 88.2                                                     | 79.2 | 9.0   |
| Noon.      | .831                                      | .909                                                   | .647    | .262    | 86.3                       | 89.6                                                     | 79.4 | 10.2  |
| 1          | .806                                      | .885                                                   | .604    | .281    | 86.7                       | 90.6                                                     | 80.2 | 10.4  |
| 2          | .779                                      | .851                                                   | .589    | .262    | 86.9                       | 91.2                                                     | 81.3 | 9.9   |
| 3          | .766                                      | .837                                                   | .570    | .267    | 86.4                       | 90.4                                                     | 81.2 | 9.2   |
| 4          | .761                                      | .835                                                   | .580    | .255    | 86.0                       | 89.3                                                     | 81.6 | 7.7   |
| 5          | .761                                      | .835                                                   | .586    | .249    | 84.9                       | 89.2                                                     | 81.2 | 8.0   |
| 6          | .772                                      | .856                                                   | .599    | .257    | 83.2                       | 86.2                                                     | 80.4 | 5.8   |
| 7          | .791                                      | .887                                                   | .611    | .276    | 82.0                       | 85.4                                                     | 78.8 | 6.6   |
| 8          | .806                                      | .893                                                   | .648    | .245    | 81.2                       | 84.2                                                     | 77.6 | 6.6   |
| 9          | .821                                      | .896                                                   | .657    | .239    | 80.7                       | 83.6                                                     | 76.4 | 7.2   |
| 10         | .825                                      | .903                                                   | .673    | .230    | 80.2                       | 83.6                                                     | 76.0 | 7.6   |
| 11         | .828                                      | .903                                                   | .674    | .229    | 79.8                       | 83.6                                                     | 75.2 | 8.4   |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force<br>of Vapour. | Mean Weight of Va-<br>pour in a Cubic<br>foot of Air. | Additional Weight of<br>Vapour required<br>for complete satu-<br>ration. | Mean degree of Hu-<br>midity, complete<br>saturation being<br>unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                                |                                                                      |
| Mid-<br>night. | 76.9                            | 2.7                 | 75.5                | 4.1                          | 0.868                            | 9.38                                                  | 1.31                                                                     | 0.88                                                                 |
| 1              | 77.0                            | 2.3                 | 75.8                | 3.5                          | .876                             | .46                                                   | .13                                                                      | .89                                                                  |
| 2              | 76.5                            | 2.3                 | 75.3                | 3.5                          | .862                             | .32                                                   | .12                                                                      | .89                                                                  |
| 3              | 76.2                            | 2.2                 | 75.1                | 3.3                          | .857                             | .28                                                   | .03                                                                      | .90                                                                  |
| 4              | 76.2                            | 2.1                 | 75.1                | 3.2                          | .857                             | .28                                                   | .00                                                                      | .90                                                                  |
| 5              | 75.5                            | 2.1                 | 74.4                | 3.2                          | .838                             | .10                                                   | 0.97                                                                     | .90                                                                  |
| 6              | 75.8                            | 2.0                 | 74.8                | 3.0                          | .849                             | .20                                                   | .93                                                                      | .91                                                                  |
| 7              | 76.1                            | 2.2                 | 75.0                | 3.3                          | .854                             | .25                                                   | 1.03                                                                     | .90                                                                  |
| 8              | 76.5                            | 3.9                 | 74.5                | 5.9                          | .840                             | .07                                                   | .87                                                                      | .83                                                                  |
| 9              | 77.1                            | 5.3                 | 74.4                | 8.0                          | .838                             | .00                                                   | 2.61                                                                     | .78                                                                  |
| 10             | 77.2                            | 6.5                 | 73.9                | 9.8                          | .824                             | 8.83                                                  | 3.24                                                                     | .73                                                                  |
| 11             | 77.6                            | 7.6                 | 73.8                | 11.4                         | .822                             | .78                                                   | .83                                                                      | .70                                                                  |
| Noon.          | 77.7                            | 8.6                 | 73.4                | 12.9                         | .811                             | .64                                                   | 4.38                                                                     | .66                                                                  |
| 1              | 77.7                            | 9.0                 | 73.2                | 13.5                         | .806                             | .57                                                   | .61                                                                      | .65                                                                  |
| 2              | 77.7                            | 9.2                 | 73.1                | 13.8                         | .803                             | .54                                                   | .71                                                                      | .65                                                                  |
| 3              | 77.3                            | 9.1                 | 72.7                | 13.7                         | .792                             | .44                                                   | .62                                                                      | .65                                                                  |
| 4              | 77.1                            | 8.9                 | 72.6                | 13.4                         | .790                             | .43                                                   | .48                                                                      | .65                                                                  |
| 5              | 77.2                            | 7.7                 | 73.3                | 11.6                         | .809                             | .63                                                   | 3.86                                                                     | .69                                                                  |
| 6              | 77.6                            | 5.6                 | 74.8                | 8.4                          | .849                             | 9.11                                                  | 2.78                                                                     | .77                                                                  |
| 7              | 77.4                            | 4.6                 | 75.1                | 6.9                          | .857                             | .21                                                   | .26                                                                      | .80                                                                  |
| 8              | 77.2                            | 4.0                 | 75.2                | 6.0                          | .860                             | .26                                                   | 1.95                                                                     | .83                                                                  |
| 9              | 77.1                            | 3.6                 | 75.3                | 5.4                          | .862                             | .31                                                   | .73                                                                      | .84                                                                  |
| 10             | 76.9                            | 3.3                 | 75.2                | 5.0                          | .860                             | .28                                                   | .60                                                                      | .85                                                                  |
| 11             | 76.7                            | 3.1                 | 75.1                | 4.7                          | .857                             | .25                                                   | .50                                                                      | .86                                                                  |

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, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                                    |
|-------|-----------------------|---------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------|
| 1     | o                     | Inches.<br>0.42                 | S.                                | Scatd. $\searrow$ i till 6 A. M. cloudy afterwards also raining at Noon & 1 & 3 P. M.                         |
| 2     | ...                   | ..                              | S. & E.                           | Cloudy also drizzling at 3 & 4 & 7 P. M.                                                                      |
| 3     | 136.0                 | ...                             | S.                                | Scatd. clouds.                                                                                                |
| 4     | ...                   | ...                             | S. W. & S.                        | Cloudy.                                                                                                       |
| 5     | 135.4                 | ...                             | S. W. & S.                        | Cloudy till 7 A. M. Scatd. clouds till 4 P. M. Scatd. $\searrow$ i afterwards.                                |
| 6     | 144.0                 | ...                             | S. W. & N. E. & N.                | Scatd. $\searrow$ i till 3 P. M. cloudless afterwards:                                                        |
| 7     | <i>Sunday.</i>        | ...                             |                                   |                                                                                                               |
| 8     | 137.0                 | ...                             | S. & W. & S. W.                   | Cloudless till 8 A. M. Scatd. clouds till 6 P. M. cloudless afterwards.                                       |
| 9     | ...                   | ...                             | N. & S. W.                        | Scatd. $\searrow$ i till 5 A. M. cloudy till 6 P. M. cloudless afterwards also drizzling between 6 & 9 A. M.  |
| 10    | ...                   | 1.26                            | S. W. & S.                        | Cloudy, also raining after intervals between 2 & 10 A. M.                                                     |
| 11    | 139.0                 | ...                             | S. & E. & S. W.                   | Scatd. $\searrow$ i.                                                                                          |
| 12    | 127.6                 | ...                             | W. & S. E. & E.                   | Scatd. clouds.                                                                                                |
| 13    | 147.0                 | ...                             | S.                                | Cloudless till 6 A. M. Scatd. clouds till 6 P. M. cloudless afterwards, also slightly drizzling at 3 P. M.    |
| 14    | <i>Sunday.</i>        | ...                             |                                   |                                                                                                               |
| 15    | 149.0                 | ...                             | S.                                | Cloudless till 8 A. M. Scatd. clouds till 9 P. M. cloudless afterwards.                                       |
| 16    | 125.0                 | ...                             | S. & W.                           | Cloudless till 5 A. M. Scatd. clouds till 6 P. M. cloudless afterwards, also drizzling between noon & 1 P. M. |
| 17    | 142.2                 | ...                             | W. & S. & S. W.                   | Cloudless till 5 A. M. Scatd. clouds till 2 P. M. cloudless afterwards.                                       |
| 18    | 140.0                 | ...                             | S. W & S. & W.                    | Cloudless.                                                                                                    |
| 19    | 141.7                 | ...                             | W. & N. W. & S. }<br>W. & N. E. } | Cloudless.                                                                                                    |
| 20    | 140.0                 | ...                             | N. E. & W. & S.                   | Cloudless till 10 A. M. Scatd. clouds afterwards.                                                             |
| 21    | <i>Sunday.</i>        | ...                             |                                   |                                                                                                               |
| 22    | 148.4                 | ...                             | S. E. & N. E.                     | Cloudless till 8 A. M. Scatd. $\searrow$ i & $\searrow$ i afterwards.                                         |
| 23    | ...                   | ...                             | S. & E.                           | Scatd. $\searrow$ i till 4 A. M. cloudless till 9 A. M. Scatd. clouds till 4 P. M. cloudless afterwards.      |
| 24    | 146.0                 | ...                             | N. E. & N. & W.                   | Cloudless till 11 A. M. Scatd. $\searrow$ i till 4 P. M. cloudless afterwards.                                |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October, 1860.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                |
|-------|-----------------------|---------------------------------|-----------------------------------|---------------------------------------------------------------------------|
|       |                       | Inches.                         |                                   |                                                                           |
| 25    | 140.0                 | ...                             | N. & N. W.                        | Cloudless till 10 A. M. Scatd. \i & \i till 9 P. M. cloudless afterwards. |
| 26    | 143.0                 | ...                             | N. & N. W.                        | Cloudless till 6 A. M. Scatd. \i till 3 P. M. cloudless afterwards.       |
| 27    | 123.0                 | ...                             | N. & N. W.                        | Scatd. \i & \i.                                                           |
| 28    | <i>Sunday.</i>        | ...                             |                                   |                                                                           |
| 29    | ...                   | ...                             | N.                                | Scatd. \i till 6 A. M. cloudy afterwards.                                 |
| 30    | 144.0                 | ...                             | N. W. & N.                        | Scatd. \i & \i till 9 P. M. cloudless afterwards.                         |
| 31    | 140.0                 | ..                              | N. & W.                           | Cloudless till 5 A. M. Scatd. \i & \i till 4 P. M. cloudless afterwards.  |

\i Cirri, \i Cirro strati, \i Cumuli, \i Cumulo strati, \i Nimbi,—i Strati, \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, 1860.*

MONTHLY RESULTS.

|                                                                 |    |    | Inches. |
|-----------------------------------------------------------------|----|----|---------|
| Mean height of the Barometer for the month,                     | .. | .. | 29.810  |
| Max. height of the Barometer, occurred at 10 A. M. on the 13th, | .. | .. | 29.959  |
| Min. height of the Barometer, occurred at 3 P. M. on the 2nd,   | .. | .. | 29.570  |
| <i>Extreme range</i> of the Barometer during the month,         | .. | .. | 0.389   |
| Mean of the Daily Max. Pressures,                               | .. | .. | 29.876  |
| Ditto ditto Min. ditto,                                         | .. | .. | 29.754  |
| <i>Mean daily range</i> of the Barometer during the month,      | .. | .. | 0.122   |

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|                                                              |    |    |      |
|--------------------------------------------------------------|----|----|------|
|                                                              |    |    | o    |
| Mean Dry Bulb Thermometer for the month,                     | .. | .. | 81.9 |
| Max. Temperature occurred at 2 P. M. on the 6th,             | .. | .. | 91.2 |
| Min. Temperature occurred at 5 A. M. on the 27th,            | .. | .. | 72.6 |
| <i>Extreme range</i> of the Temperature during the month,    | .. | .. | 18.6 |
| Mean of the daily Max. Temperature,                          | .. | .. | 87.6 |
| Ditto ditto Min. ditto,                                      | .. | .. | 77.5 |
| <i>Mean daily range</i> of the Temperature during the month, | .. | .. | 10.1 |

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|                                                               |    |    |        |
|---------------------------------------------------------------|----|----|--------|
|                                                               |    |    | o      |
| Mean Wet Bulb Thermometer for the month,                      | .. | .. | 76.9   |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, .. |    |    | 5.0    |
| Computed Mean Dew Point for the month,                        | .. | .. | 74.4   |
| Mean Dry Bulb Thermometer above computed Mean Dew-point, ..   |    |    | 7.5    |
|                                                               |    |    | Inches |
| Mean Elastic force of vapour for the month, ..                | .. | .. | 0.838  |

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|                                                                         |    |    |             |
|-------------------------------------------------------------------------|----|----|-------------|
|                                                                         |    |    | Troy grains |
| Mean weight of Vapour for the month, ..                                 | .. | .. | 9.00        |
| Additional weight of Vapour required for complete saturation, ..        | .. | .. | 2.44        |
| Mean degree of humidity for the month, complete saturation being unity, |    |    | 0.79        |

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|                                                      |    |    |         |
|------------------------------------------------------|----|----|---------|
|                                                      |    |    | Inches  |
| Rained 6 days, Max. fall of rain during 24 hours, .. | .. | .. | 1.26    |
| Total amount of rain during the month, ..            | .. | .. | 1.68    |
| Prevailing direction of the Wind, ..                 | .. | .. | S. & N. |

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of October, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

| Hour.     | No. of days. |          |       |          |    |          |       |          |    |          |       |          |    |          |       |          |       |          |         |
|-----------|--------------|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|-------|----------|---------|
|           | N.           | Rain on. | N. E. | Rain on. | E. | Rain on. | S. E. | Rain on. | S. | Rain on. | S. W. | Rain on. | W. | Rain on. | N. W. | Rain on. | Calm. | Rain on. | Missed. |
| Midnight. | 7            | 3        |       |          |    |          |       |          | 11 | 3        |       |          | 1  |          |       |          |       |          | 2       |
| 1         | 6            | 4        |       |          |    |          | 1     |          | 11 | 3        |       |          |    |          |       |          |       |          | 2       |
| 2         | 7            | 4        |       |          | 1  |          | 1     |          | 9  | 3        |       |          | 1  |          |       |          |       |          | 2       |
| 3         | 7            | 4        |       |          | 1  |          | 1     |          | 8  | 3        |       |          | 1  |          |       |          |       |          | 1       |
| 4         | 5            | 4        |       |          | 1  |          | 1     |          | 9  | 3        |       |          | 1  |          |       |          |       |          | 3       |
| 5         | 6            | 3        |       |          |    |          | 1     |          | 9  | 3        | 1     |          | 1  |          |       |          |       |          | 4       |
| 6         | 7            | 3        |       |          | 3  |          | 2     | 1        | 8  | 4        |       |          |    |          |       |          |       |          |         |
| 7         | 6            | 2        |       |          | 3  |          | 2     | 1        | 7  | 5        |       |          | 2  |          |       |          |       |          |         |
| 8         | 8            | 1        |       |          | 5  |          | 2     |          | 4  | 2        |       |          | 2  |          |       |          |       |          | 3       |
| 9         | 6            | 3        |       |          | 4  |          | 2     | 1        | 7  | 2        |       |          | 2  |          | 1     |          |       |          |         |
| 10        | 6            | 3        |       |          | 2  |          | 3     | 1        | 5  | 4        |       |          | 3  |          | 1     |          |       |          |         |
| 11        | 5            | 2        |       |          | 1  |          | 2     |          | 5  | 6        |       |          | 3  |          | 3     |          |       |          |         |
| Noon.     | 6            | 1        |       |          | 3  |          | 1     |          | 6  | 5        |       |          | 5  |          | 2     |          |       |          |         |
| 1         | 7            | 1        |       |          | 1  |          |       | 1        | 4  | 4        |       |          | 7  |          | 3     |          |       |          |         |
| 2         | 7            |          |       |          | 1  |          |       |          | 3  | 4        |       |          | 8  |          | 2     |          |       |          |         |
| 3         | 6            |          |       |          | 3  |          | 2     |          | 3  | 5        |       |          | 4  |          | 4     |          |       |          |         |
| 4         | 2            |          | 1     |          | 1  |          | 2     |          | 3  | 4        | 1     |          | 7  |          | 6     |          |       |          | 1       |
| 5         | 2            |          | 1     |          | 1  |          | 1     |          | 6  | 3        |       |          | 8  |          | 5     |          |       |          |         |
| 6         | 3            |          |       |          | 1  |          | 1     |          | 8  | 2        |       |          | 7  |          | 5     |          |       |          |         |
| 7         | 3            |          |       |          | 2  |          | 1     |          | 8  | 3        | 1     |          | 5  |          | 5     |          |       |          |         |
| 8         | 3            |          |       |          | 1  |          | 1     |          | 9  | 4        |       |          | 4  |          | 5     |          |       |          | 1       |
| 9         | 3            |          |       |          | 1  |          | 1     |          | 9  | 4        |       |          | 4  |          | 5     |          |       |          |         |
| 10        | 4            |          |       |          | 1  |          | 1     |          | 9  | 4        |       |          | 3  |          | 5     |          |       |          |         |
| 11        | 5            |          |       |          | 1  |          | 1     |          | 8  | 3        |       |          | 3  |          | 4     |          |       |          | 2       |

Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November, 1860.

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Date. | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer during the day. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature during the day. |      |       |
|-------|-------------------------------------------|----------------------------------------|---------|---------|----------------------------|------------------------------------------|------|-------|
|       |                                           | Max.                                   | Min.    | Diff.   |                            | Max.                                     | Min. | Diff. |
|       | Inches.                                   | Inches.                                | Inches. | Inches. | o                          | o                                        | o    | o     |
| 1     | 29.792                                    | 29.865                                 | 29.741  | 0.124   | 78.1                       | 85.5                                     | 71.8 | 13.7  |
| 2     | .813                                      | .888                                   | .772    | .116    | 77.1                       | 86.2                                     | 70.0 | 16.2  |
| 3     | .851                                      | .931                                   | .803    | .128    | 76.1                       | 85.8                                     | 68.0 | 17.8  |
| 4     | Sunday.                                   |                                        |         |         |                            |                                          |      |       |
| 5     | .935                                      | .992                                   | .898    | .094    | 78.1                       | 85.4                                     | 71.8 | 13.6  |
| 6     | .913                                      | .968                                   | .856    | .112    | 78.8                       | 85.0                                     | 74.6 | 10.4  |
| 7     | .886                                      | .951                                   | .820    | .131    | 78.1                       | 85.6                                     | 73.0 | 12.6  |
| 8     | .880                                      | .947                                   | .825    | .122    | 78.9                       | 85.0                                     | 74.9 | 10.1  |
| 9     | .908                                      | .975                                   | .860    | .115    | 78.5                       | 86.2                                     | 72.4 | 13.8  |
| 10    | .939                                      | 30.000                                 | .877    | .123    | 77.8                       | 85.2                                     | 71.4 | 13.8  |
| 11    | Sunday.                                   |                                        |         |         |                            |                                          |      |       |
| 12    | .964                                      | .043                                   | .891    | .152    | 77.8                       | 85.8                                     | 71.0 | 14.8  |
| 13    | .975                                      | .042                                   | .917    | .125    | 76.6                       | 85.5                                     | 69.6 | 15.9  |
| 14    | .960                                      | .034                                   | .889    | .145    | 76.7                       | 86.6                                     | 69.3 | 17.3  |
| 15    | .908                                      | 29.973                                 | .840    | .133    | 76.6                       | 86.6                                     | 69.5 | 17.1  |
| 16    | .874                                      | .923                                   | .820    | .103    | 78.0                       | 85.8                                     | 72.6 | 13.2  |
| 17    | .841                                      | .914                                   | .758    | .156    | 79.0                       | 87.2                                     | 73.2 | 14.0  |
| 18    | Sunday.                                   |                                        |         |         |                            |                                          |      |       |
| 19    | .782                                      | .837                                   | .740    | .097    | 79.4                       | 88.6                                     | 72.8 | 15.8  |
| 20    | .871                                      | .939                                   | .806    | .133    | 78.1                       | 87.0                                     | 72.0 | 15.0  |
| 21    | .932                                      | 30.006                                 | .887    | .119    | 77.0                       | 85.6                                     | 70.8 | 14.8  |
| 22    | .958                                      | .029                                   | .913    | .116    | 72.5                       | 82.1                                     | 67.0 | 15.1  |
| 23    | .975                                      | .036                                   | .928    | .108    | 70.0                       | 80.9                                     | 62.9 | 18.0  |
| 24    | 30.001                                    | .079                                   | .951    | .128    | 69.6                       | 80.3                                     | 61.4 | 18.9  |
| 25    | Sunday.                                   |                                        |         |         |                            |                                          |      |       |
| 26    | .028                                      | .087                                   | .978    | .109    | 69.9                       | 80.6                                     | 62.4 | 18.2  |
| 27    | .081                                      | .167                                   | 30.031  | .136    | 69.7                       | 81.2                                     | 60.4 | 20.8  |
| 28    | .077                                      | .149                                   | .017    | .132    | 69.4                       | 80.6                                     | 60.8 | 19.8  |
| 29    | .043                                      | .116                                   | 29.956  | .160    | 70.2                       | 80.4                                     | 62.8 | 17.6  |
| 30    | .017                                      | .106                                   | .938    | .168    | 70.9                       | 80.6                                     | 63.2 | 17.4  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Thermo-<br>meter. | Dry Bulb above Wet. | Computed Dew Point. | Dry<br>Bulb<br>above<br>Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of Air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humidity,<br>complete saturation be-<br>ing unity. |
|-------|---------------------------------|---------------------|---------------------|---------------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|
|       | o                               | o                   | o                   | o                                     | Inches.                          | T. gr.                                           | T. gr.                                                                  |                                                                   |
| 1     | 69.4                            | 8.7                 | 65.0                | 13.1                                  | .617                             | 6.69                                             | 3.53                                                                    | .66                                                               |
| 2     | 69.2                            | 7.9                 | 65.2                | 11.9                                  | .621                             | .74                                              | .18                                                                     | .68                                                               |
| 3     | 69.0                            | 7.1                 | 65.4                | 10.7                                  | .626                             | .80                                              | 2.83                                                                    | .71                                                               |
| 4     | <i>Sunday.</i>                  |                     |                     |                                       |                                  |                                                  |                                                                         |                                                                   |
| 5     | 70.9                            | 7.2                 | 67.3                | 10.8                                  | .666                             | 7.21                                             | 3.01                                                                    | .71                                                               |
| 6     | 73.2                            | 5.6                 | 70.4                | 8.4                                   | .736                             | .97                                              | 2.47                                                                    | .76                                                               |
| 7     | 73.6                            | 4.5                 | 71.3                | 6.8                                   | .758                             | 8.21                                             | .01                                                                     | .80                                                               |
| 8     | 73.7                            | 5.2                 | 71.1                | 7.8                                   | .753                             | .15                                              | .32                                                                     | .78                                                               |
| 9     | 71.8                            | 6.7                 | 68.4                | 10.1                                  | .690                             | 7.47                                             | .88                                                                     | .72                                                               |
| 10    | 71.0                            | 6.8                 | 67.6                | 10.2                                  | .672                             | .29                                              | .84                                                                     | .72                                                               |
| 11    | <i>Sunday.</i>                  |                     |                     |                                       |                                  |                                                  |                                                                         |                                                                   |
| 12    | 70.3                            | 7.5                 | 66.5                | 11.3                                  | .648                             | .03                                              | 3.10                                                                    | .69                                                               |
| 13    | 69.0                            | 7.6                 | 65.2                | 11.4                                  | .621                             | 6.76                                             | .01                                                                     | .69                                                               |
| 14    | 69.6                            | 7.1                 | 66.0                | 10.7                                  | .638                             | .92                                              | 2.88                                                                    | .71                                                               |
| 15    | 69.9                            | 6.7                 | 66.5                | 10.1                                  | .648                             | 7.05                                             | .72                                                                     | .72                                                               |
| 16    | 72.3                            | 5.7                 | 69.4                | 8.6                                   | .713                             | .72                                              | .47                                                                     | .76                                                               |
| 17    | 73.9                            | 5.1                 | 71.3                | 7.7                                   | .758                             | 8.20                                             | .30                                                                     | .78                                                               |
| 18    | <i>Sunday.</i>                  |                     |                     |                                       |                                  |                                                  |                                                                         |                                                                   |
| 19    | 73.4                            | 6.0                 | 70.4                | 9.0                                   | .736                             | 7.95                                             | .67                                                                     | .75                                                               |
| 20    | 70.4                            | 7.7                 | 66.5                | 11.6                                  | .648                             | .02                                              | 3.20                                                                    | .69                                                               |
| 21    | 68.2                            | 8.8                 | 63.8                | 13.2                                  | .593                             | 6.44                                             | .45                                                                     | .65                                                               |
| 22    | 64.8                            | 7.7                 | 60.9                | 11.6                                  | .539                             | 5.90                                             | 2.73                                                                    | .68                                                               |
| 23    | 62.5                            | 7.5                 | 58.7                | 11.3                                  | .501                             | .52                                              | .48                                                                     | .69                                                               |
| 24    | 61.4                            | 8.2                 | 57.3                | 12.3                                  | .478                             | .26                                              | .64                                                                     | .67                                                               |
| 25    | <i>Sunday.</i>                  |                     |                     |                                       |                                  |                                                  |                                                                         |                                                                   |
| 26    | 62.8                            | 7.1                 | 59.2                | 10.7                                  | .509                             | .60                                              | .38                                                                     | .70                                                               |
| 27    | 60.6                            | 9.1                 | 56.0                | 13.7                                  | .453                             | .03                                              | .90                                                                     | .63                                                               |
| 28    | 61.3                            | 8.1                 | 57.2                | 12.2                                  | .476                             | .24                                              | .62                                                                     | .67                                                               |
| 29    | 63.5                            | 6.7                 | 60.1                | 10.1                                  | .525                             | .77                                              | .28                                                                     | .72                                                               |
| 30    | 64.7                            | 6.2                 | 61.6                | 9.3                                   | .552                             | 6.06                                             | .17                                                                     | .74                                                               |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of November, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements dependent thereon.

| Hour.      | Mean Height of the Barometer at 32° Fahr. | Range of the Barometer for each hour during the month. |         |         | Mean Dry Bulb Thermometer. | Range of the Temperature for each hour during the month. |      |       |
|------------|-------------------------------------------|--------------------------------------------------------|---------|---------|----------------------------|----------------------------------------------------------|------|-------|
|            |                                           | Max.                                                   | Min.    | Diff.   |                            | Max.                                                     | Min. | Diff. |
|            | Inches.                                   | Inches.                                                | Inches. | Inches. | o                          | o                                                        | o    | o     |
| Mid-night. | 29.926                                    | 30.092                                                 | 29.773  | 0.319   | 72.1                       | 76.8                                                     | 64.2 | 12.6  |
| 1          | .923                                      | .080                                                   | .768    | .312    | 71.3                       | 76.4                                                     | 63.3 | 13.1  |
| 2          | .915                                      | .070                                                   | .760    | .310    | 70.8                       | 76.0                                                     | 62.1 | 13.9  |
| 3          | .916                                      | .058                                                   | .760    | .298    | 70.1                       | 75.7                                                     | 61.0 | 14.7  |
| 4          | .905                                      | .057                                                   | .755    | .302    | 70.0                       | 75.0                                                     | 61.3 | 13.7  |
| 5          | .910                                      | .062                                                   | .765    | .297    | 69.4                       | 74.7                                                     | 61.2 | 13.5  |
| 6          | .936                                      | .083                                                   | .772    | .311    | 68.9                       | 75.0                                                     | 60.4 | 14.6  |
| 7          | .956                                      | .114                                                   | .796    | .318    | 69.3                       | 75.8                                                     | 61.2 | 14.6  |
| 8          | .983                                      | .138                                                   | .817    | .321    | 71.9                       | 77.8                                                     | 62.6 | 15.2  |
| 9          | .998                                      | .161                                                   | .836    | .325    | 74.6                       | 79.8                                                     | 66.4 | 13.4  |
| 10         | .995                                      | .167                                                   | .836    | .331    | 77.8                       | 81.8                                                     | 71.0 | 10.8  |
| 11         | .976                                      | .146                                                   | .837    | .309    | 80.4                       | 84.4                                                     | 74.6 | 9.8   |
| Noon.      | .950                                      | .114                                                   | .792    | .322    | 82.5                       | 86.3                                                     | 76.6 | 9.7   |
| 1          | .919                                      | .080                                                   | .767    | .313    | 83.8                       | 88.0                                                     | 79.4 | 8.6   |
| 2          | .896                                      | .046                                                   | .744    | .302    | 84.2                       | 88.6                                                     | 80.3 | 8.3   |
| 3          | .881                                      | .031                                                   | .740    | .291    | 83.6                       | 86.6                                                     | 79.2 | 7.4   |
| 4          | .876                                      | .034                                                   | .746    | .288    | 81.9                       | 85.2                                                     | 77.5 | 7.7   |
| 5          | .884                                      | .035                                                   | .740    | .295    | 79.9                       | 83.2                                                     | 75.0 | 8.2   |
| 6          | .894                                      | .039                                                   | .746    | .293    | 77.8                       | 82.2                                                     | 71.8 | 10.4  |
| 7          | .917                                      | .058                                                   | .773    | .285    | 75.8                       | 80.4                                                     | 70.0 | 10.4  |
| 8          | .932                                      | .074                                                   | .791    | .283    | 74.7                       | 79.4                                                     | 68.0 | 11.4  |
| 9          | .943                                      | .084                                                   | .798    | .286    | 73.7                       | 78.6                                                     | 66.9 | 11.7  |
| 10         | .948                                      | .091                                                   | .807    | .284    | 72.8                       | 77.9                                                     | 65.6 | 12.3  |
| 11         | .943                                      | .101                                                   | .803    | .298    | 72.4                       | 77.6                                                     | 64.8 | 12.8  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers 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, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force<br>of Vapour. | Mean Weight of Va-<br>pour in a Cubic<br>foot of Air. | Additional Weight of<br>Vapour required<br>for complete satu-<br>ration. | Mean degree of Hu-<br>midity, complete<br>saturation being<br>unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------|
|                | o                               | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                                |                                                                      |
| Mid-<br>night. | 67.9                            | 4.2                 | 65.8                | 6.3                          | 0.634                            | 6.96                                                  | 1.57                                                                     | 0.82                                                                 |
| 1              | 67.3                            | 4.0                 | 65.3                | 6.0                          | .623                             | .85                                                   | .48                                                                      | .82                                                                  |
| 2              | 66.8                            | 4.0                 | 64.8                | 6.0                          | .613                             | .75                                                   | .45                                                                      | .82                                                                  |
| 3              | 66.2                            | 3.9                 | 64.2                | 5.9                          | .601                             | .61                                                   | .42                                                                      | .82                                                                  |
| 4              | 66.2                            | 3.8                 | 64.3                | 5.7                          | .603                             | .64                                                   | .36                                                                      | .83                                                                  |
| 5              | 65.8                            | 3.6                 | 64.0                | 5.4                          | .597                             | .58                                                   | .28                                                                      | .84                                                                  |
| 6              | 65.1                            | 3.8                 | 63.2                | 5.7                          | .582                             | .41                                                   | .33                                                                      | .83                                                                  |
| 7              | 65.2                            | 4.1                 | 63.1                | 6.2                          | .580                             | .39                                                   | .44                                                                      | .82                                                                  |
| 8              | 66.5                            | 5.4                 | 63.8                | 8.1                          | .593                             | .50                                                   | .98                                                                      | .77                                                                  |
| 9              | 68.0                            | 6.6                 | 64.7                | 9.9                          | .611                             | .66                                                   | 2.54                                                                     | .72                                                                  |
| 10             | 69.0                            | 8.8                 | 64.6                | 13.2                         | .609                             | .60                                                   | 3.53                                                                     | .65                                                                  |
| 11             | 70.1                            | 10.3                | 64.9                | 15.5                         | .615                             | .63                                                   | 4.31                                                                     | .61                                                                  |
| Noon.          | 70.5                            | 12.0                | 64.5                | 18.0                         | .607                             | .52                                                   | 5.12                                                                     | .56                                                                  |
| 1              | 71.0                            | 12.8                | 64.6                | 19.2                         | .609                             | .52                                                   | .58                                                                      | .54                                                                  |
| 2              | 71.0                            | 13.2                | 64.4                | 19.8                         | .605                             | .47                                                   | .77                                                                      | .53                                                                  |
| 3              | 70.7                            | 12.9                | 64.2                | 19.4                         | .601                             | .44                                                   | .59                                                                      | .54                                                                  |
| 4              | 70.3                            | 11.6                | 64.5                | 17.4                         | .607                             | .53                                                   | 4.91                                                                     | .57                                                                  |
| 5              | 70.3                            | 9.6                 | 65.5                | 14.4                         | .628                             | .78                                                   | .00                                                                      | .63                                                                  |
| 6              | 70.6                            | 7.2                 | 67.0                | 10.8                         | .659                             | 7.14                                                  | 2.99                                                                     | .71                                                                  |
| 7              | 69.9                            | 5.9                 | 66.9                | 8.9                          | .657                             | .15                                                   | .39                                                                      | .75                                                                  |
| 8              | 69.4                            | 5.3                 | 66.7                | 8.0                          | .653                             | .11                                                   | .12                                                                      | .77                                                                  |
| 9              | 69.0                            | 4.7                 | 66.6                | 7.1                          | .651                             | .11                                                   | 1.85                                                                     | .79                                                                  |
| 10             | 68.2                            | 4.6                 | 65.9                | 6.9                          | .636                             | 6.96                                                  | .75                                                                      | .80                                                                  |
| 11             | 67.9                            | 4.5                 | 65.6                | 6.8                          | .630                             | .90                                                   | .70                                                                      | .80                                                                  |

All the Hygrometrical elements are computed by the Greenwich Constants.

Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                |
|-------|-----------------------|---------------------------------|-----------------------------------|---------------------------------------------------------------------------|
|       | o                     | Inches.                         |                                   |                                                                           |
| 1     | 149.4                 | ...                             | W. & N. & N. E.                   | Cloudless.                                                                |
| 2     | 142.0                 | ...                             | W. & N. E. & N.                   | Cloudless.                                                                |
| 3     | 144.5                 | ...                             | W. & S. W. & N. E.                | Cloudless.                                                                |
| 4     | Sunday.               | ...                             |                                   |                                                                           |
| 5     | 140.0                 | ..                              | N. & N. W. & W.                   | Cloudy till 7 A. M. Scatd. \i & \i afterwards.                            |
| 6     | ...                   | ...                             | N. & W.                           | Scatd. clouds.                                                            |
| 7     | ...                   | ...                             | E. & N. E. & N. W.                | Cloudless till 5 A. M. Scatd. clouds till 8 P. M. cloudless afterwards.   |
| 8     | 123.0                 | ...                             | N. & N. W.                        | Scatd. clouds till 5 P. M. cloudless afterwards.                          |
| 9     | 141.7                 | ...                             | N.                                | Cloudless.                                                                |
| 10    | 141.5                 | ...                             | N.                                | Cloudless till 11 A. M. Scatd. \i & \i afterwards.                        |
| 11    | Sunday.               | ...                             |                                   |                                                                           |
| 12    | 139.5                 | ...                             | N. W. & N.                        | Cloudless till 8 A. M. Scatd. \i till 4 P. M. cloudless afterwards.       |
| 13    | 144.5                 | ...                             | N. & W. & N. W.                   | Cloudless till 4 A. M. Scatd. \i & \i till 11 A. M. cloudless afterwards. |
| 14    | 142.0                 | ...                             | N. & N. W.                        | Cloudless till 11 A. M. Scatd \i & \i till 6 P. M. cloudless afterwards.  |
| 15    | 144.8                 | ...                             | N.                                | Cloudless till 7 A. M. Scatd. \i till 3 P. M. cloudless afterwards.       |
| 16    | 139.0                 | ...                             | N. & E.                           | Cloudless till 2 A. M. Scatd. \i & \i afterwards.                         |
| 17    | 146.0                 | ...                             | N. E.                             | Scatd. clouds.                                                            |
| 18    | Sunday.               | ...                             |                                   |                                                                           |
| 19    | 147.4                 | ...                             | N. & W.                           | Scatd. clouds till 6 P. M. cloudless afterwards.                          |
| 20    | 146.4                 | ...                             | N. & N. W.                        | Cloudless.                                                                |
| 21    | 144.4                 | ...                             | N.                                | Cloudless.                                                                |
| 22    | 139.0                 | ...                             | N. & N. W.                        | Cloudless.                                                                |
| 23    | 139.2                 | ...                             | N. W. & N.                        | Cloudless till 11 A. M. Scatd. \i & \i till 6 P. M. cloudless afterwards. |
| 24    | 141.0                 | ...                             | N. W. & N.                        | Cloudless.                                                                |
| 25    | Sunday.               | ...                             |                                   |                                                                           |
| 26    | 139.0                 | ...                             | N. W. & W.                        | Cloudless.                                                                |
| 27    | 138.0                 | ...                             | N. W. & W. & N.                   | Cloudless.                                                                |
| 28    | 140.0                 | ...                             | N. & W.                           | Cloudless.                                                                |
| 29    | 136.0                 | ..                              | N. W.                             | Cloudless till 5 A. M. Scatd. \i & \i afterwards.                         |
| 30    | 136.0                 | ...                             | N. W. & N. & S. W.                | Scatd. clouds of different kinds.                                         |

\i Cirri, \i Cirro strati, \i Cumuli, \i Cumulo strati, \i Nimbi,—i Strati  
\i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November, 1860.*

## MONTHLY RESULTS.

|                                                                         |    |    |             |
|-------------------------------------------------------------------------|----|----|-------------|
|                                                                         |    |    | Inches.     |
| Mean height of the Barometer for the month,                             | .. | .. | 29.930      |
| Max. height of the Barometer, occurred at 10 A. M. on the 27th,         | .. | .. | 30.167      |
| Min. height of the Barometer, occurred at 3 & 5 P. M. on the 19th,      | .. | .. | 29.740      |
| <i>Extreme range</i> of the Barometer during the month,                 | .. | .. | 0.427       |
| Mean of the Daily Max. Pressures,                                       | .. | .. | 30.000      |
| Ditto ditto Min. ditto,                                                 | .. | .. | 29.874      |
| <i>Mean daily range</i> of the Barometer during the month,              | .. | .. | 0.126       |
| —————                                                                   |    |    |             |
|                                                                         |    |    | 0           |
| Mean Dry Bulb Thermometer for the month,                                | .. | .. | 75.5        |
| Max. Temperature occurred at 2 P. M. on the 19th,                       | .. | .. | 88.6        |
| Min. Temperature occurred at 6 A. M. on the 27th,                       | .. | .. | 60.4        |
| <i>Extreme range</i> of the Temperature during the month,               | .. | .. | 28.2        |
| Mean of the daily Max. Temperature,                                     | .. | .. | 84.4        |
| Ditto ditto Min. ditto,                                                 | .. | .. | 68.8        |
| <i>Mean daily range</i> of the Temperature during the month,            | .. | .. | 15.6        |
| —————                                                                   |    |    |             |
|                                                                         |    |    | 0           |
| Mean Wet Bulb Thermometer for the month,                                | .. | .. | 68.5        |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer,              | .. | .. | 7.0         |
| Computed Mean Dew-point for the month,                                  | .. | .. | 65.0        |
| Mean Dry Bulb Thermometer above computed Mean Dew-point,                | .. | .. | 10.5        |
|                                                                         |    |    | Inches      |
| Mean Elastic force of vapour for the month,                             | .. | .. | 0.617       |
| —————                                                                   |    |    |             |
|                                                                         |    |    | Troy grains |
| Mean weight of Vapour for the month,                                    | .. | .. | 6.72        |
| Additional weight of Vapour required for complete saturation,           | .. | .. | 2.74        |
| Mean degree of humidity for the month, complete saturation being unity, | .. | .. | 0.71        |
| —————                                                                   |    |    |             |
|                                                                         |    |    | Inches      |
| Rained No day, Max. fall of rain during 24 hours,                       | .. | .. | Nil.        |
| Total amount of rain during the month,                                  | .. | .. | Nil.        |
| Prevailing direction of the Wind,                                       | .. | .. | N. & N. W.  |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour,  
when any particular wind was blowing, it rained.

| Hour.     | N.           | Rain on. | N. E. | Rain on. | E. | Rain on. | S. E. | Rain on. | S. | Rain on. | S. W. | Rain on. | W. | Rain on. | N. W. | Rain on. | Calm. | Rain on. | Missed. |
|-----------|--------------|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|----|----------|-------|----------|-------|----------|---------|
|           | No. of days. |          |       |          |    |          |       |          |    |          |       |          |    |          |       |          |       |          |         |
| Midnight. | 15           | 1        |       |          |    |          |       |          |    |          | 1     |          | 3  |          | 4     |          |       |          | 2       |
| 1         | 17           | 1        |       |          |    |          |       |          |    |          | 1     |          | 3  |          | 4     |          |       |          |         |
| 2         | 17           | 1        |       |          |    |          |       |          |    |          | 1     |          | 3  |          | 4     |          |       |          |         |
| 3         | 16           | 1        |       |          |    |          |       |          |    |          | 1     |          | 3  |          | 4     |          |       |          | 1       |
| 4         | 14           | 2        |       |          |    |          |       |          |    |          |       | 2        | 2  |          | 3     |          |       |          | 5       |
| 5         | 12           | 2        |       |          |    |          |       |          |    |          | 1     |          | 3  |          | 5     |          |       |          | 3       |
| 6         | 14           | 3        |       |          |    |          |       |          |    |          | 1     |          | 2  |          | 6     |          |       |          |         |
| 7         | 13           | 4        |       |          |    |          |       |          |    |          | 1     |          | 2  |          | 6     |          |       |          |         |
| 8         | 13           | 4        |       |          |    |          |       |          |    |          | 1     |          | 1  |          | 7     |          |       |          |         |
| 9         | 13           | 1        |       |          | 1  |          |       |          |    |          | 1     |          | 3  |          | 7     |          |       |          |         |
| 10        | 12           |          |       |          | 2  |          |       |          |    |          |       |          | 3  |          | 9     |          |       |          |         |
| 11        | 11           | 1        |       |          | 1  |          |       |          |    |          | 1     |          | 4  |          | 8     |          |       |          |         |
| Noon.     | 10           | 4        |       |          | 1  |          |       |          |    |          | 1     |          | 3  |          | 7     |          |       |          |         |
| 1         | 11           | 2        |       |          | 1  |          |       |          |    |          | 1     |          | 4  |          | 7     |          |       |          |         |
| 2         | 10           | 1        |       |          | 1  |          |       |          | 1  |          | 1     |          | 5  |          | 7     |          |       |          |         |
| 3         | 10           | 3        |       |          | 2  |          |       |          |    |          | 2     |          | 2  |          | 7     |          |       |          |         |
| 4         | 11           | 2        |       |          | 1  |          |       |          |    |          | 2     |          | 1  |          | 8     |          |       |          | 1       |
| 5         | 8            | 2        |       |          | 1  |          |       |          |    |          |       |          | 6  |          | 9     |          |       |          |         |
| 6         | 5            | 5        |       |          | 2  |          |       |          | 1  |          |       |          | 6  |          | 7     |          |       |          |         |
| 7         | 7            | 4        |       |          | 2  |          |       |          | 1  |          |       |          | 5  |          | 7     |          |       |          |         |
| 8         | 9            | 4        |       |          | 2  |          |       |          | 1  |          |       |          | 5  |          | 5     |          |       |          |         |
| 9         | 9            | 4        |       |          | 2  |          |       |          | 1  |          |       |          | 5  |          | 5     |          |       |          |         |
| 10        | 8            | 3        |       |          | 1  |          |       |          | 1  |          |       |          | 5  |          | 4     |          |       |          | 4       |
| 11        | 8            | 3        |       |          | 2  |          |       |          | 1  |          |       |          | 5  |          | 6     |          |       |          | 1       |



Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December, 1860.

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Feet.

Height of the Cistern of the Standard Barometer above the Sea level, 18.11

Daily Means, &c. of the Observations and of the Hygrometrical elements  
ependent thereon.

| Date. | Mean Height of<br>the Barometer<br>at 32° Fahr. | Range of the Barometer<br>during the day. |         |         | Mean Dry Bulb<br>Thermometer. | Range of the Tempera-<br>ture during the day. |      |       |
|-------|-------------------------------------------------|-------------------------------------------|---------|---------|-------------------------------|-----------------------------------------------|------|-------|
|       |                                                 | Max.                                      | Min.    | Diff.   |                               | Max.                                          | Min. | Diff. |
|       | Inches.                                         | Inches.                                   | Inches. | Inches. | °                             | °                                             | °    | °     |
| 1     | 29.984                                          | 30.058                                    | 29.931  | 0.127   | 70.3                          | 80.4                                          | 63.4 | 17.0  |
| 2     | Sunday.                                         |                                           |         |         |                               |                                               |      |       |
| 3     | .999                                            | .056                                      | .950    | .106    | 68.7                          | 79.0                                          | 60.8 | 18.2  |
| 4     | .989                                            | .075                                      | .943    | .132    | 68.9                          | 77.0                                          | 60.4 | 16.6  |
| 5     | .991                                            | .069                                      | .937    | .132    | 69.7                          | 78.6                                          | 62.6 | 16.0  |
| 6     | .977                                            | .048                                      | .926    | .122    | 69.6                          | 79.2                                          | 62.1 | 17.1  |
| 7     | .967                                            | .049                                      | .905    | .144    | 70.3                          | 80.0                                          | 63.0 | 17.0  |
| 8     | .994                                            | .090                                      | .947    | .143    | 69.4                          | 79.9                                          | 61.2 | 18.7  |
| 9     | Sunday.                                         |                                           |         |         |                               |                                               |      |       |
| 10    | 30.016                                          | .092                                      | .964    | .128    | 67.5                          | 77.6                                          | 60.2 | 17.4  |
| 11    | .014                                            | .100                                      | .951    | .149    | 66.2                          | 77.2                                          | 57.0 | 20.2  |
| 12    | 29.993                                          | .072                                      | .932    | .140    | 65.7                          | 77.2                                          | 58.0 | 19.2  |
| 13    | .980                                            | .069                                      | .935    | .134    | 65.5                          | 77.0                                          | 56.6 | 20.4  |
| 14    | .998                                            | .080                                      | .946    | .134    | 66.4                          | 78.6                                          | 58.0 | 20.6  |
| 15    | 30.050                                          | .149                                      | .994    | .155    | 65.8                          | 77.8                                          | 57.2 | 20.6  |
| 16    | Sunday.                                         |                                           |         |         |                               |                                               |      |       |
| 17    | 29.993                                          | .078                                      | .932    | .146    | 65.1                          | 76.6                                          | 56.7 | 19.9  |
| 18    | .984                                            | .072                                      | .925    | .147    | 65.1                          | 76.4                                          | 56.2 | 20.2  |
| 19    | .992                                            | .063                                      | .937    | .126    | 66.3                          | 77.0                                          | 57.6 | 19.4  |
| 20    | 30.007                                          | .083                                      | .937    | .146    | 66.9                          | 77.6                                          | 59.6 | 18.0  |
| 21    | .033                                            | .097                                      | .975    | .122    | 67.1                          | 78.0                                          | 59.9 | 18.1  |
| 22    | .050                                            | .133                                      | .973    | .160    | 63.8                          | 75.4                                          | 55.0 | 20.4  |
| 23    | Sunday.                                         |                                           |         |         |                               |                                               |      |       |
| 24    | .050                                            | .124                                      | 30.009  | .115    | 67.7                          | 78.6                                          | 58.4 | 20.2  |
| 25    | .048                                            | .126                                      | .003    | .123    | 67.8                          | 78.7                                          | 59.0 | 19.7  |
| 26    | .034                                            | .120                                      | 29.974  | .146    | 66.9                          | 77.6                                          | 58.2 | 19.4  |
| 27    | .028                                            | .110                                      | .990    | .120    | 68.5                          | 79.4                                          | 58.8 | 20.6  |
| 28    | .023                                            | .095                                      | .980    | .115    | 67.7                          | 78.8                                          | 58.9 | 19.9  |
| 29    | .044                                            | .119                                      | 30.001  | .118    | 67.8                          | 78.6                                          | 59.8 | 18.8  |
| 30    | Sunday.                                         |                                           |         |         |                               |                                               |      |       |
| 31    | .086                                            | .172                                      | .035    | .137    | 63.6                          | 75.6                                          | 54.0 | 21.6  |

The Mean height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the twenty-four hourly observations made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December, 1860.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-<br>mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew<br>Point. | Mean Elastic force of<br>Vapour. | Mean Weight of Vapour<br>in a cubic foot of air. | Additional Weight of Va-<br>pour required for com-<br>plete saturation. | Mean degree of Humi-<br>dity, complete satura-<br>tion being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1     | 64.1                            | 6.2                 | 61.0                | 9.3                          | Inches.<br>0.541                 | T. gr.<br>5.95                                   | T. gr.<br>2.13                                                          | 0.74                                                                |
| 2     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 3     | 61.9                            | 6.8                 | 58.5                | 10.2                         | .498                             | .549                                             | .20                                                                     | .71                                                                 |
| 4     | 63.1                            | 5.8                 | 60.2                | 8.7                          | .527                             | .80                                              | 1.94                                                                    | .75                                                                 |
| 5     | 64.5                            | 5.2                 | 61.9                | 7.8                          | .557                             | 6.13                                             | .80                                                                     | .77                                                                 |
| 6     | 64.9                            | 4.7                 | 62.5                | 7.1                          | .568                             | .26                                              | .64                                                                     | .79                                                                 |
| 7     | 64.0                            | 6.3                 | 60.8                | 9.5                          | .537                             | 5.90                                             | 2.18                                                                    | .73                                                                 |
| 8     | 63.4                            | 6.0                 | 60.4                | 9.0                          | .530                             | .84                                              | .02                                                                     | .74                                                                 |
| 9     | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 10    | 60.6                            | 6.9                 | 56.5                | 11.0                         | .465                             | .14                                              | .28                                                                     | .69                                                                 |
| 11    | 59.6                            | 6.6                 | 55.6                | 10.6                         | .452                             | .01                                              | .11                                                                     | .70                                                                 |
| 12    | 59.3                            | 6.4                 | 55.5                | 10.2                         | .450                             | .00                                              | .02                                                                     | .71                                                                 |
| 13    | 58.9                            | 6.6                 | 54.9                | 10.6                         | .441                             | 4.89                                             | .09                                                                     | .70                                                                 |
| 14    | 59.4                            | 7.0                 | 55.2                | 11.2                         | .445                             | .94                                              | .23                                                                     | .69                                                                 |
| 15    | 58.9                            | 6.9                 | 54.8                | 11.0                         | .440                             | .87                                              | .17                                                                     | .69                                                                 |
| 16    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 17    | 58.5                            | 6.6                 | 54.5                | 10.6                         | .435                             | .83                                              | .06                                                                     | .70                                                                 |
| 18    | 59.1                            | 6.0                 | 55.5                | 9.6                          | .450                             | 5.00                                             | 1.89                                                                    | .73                                                                 |
| 19    | 60.0                            | 6.3                 | 56.2                | 10.1                         | .461                             | .11                                              | 2.04                                                                    | .72                                                                 |
| 20    | 60.8                            | 6.1                 | 57.1                | 9.8                          | .475                             | .25                                              | .03                                                                     | .72                                                                 |
| 21    | 59.1                            | 8.0                 | 54.3                | 12.8                         | .432                             | 4.78                                             | .54                                                                     | .65                                                                 |
| 22    | 56.4                            | 7.4                 | 51.2                | 12.6                         | .389                             | .33                                              | .28                                                                     | .66                                                                 |
| 23    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 24    | 62.1                            | 5.6                 | 58.7                | 9.0                          | .501                             | 5.54                                             | 1.92                                                                    | .74                                                                 |
| 25    | 61.7                            | 6.1                 | 58.0                | 9.8                          | .489                             | .40                                              | 2.08                                                                    | .72                                                                 |
| 26    | 61.0                            | 5.9                 | 57.5                | 9.4                          | .481                             | .33                                              | 1.95                                                                    | .73                                                                 |
| 27    | 62.0                            | 6.5                 | 58.7                | 9.8                          | .501                             | .53                                              | 2.12                                                                    | .72                                                                 |
| 28    | 61.1                            | 6.6                 | 57.1                | 10.6                         | .475                             | .24                                              | .22                                                                     | .70                                                                 |
| 29    | 60.2                            | 7.6                 | 55.6                | 12.2                         | .452                             | .00                                              | .48                                                                     | .67                                                                 |
| 30    | <i>Sunday.</i>                  |                     |                     |                              |                                  |                                                  |                                                                         |                                                                     |
| 31    | 56.1                            | 7.5                 | 50.8                | 12.8                         | .383                             | 4.28                                             | .29                                                                     | .65                                                                 |

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, 1860.*

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. | 30.006                                    | 30.100                                                 | 29.964  | 0.136   | 62.6                       | 66.4                                                     | 57.8 | 8.6   |
| 1          | .001                                      | .090                                                   | .949    | .141    | 62.0                       | 66.0                                                     | 57.0 | 9.0   |
| 2          | 29.994                                    | .075                                                   | .945    | .130    | 61.3                       | 65.2                                                     | 56.5 | 8.7   |
| 3          | .988                                      | .067                                                   | .938    | .129    | 60.7                       | 64.4                                                     | 56.1 | 8.3   |
| 4          | .984                                      | .051                                                   | .949    | .102    | 60.2                       | 63.8                                                     | 56.8 | 7.0   |
| 5          | .999                                      | .079                                                   | .963    | .116    | 59.7                       | 64.0                                                     | 54.1 | 9.9   |
| 6          | 30.019                                    | .108                                                   | .989    | .119    | 59.2                       | 63.4                                                     | 54.0 | 9.4   |
| 7          | .041                                      | .131                                                   | 30.005  | .126    | 59.3                       | 64.8                                                     | 54.4 | 10.4  |
| 8          | .068                                      | .129                                                   | .029    | .100    | 62.6                       | 66.8                                                     | 58.1 | 8.7   |
| 9          | .090                                      | .172                                                   | .041    | .131    | 65.9                       | 71.4                                                     | 61.4 | 10.0  |
| 10         | .087                                      | .159                                                   | .034    | .125    | 69.8                       | 74.2                                                     | 64.6 | 9.6   |
| 11         | .071                                      | .140                                                   | .021    | .119    | 73.1                       | 77.0                                                     | 68.8 | 8.2   |
| Noon.      | .039                                      | .116                                                   | 29.987  | .129    | 75.6                       | 78.5                                                     | 72.4 | 6.1   |
| 1          | .006                                      | .096                                                   | .952    | .144    | 77.1                       | 80.0                                                     | 74.4 | 5.6   |
| 2          | 29.982                                    | .059                                                   | .924    | .135    | 77.9                       | 80.4                                                     | 75.4 | 5.0   |
| 3          | .967                                      | .043                                                   | .911    | .132    | 77.4                       | 79.4                                                     | 74.8 | 4.6   |
| 4          | .961                                      | .037                                                   | .905    | .132    | 75.2                       | 77.0                                                     | 71.0 | 6.0   |
| 5          | .965                                      | .035                                                   | .919    | .116    | 73.2                       | 75.8                                                     | 70.6 | 5.2   |
| 6          | .974                                      | .056                                                   | .927    | .129    | 70.4                       | 73.0                                                     | 66.8 | 6.2   |
| 7          | .991                                      | .063                                                   | .948    | .115    | 68.2                       | 71.7                                                     | 64.4 | 7.3   |
| 8          | 30.006                                    | .075                                                   | .955    | .120    | 66.6                       | 69.8                                                     | 62.4 | 7.4   |
| 9          | .016                                      | .070                                                   | .962    | .108    | 65.4                       | 69.8                                                     | 60.4 | 9.4   |
| 10         | .019                                      | .076                                                   | .977    | .099    | 64.4                       | 68.4                                                     | 59.8 | 8.6   |
| 11         | .016                                      | .067                                                   | .968    | .099    | 63.5                       | 67.2                                                     | 58.9 | 8.3   |

The Mean Height of the Barometer, as likewise the Mean Dry and Wet Bulb Thermometers are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December, 1860.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

| Hour.          | Mean Wet Bulb<br>Thermometer. | Dry Bulb above Wet. | Computed Dew point. | Dry Bulb above Dew<br>point. | Mean Elastic force of<br>Vapour. | Mean Weight of Va-<br>pour in a Cubic foot<br>of Air. | Additional Weight of<br>vapour required for<br>complete saturation. | Mean degree of Hu-<br>midity, complete satu-<br>ration being unity. |
|----------------|-------------------------------|---------------------|---------------------|------------------------------|----------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                | o                             | o                   | o                   | o                            | Inches.                          | Troy grs.                                             | Troy grs.                                                           |                                                                     |
| Mid-<br>night. | 59.3                          | 3.3                 | 57.0                | 5.6                          | .473                             | 5.28                                                  | 1.09                                                                | 0.83                                                                |
| 1              | 58.8                          | 3.2                 | 56.6                | 5.4                          | .467                             | .23                                                   | .02                                                                 | .84                                                                 |
| 2              | 58.3                          | 3.0                 | 55.9                | 5.4                          | .456                             | .11                                                   | .01                                                                 | .84                                                                 |
| 3              | 57.8                          | 2.9                 | 55.5                | 5.2                          | .450                             | .05                                                   | 0.95                                                                | .84                                                                 |
| 4              | 57.5                          | 2.7                 | 55.3                | 4.9                          | .447                             | .02                                                   | .89                                                                 | .85                                                                 |
| 5              | 56.9                          | 2.8                 | 54.7                | 5.0                          | .438                             | 4.92                                                  | .90                                                                 | .85                                                                 |
| 6              | 56.6                          | 2.6                 | 54.5                | 4.7                          | .435                             | .89                                                   | .84                                                                 | .85                                                                 |
| 7              | 56.6                          | 2.7                 | 54.4                | 4.9                          | .434                             | .87                                                   | .87                                                                 | .85                                                                 |
| 8              | 58.3                          | 4.3                 | 55.3                | 7.3                          | .447                             | 5.00                                                  | 1.37                                                                | .79                                                                 |
| 9              | 60.1                          | 5.8                 | 56.6                | 9.3                          | .467                             | .18                                                   | .88                                                                 | .73                                                                 |
| 10             | 61.9                          | 7.9                 | 57.9                | 11.9                         | .488                             | .36                                                   | 2.59                                                                | .67                                                                 |
| 11             | 63.2                          | 9.9                 | 58.2                | 14.9                         | .493                             | .38                                                   | 3.41                                                                | .61                                                                 |
| Noon.          | 63.7                          | 11.9                | 57.7                | 17.9                         | .485                             | .26                                                   | 4.22                                                                | .56                                                                 |
| 1              | 64.2                          | 12.9                | 57.7                | 19.4                         | .485                             | .25                                                   | .67                                                                 | .53                                                                 |
| 2              | 64.6                          | 13.3                | 57.9                | 20.0                         | .488                             | .27                                                   | .89                                                                 | .52                                                                 |
| 3              | 64.0                          | 13.4                | 57.3                | 20.1                         | .478                             | .17                                                   | .84                                                                 | .52                                                                 |
| 4              | 63.3                          | 11.9                | 57.3                | 17.9                         | .478                             | .20                                                   | .17                                                                 | .56                                                                 |
| 5              | 63.5                          | 9.7                 | 58.6                | 14.6                         | .499                             | .45                                                   | 3.37                                                                | .62                                                                 |
| 6              | 63.5                          | 6.9                 | 60.0                | 10.4                         | .523                             | .75                                                   | 2.35                                                                | .71                                                                 |
| 7              | 62.6                          | 5.6                 | 59.2                | 9.0                          | .509                             | .63                                                   | 1.95                                                                | .74                                                                 |
| 8              | 62.1                          | 4.5                 | 59.4                | 7.2                          | .513                             | .68                                                   | .53                                                                 | .79                                                                 |
| 9              | 61.2                          | 4.2                 | 58.7                | 6.7                          | .501                             | .56                                                   | .39                                                                 | .80                                                                 |
| 10             | 60.6                          | 3.8                 | 57.9                | 6.5                          | .488                             | .41                                                   | .33                                                                 | .80                                                                 |
| 11             | 59.9                          | 3.6                 | 57.4                | 6.1                          | .480                             | .35                                                   | .20                                                                 | .82                                                                 |

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, 1860.

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 5 feet above Ground. | Prevailing direction of the Wind. | General Aspect of the Sky.                                                                        |
|-------|-----------------------|---------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------|
|       | o                     | Inches.                         |                                   |                                                                                                   |
| 1     | 138.0                 | ..                              | N. & N. W.                        | Scatd. clouds till 4 P. M. cloudless afterwards.                                                  |
| 2     | <i>Sunday.</i>        |                                 |                                   |                                                                                                   |
| 3     | 135.0                 | ..                              | N. & W.                           | Cloudless.                                                                                        |
| 4     | 121.5                 | ..                              | N.                                | Cloudless till 10 A. M. Scatd. \i afterwards.                                                     |
| 5     | 130.0                 | ..                              | S. W. & S. E. & N.                | Cloudless till 10 A. M. Scatd. clouds till 4 P. M. cloudless afterwards; also foggy after 9 P. M. |
| 6     | 133.0                 | ..                              | E. & N E. & N.                    | Cloudless till 10 A. M. Scatd. clouds afterwards; also foggy between Mid-night & 5 A. M.          |
| 7     | 140.0                 | ..                              | N.                                | Cloudless.                                                                                        |
| 8     | 139.4                 | ..                              | N. W. & N.                        | Cloudless.                                                                                        |
| 9     | <i>Sunday.</i>        |                                 |                                   |                                                                                                   |
| 10    | 134.2                 | ..                              | N. & N. W.                        | Cloudless.                                                                                        |
| 11    | 139.0                 | ..                              | S. W. & N. & W.                   | Cloudless.                                                                                        |
| 12    | 139.0                 | ..                              | S. W. & W.                        | Cloudless.                                                                                        |
| 13    | 135.6                 | ..                              | N. & N. W.                        | Cloudless.                                                                                        |
| 14    | 136.7                 | ..                              | N. & N. W.                        | Cloudless till 5 A. M. Scatd. \i till 10 A. M. cloudless afterwards.                              |
| 15    | 135.0                 | ..                              | N.                                | Cloudless; also foggy after 9 P. M.                                                               |
| 16    | <i>Sunday.</i>        |                                 |                                   |                                                                                                   |
| 17    | 132.0                 | ..                              | N. & N. W.                        | Cloudless.                                                                                        |
| 18    | 133.0                 | ..                              | W. & N. & N. W.                   | Cloudless till 11 A. M. Scatd. \i till 5 P. M. cloudless afterwards.                              |
| 19    | 136.4                 | ..                              | N.                                | Cloudless.                                                                                        |
| 20    | 134.0                 | ..                              | N. & N. E.                        | Cloudless till 6 A. M. Scatd. \i till 4 P. M. cloudless afterwards.                               |
| 21    | 136.0                 | ..                              | N.                                | Cloudless.                                                                                        |
| 22    | 134.0                 | ..                              | N. W. & N.                        | Cloudless till 5 A. M. Scatd. \i & \i till 5 P. M. cloudless afterwards.                          |
| 23    | <i>Sunday.</i>        |                                 |                                   |                                                                                                   |
| 24    | 136.0                 | ..                              | N. & N. E.                        | Cloudless.                                                                                        |
| 25    | 135.0                 | ..                              | N. & S.                           | Cloudless till 6 A. M. Scatd. \i & \i till 6 P. M. cloudless afterwards.                          |
| 26    | 136.0                 | ..                              | N. & W.                           | Cloudless till 2 A. M. Scatd. \i & \i afterwards.                                                 |
| 27    | 136.0                 | ..                              | N. & N. W.                        | Cloudless.                                                                                        |
| 28    | 137.2                 | ..                              | N. W. & N.                        | Cloudless.                                                                                        |
| 29    | 137.0                 | ..                              | N. & S. W.                        | Cloudless.                                                                                        |
| 30    | <i>Sunday.</i>        |                                 |                                   |                                                                                                   |
| 31    | 131.4                 | ..                              | N. & W.                           | Cloudless.                                                                                        |

\i Cirri, \i Cirro strati, \i Cumuli, \i Cumulo strati, \i Nimbi, —i Strati  
 \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December, 1860.*

## MONTHLY RESULTS.

|                                                               |    |    | Inches |
|---------------------------------------------------------------|----|----|--------|
| Mean height of the Barometer for the month,                   | .. | .. | 30.012 |
| Max. height of the Barometer occurred at 9 A. M. on the 31st, | .. | .. | 30.172 |
| Min. height of the Barometer occurred at 4 P. M. on the 7th,  | .. | .. | 29.905 |
| <i>Extreme range</i> of the Barometer during the month,       | .. | .. | 0.267  |
| Mean of the Daily Max. Pressures,                             | .. | .. | 30.092 |
| Ditto ditto Min. ditto,                                       | .. | .. | 29.959 |
| <i>Mean daily range</i> of the Barometer during the month,    | .. | .. | 0.133  |

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|                                                               |    |    | o    |
|---------------------------------------------------------------|----|----|------|
| Mean Dry Bulb Thermometer for the month,                      | .. | .. | 67.2 |
| Max. Temperature occurred at 2 P. M. on the 1st,              | .. | .. | 80.4 |
| Min. Temperature occurred at 6 A. M. on the 31st,             | .. | .. | 54.0 |
| <i>Extreme range</i> of the Temperature during the month,     | .. | .. | 26.4 |
| Mean of the daily Max. Temperature,                           | .. | .. | 78.0 |
| Ditto ditto Min. ditto,                                       | .. | .. | 58.9 |
| <i>Mean daily range</i> of the Temperature during the month,  | .. | .. | 19.1 |
| Mean Wet Bulb Thermometer for the month, ..                   | .. | .. | 60.8 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer, .. | .. | .. | 6.4  |
| Computed Mean Dew-point for the month, ..                     | .. | .. | 57.0 |
| Mean Dry Bulb Thermometer above computed Mean Dew-point, ..   | .. | .. | 10.2 |

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|                                                |    |    | Inches |
|------------------------------------------------|----|----|--------|
| Mean Elastic force of Vapour for the month, .. | .. | .. | 0.473  |

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|                                                                            |    |    | Troy grains |
|----------------------------------------------------------------------------|----|----|-------------|
| Mean Weight of Vapour for the month, ..                                    | .. | .. | 5.23        |
| Additional Weight of Vapour required for complete saturation, ..           | .. | .. | 2.12        |
| Mean degree of humidity for the month, complete saturation being unity, .. | .. | .. | 0.71        |

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|                                                        |    |    | Inches     |
|--------------------------------------------------------|----|----|------------|
| Rained No. days, Max. fall of rain during 24 hours, .. | .. | .. | Nil.       |
| Total amount of rain during the month, ..              | .. | .. | Nil.       |
| Prevailing direction of the Wind, ..                   | .. | .. | N. & N. W. |

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December, 1860.*

MONTHLY RESULTS.

Table showing the number of days on which at a given hour any particular wind  
blew, together with the number of days on which at the same hour,  
when any particular wind was blowing, it rained.

| Hour.     | No. of days. |                   |                |                   |                |                   |                |                   |                   |          |         |  |  |
|-----------|--------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|-------------------|----------|---------|--|--|
|           | N.           | Rain on.<br>N. E. | Rain on.<br>E. | Rain on.<br>S. E. | Rain on.<br>S. | Rain on.<br>S. W. | Rain on.<br>W. | Rain on.<br>N. W. | Rain on.<br>Calm. | Rain on. | Missed. |  |  |
| Midnight. | 16           |                   | 1              |                   | 1              | 1                 | 2              | 2                 |                   |          | 3       |  |  |
| 1         | 18           |                   | 1              |                   | 1              | 2                 | 2              | 2                 |                   |          |         |  |  |
| 2         | 18           |                   | 1              |                   | 1              | 2                 | 2              | 2                 |                   |          |         |  |  |
| 3         | 16           |                   | 1              |                   | 1              | 2                 | 2              | 2                 |                   |          | 2       |  |  |
| 4         | 18           |                   | 1              |                   | 1              | 2                 | 2              | 1                 |                   |          | 2       |  |  |
| 5         | 17           |                   | 1              |                   | 1              | 2                 | 2              | 2                 |                   |          | 2       |  |  |
| 6         | 16           | 1                 | 1              |                   | 1              | 1                 | 4              | 3                 |                   |          |         |  |  |
| 7         | 14           | 2                 |                |                   | 1              | 2                 | 5              | 3                 |                   |          |         |  |  |
| 8         | 11           | 2                 |                |                   | 1              | 1                 | 4              | 5                 |                   |          | 2       |  |  |
| 9         | 15           | 2                 |                | 2                 | 1              | 1                 | 1              | 4                 |                   |          |         |  |  |
| 10        | 15           | 2                 | 2              |                   | 3              | 2                 | 2              | 2                 |                   |          |         |  |  |
| 11        | 12           | 1                 | 2              | 1                 | 1              | 2                 | 2              | 5                 |                   |          |         |  |  |
| Noon.     | 10           |                   | 2              |                   |                | 1                 | 3              | 8                 |                   |          |         |  |  |
| 1         | 11           | 2                 |                | 1                 |                | 2                 | 3              | 7                 |                   |          |         |  |  |
| 2         | 9            | 2                 |                | 1                 |                | 1                 | 3              | 10                |                   |          |         |  |  |
| 3         | 7            | 1                 |                | 1                 |                | 1                 | 3              | 13                |                   |          |         |  |  |
| 4         | 8            | 1                 |                | 1                 |                | 1                 | 3              | 12                |                   |          | 1       |  |  |
| 5         | 7            | 2                 | 1              | 1                 |                | 2                 | 2              | 11                |                   |          |         |  |  |
| 6         | 11           | 2                 | 1              | 1                 | 1              | 2                 | 2              | 6                 |                   |          |         |  |  |
| 7         | 12           | 2                 | 1              | 1                 | 1              | 2                 | 2              | 5                 |                   |          |         |  |  |
| 8         | 13           | 2                 | 1              | 1                 | 1              | 2                 | 2              | 5                 |                   |          |         |  |  |
| 9         | 13           | 2                 | 1              | 1                 | 1              | 2                 | 2              | 5                 |                   |          |         |  |  |
| 10        | 13           | 2                 | 1              | 1                 | 1              | 1                 | 2              | 5                 |                   |          | 1       |  |  |
| 11        | 12           | 2                 | 1              |                   | 1              | 2                 | 1              | 5                 |                   |          | 2       |  |  |

W. J. L. Cooper has

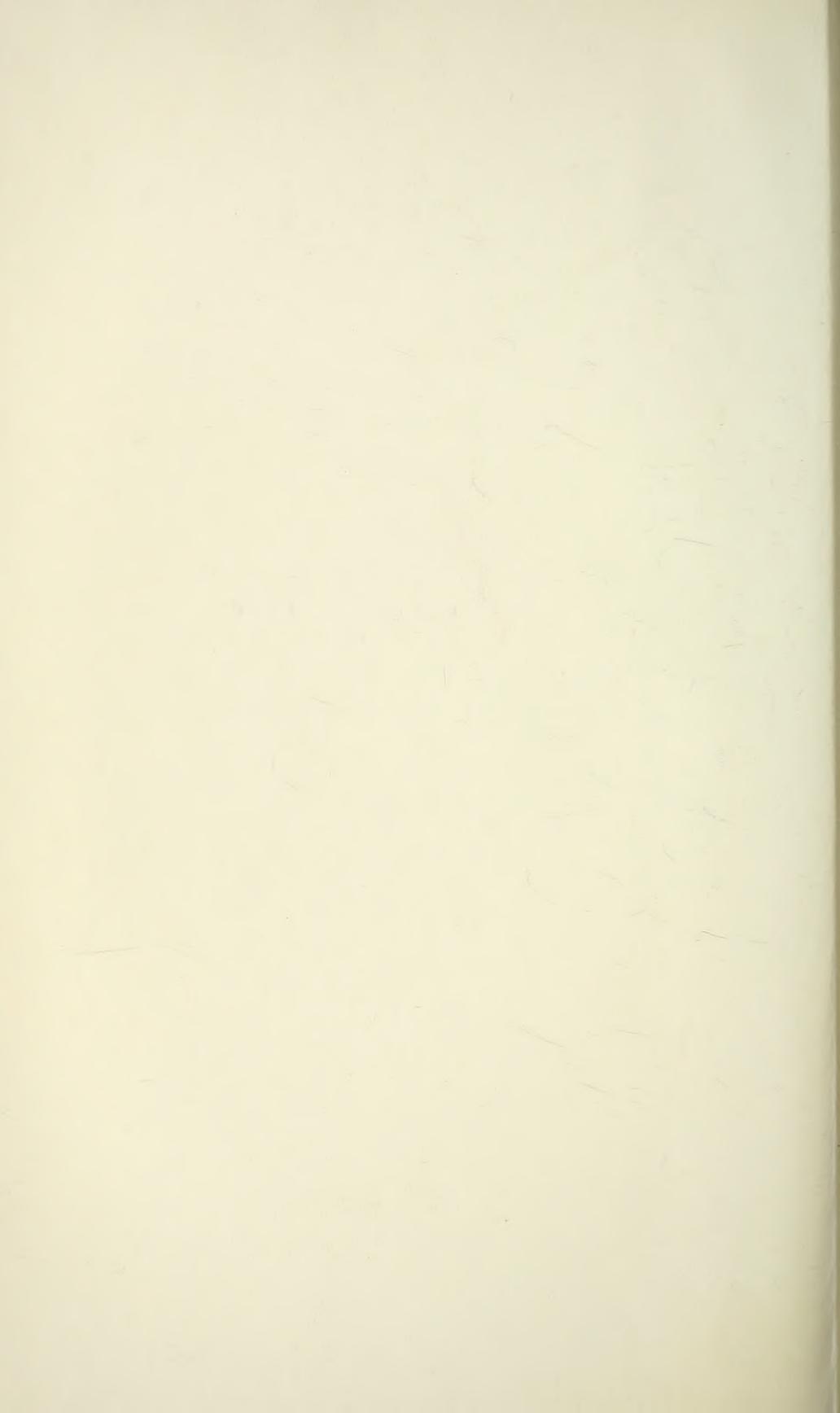
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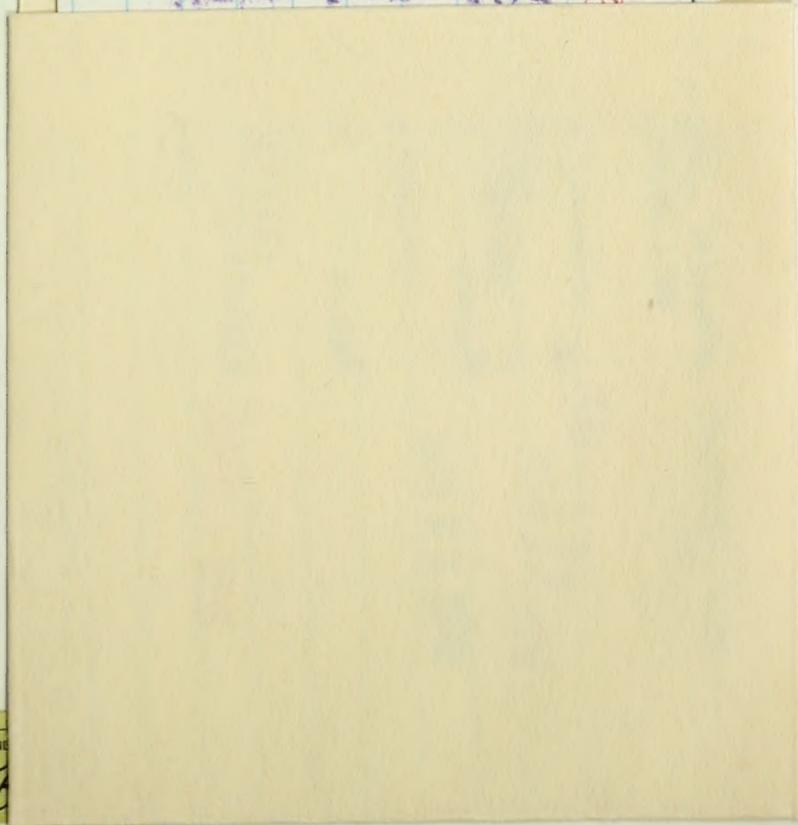
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