MADRAS JOURNAL

LITERATURE AND SCIENCE.

EDITED BY THE HONORARY SECRETARY
TO THE MADRAS LITERARY SOCIETY AND AUXILIARY OF
THE ROYAL ASIATIC SOCIETY.

Third Series.—Part 2.

October 1866.

MADRAS:

PRINTED BY GRAVES, COOKSON AND CO.
UNITED SCOTTISH PRESS.
1866.

CONTENTS.

including them within the group of Quarternary or possibly even Recent deposits(1).

These implement-bearing-formations so far as they have hitherto been examined in the Madras and North Arcot Districts are found resting either on the older metamorphic rocks of the country, the Gneissic series, or more generally on a series of formations probably of greater geological antiquity than the Cretaceous system. These formations provisionally termed the Stri Permatoor series, because of their having been first studied near the town of that name contain vegetable remains which appear to be identical in species with some discovered in the Rajmahal hills in Bengal and also in Cutch. These latter fossil plants are thought to have affinities to, even if they be not absolutely identical with certain forms occurring in the Jurassic formations of Europe.

All the Implements that I have seen hitherto, amounting to several hundreds, are made of quartzite—which is a metamorphosed sandstone, generally semi-vitreous in texture, very hard and tough, and, on the whole the best substitute for flint in this part of India.

The first Implement discovered was found by me on the 30th May last year, among the debris thrown out of a small gravel pit a few hundred yards north of the Cantonment at Palaveram (10 miles S. W. of Madras) and about the same distance west from the high-road. My acquaintance with the flint Implements which have excited so much interest in Europe was at that time limited to figures of them given in "The Geologist," and I was then but little familiar with peculiarities of fracture of quartzite pebbles. I felt a little doubtful therefore in unhesitatingly regarding my find as a genuine Stone Implement, so contented myself

(1.) NOTE.—The term Recent deposits is intended to embrace all in which the included organisms are of living species.

with mentioning it in a letter to my friend and colleague Mr. King and showing it to different members of my family.

As I was leaving Palaveram the very evening I found the Implement, I could not at the time extend my researches for further specimens, but a careful search made in January last put me in possession of two further Implements of much more perfect shape than the first.

The figure and description of this first Implement will be found further on.

Although my attention had been thus awakened, and I kept carefully looking out for Implements in other places where the lateritic gravels contained pebbles or fragments of quartzite, I did not meet with any more for several months.

On the 28th September last, my colleague Mr. King, who had accompanied me to see some sections of the plant-bearing-shales (of the Stri Permatoor series) in the Atrampakkum nullah(1) (a tributary of the Cortelliar) picked up two well-shaped oval Implements on a little terrace of quartzite shingle in the bed of the stream.

The true nature of these Implements was so unmistakeable, that we immediately commenced searching for more, and in a few minutes were well rewarded, by finding several others as we walked up the dry bed of the nullah.

The condition of the Implements found showing evidently that they came from somewhere near at hand, we resolved to search the banks of the nullah very closely in order if possible to discover other Implements *in situ*.

The following day we proceeded to examine the nullah and its tributary gullies, commencing where the lateritic gravel first becomes well exposed on the west side of the

(1) NOTE.—By some mistake this village is called Nirumpauk on the Atlas sheet No. 78. All the places named will be found on that Map on which the general features of the country are also well laid down.

old ruined pagoda at the northern end of the Numbaucum tank. It was not long before we found several finely shaped quartzite Implements *in situ*, imbedded with numerous quartzite pebbles in a bed of hard ferruginous laterite conglomerate which there rests unconformably on the plant shales.

The Implements *in situ* were found at depths below the surface varying from three to eight or ten feet, and often so tightly impacted as to necessitate some little labour with the hammer to extract them uninjured.

Since the discovery of the Quartzite Implements at Palaveram and in the Atrampakkam nullah, they have been met with and collected at numerous other places in the Madras and North Arcot Districts. The list of such places given in the Appendix shows the wide distribution of the Implement bearing gravels, since the deposition of which the geological features of this part of the Carnatic have undergone material alterations. The names of the persons by whom the Implements were first collected are also given in the Appendix.

Geological features of the Implement bearing formations.

The circumstances under which the Implements are found occurring now demand some attention, as the formations they have been found in do not appear all to belong to the same series. They have been found in typical unaltered laterite conglomerates of uncertain age, but very probably younger than the typical laterite, and in lateritic gravels and sands.

The first Implement discovered was derived from the lateritic gravel at Palaveram, which occurs on the north side of the Cantonment in a thin bed resting on the gneiss. South, West of the Cantonment and also on the south side

the brigade ground at St. Thomas's Mount, where the surface has been less eroded, the bed may be seen in numerous ballast pits to have a thickness of 2-3 feet and occasionally to assume the true conglomerate character. This laterite must be considered as an outlier of the more extensive spreads occurring south of the great Chembrumbaucum tank near Poonamallee.

The Implements discovered in such large numbers north of Trivellore in the Atrumpakkam nullah valley are derived from beds of lateritic conglomerate which are probably younger than the typical laterite occupying extensive tracts of higher ground in the immediate neighbourhood.

These higher lying laterite conglomerate beds however themselves yield numerous specimens of worked stones identical in type with those from the low level conglomerates. The reasons for regarding the latter as of later date will be considered further on.

Finally, Implements have been obtained from sandy quartzite gravel and shingle beds between Stripermatoor and Conjeveram, but none have been found *in situ* in those deposits.

The discovery of Implements in various localities and formations in North Arcot District was made by my colleague Mr. King, whose description of them will be found appended to this paper.

The most instructive sections shewing the relation of the low level Implement-bearing-conglomerates, occur in the banks of the Atrampakkam nullah and of the various gullies connected with it, several of which were formed by the bursting of the large Numbaucum tank.

Immediately below the old ruined pagoda already referred to is a capital section cut by a gully formed through the

bursting of the tank. The Implement-conglomerate as here shown, lies only a couple of hundred yards west of where Implements were discovered *in situ*.

The sequence of beds here shown is the following:—

a. Soil and made ground 6'.

b. Lateritic conglomerate with layers of quartzite pebbles 1½'—3'.

c. Sandy clay with quartzite pebbles and kunkur in strings 5½'—6½'.

d. Lateritic conglomerate full of quartzite pebbles 3'.

e. Grey shales (plant shales) with ferruginous stains 1' 8'.

A few yards to the west of the pagoda a shallow gully exposes these beds as far as the top of lateritic conglomerate bed "d," and here I found a good hatchet shaped Implement sticking out of the overlying sandy clay "c"—a few inches above the junction of the two strata. This Implement was apparently *in situ*,—about 10 or 11 feet below the true surface. The first Implement found unequivocally *in situ*, was disinterred by Mr. King from a bed of lateritic conglomerate exposed to the east of the tank in another deep gully formed by the escape of the surplus water over the kalingula, aided by another bursting of the bund between the kalingula and the pagoda.

A few yards from the spot where the Implement was found, the vertical left bank is seen to consist of the following beds.

a. Soil 2'—3'.

b. Clay with laterite pebbles and a little kunkur 3' 6"—4'.

c. Pebbly laterite conglomerate 1'.

d. Kunkurry clay—7'.

The Implement was imbedded in bed "c."

Fifteen or twenty yards further down the gully, I came upon a large hatchet shaped Implement (Plate XII) lying *in situ* on the here exposed top surface of the bed *c*, fully six feet below the general surface.

The banks of this gully and its tributaries show in several places two distinct beds of lateritic conglomerate divided by sandy clay corresponding with the bed *c* of the pagoda gully section—in other places the sandy clay is absent and but one bed of laterite seen.

About ½ a mile eastward of the spot where the above two Implements were met with, and a little below the junction of the Kalingula gully with the main stream—another section is formed by a small gully running northward.

The beds seen in this section are:—

a. Vegetable soil 2"—3".

a'. Loamy sand 10".

b. Lateritic gravel 9".

c. Clayey sand with much kunkur and a few pebbles of kunkur and laterite 1'—4".

d. Lateritic conglomerates with Implements.

e. Plant shales with kunkur infilteration 1'—1".

On the face of the bed *e* at this place a large, and rather water-worn implement was well exposed, but the non-exposed part was so firmly impacted in the conglomerate as to require several blows from a rather heavy hammer to detach it. A few yards to the north two other Implements were extracted from the same bed in which they were also firmly imbedded.

A gradual thinning out eastward of the lateritic deposits from the pagoda gully section can be distinctly traced, and

there is no good reason to doubt the identity of the beds *b*, *c* and *d* of the above section with the corresponding beds in the pagoda gully section.

A small excavation was made in this gully, and about half a cubic yard of the lateritic conglomerate (*d*) thrown down, and found to contain several Implements of small size and not very good shape. Although the conglomerate looked rather friable, it was found to be very tough and compact, and it took a long time to break it down, though a strong man was set to it armed with a heavy English pickaxe.

From the side of a little gully tributary to a stream falling into the Atrampakkam nullah from the north, and at a spot about ½ a mile E. of Nelway village, a very fine Implement (Plate VI) was extracted with no little trouble from a very hard bed of lateritic conglomerate. It was imbedded fully 3' below the top of the bed close to the bottom of the gully which does not cut through the conglomerate so as to reveal its whole thickness. On the high ground about a mile to the N. E. of this gully (which is immediately north of a lime kiln), several poor and partly broken specimens of Implements were found weathered out of the laterite rock and scattered over the surface a few hundred yards to the N. W. of a village of the name of Cunjalum, which is not shown on the Atlas sheet No. 78. Amongst these was a small one figured on Plate XIV, which is interesting as being the only specimen of an arrow-head hitherto met with. The very compact laterite rock on this high ground bears a striking resemblance to the typical rock at the Red Hills near Madras and at Capper's Hill near Cuddalore—at the former of which places unmistakeable Stone Implements have been discovered by Dr. Cornish of the Madras Medical Service.

The Cunjalum laterite contains many fewer quartzite pebbles and fragments than are found in the conglomerate beds exposed in the nullah—which might be regarded as an

argument in favour of the two deposits being of different ages, were it not that about two miles N. W. an equally high level spread of conglomerate near Goompolliam, from which Implements were obtained, is quite as largely made up of pebbles as any part of the beds in the Atrampakkam nullah.

Unfortunately no section could be found to clear up the relation of the lateritic conglomerate in the valley of the Atrampakkam nullah to that on the top of this high ground E. of Nelway, and I am rather doubtful whether to consider them as part of one and the same series or to regard the lower lying beds as subsequently formed and mainly from the debris of the higher lying ones. Dr. Oldham and Mr. King inclined to think these low level beds younger than the typical laterite and derived from it, in fact a local alluvium.

It is not impossible that the laterite of the valley and the high ground in question might belong to one and the same formation, which accommodated itself to the greatly eroded surface of the plant-bearing series, a phenomenon which on a smaller scale, may be well observed in hundreds of places in the many sections occurring in this part of the country.

On a far larger scale is such a conformity of the laterite with the shape of the surface traceable in the valley of the Ingawarpolliam nullah 5 or 6 miles E. of Sattavedu, where the laterite passes down from the high ground, disappears under the local alluvium and re-appears again on the opposite side of the valley. A similar phenomenon is stated to be of common occurrence in the laterite of Bancoorah District in S. W. Bengal(1). This point must remain for

(1) NOTE.—See Report on the Geological Structure and Physical Features of the Districts of Bancoorah, Midnapore and Orissa. Bengal Memoirs—Geol. Survey of India—Vol. I, page 370

future explorers to explain definitively by the discovery of better sections.

The typical laterite rocks of the Red Hills near Madras, which as already mentioned yielded Implements to the research of Dr. Cornish, can be regarded only as an outlier of the larger and more elevated laterite areas which lie between the Sattavedu and Alicoor hills and the Coast alluvium. I have myself lately had the pleasure of chiselling out several well shaped and well preserved Implements from the hard glazed-surfaced laterite rock occurring at the northern end of the Red Hills area and capping the line of cliffs which occurs along the Corteliar, north eastward of Vermootapolliam, and compels the river to diverge to the north for a distance of about one mile. No Implements appear to occur in the gritty beds underlying the laterite conformably, both here and in the Manjakarney outlier 1¾ miles to the N. W. The gritty beds are most probably identical with those underlying the Cappers Hill laterite and called "Cuddalore Sandstones" by Mr. Henry Blanford(1). Laterite of precisely the same mineral character and appearance occurs north of the Narnaveram river and may be seen resting on similar grits near Ingawarpolliam and Amerumbardoo(2). Besides these places typical laterite occurs at and around Maderapaucum, Cunnumbaucum, Boodoor and Caradepoctoor

(1.) NOTE.—See Memoirs of the Geological Survey of India, Vol. IV., page 165.

(2.) NOTE.—Near this village are a great many so called "Corumbur rings." Some of which contain Kistvaens of quarried and rudely cut laterite blocks evidently derived from the immediate neighbourhood. Many others occur in the scrub-jungle to the north. From a small rain gully running west from this jungly ground opposite to Roshunnugger (or Roshunaveram as it is generally called,) I obtained half of a perforated black stone carefully rounded and smoothed. The stone when entire was probably of oval shape and evidently of human shaping and most likely came from one of the Kistvaens, most of which have been opened and plundered.

Further south near Arconum I met with a well made "Celt" lying on the surface very near to some half destroyed Corumbur rings which lie on the north side of the Corteliar opposite Tukkool (5 miles S. E. by E. of

and various other places. At the six places named Implements have been extracted from the solid rock. Of these some were in very good condition, others considerably weathered. The latter seemed made of a less than usually compact variety of quartzite which has been most affected where the laterite acquired a glazed surface.

Many others also belonging to all the classes which are described further on were found scattered over the surface having been weathered out of the laterite rock.

formation in which the Implements occur at Kircum
(1) in the Soornamookey valley is a bed of laterite
bbles of quartzite resting on decayed gneiss.

indebted to Mr. W. R. Robinson, C. E. of the Madras
for the following section of the Kircumbaddy plain
ticulars of the occurrence of the Implements.

Laterite including a bed of pebbles.....	4 feet.
Decayed gneiss.....	10 feet.
Gneiss.....	

Implements occur in the laterite at a depth of from
feet below the surface which is the position of the
pebble bed As in many other places further south, Imple-

Arconum Junction.) The "Celt" appeared from its position to have been swept down the slope from the Corumbur rings by heavy rains.

A couple of hundred yards eastward I picked up a good oval Implement of small size from among the debris of a bed of laterite conglomerate.

About a mile further N. E. lies a curious circular encampment with a double line of circumvallation thrown up on the side of the low hill—which is there capped with quartzite shingles derived from the weathering of the coarse lateritic conglomerate which there contains the Implements. This interesting encampment is said by the country people to be the work of the "Corumbur Rajah." Near the "Red Hills" tanks the lateritic conglomerate, which further north contains many Implements, has been quarried and used in the construction of stone circles and Kistvaens.

It would be very interesting if a chipped implement could be found in one of the blocks forming these "Celtic" burying places.

(1) NOTE.—Kircumbaddy is close to the Tripetty Station on the N. W. branch of the Madras Railway, but fully 5 miles E. from Tripetty town.

ments are found scattered on the surface where the laterite has been eroded by atmospheric agencies.

The Implements many of which were dug up here in presence of Mr. Robinson appear from a sketch of their various forms he has kindly furnished me to agree with those found in the Atrumpaukum nullah sections and to be susceptible of the same classification as further on proposed for the Implements from the latter locality.

The few specimens from Kircumbaddy which have come under my notice were of coarser workmanship than the majority of those found in the Madras District.

The quartzite pebbles occurring in these lateritic conglomerate beds in such vast numbers are derived not directly from the quartzite rocks forming such grand scarps on the Ramagherry and the Naggery mountains lying a few miles to the N. W. and N., but from certain beds of coarse conglomerates and sandstones forming the main mass of the groups of low rounded hills lying east and south east of those mountains.

In the sandstones associated with these coarse conglomerates, Mr. King discovered in the neighbourhood of Sattavedu vegetable remains apparently identical with some occurring in the shales of the Stripermatoor series, and there can be little or no doubt of their belonging to the latter very important series of fossiliferous formations, although they have not as yet been discovered in contact with them because of the great continuity and thickness of the *talus* of debris occurring every where around their base. These old conglomerates to which Mr. King has assigned the name of Sattavedu conglomerates, are of great thickness, and cover a considerable tract of country.

They are as a rule extraordinarily coarse, the included thoroughly water-worn masses varying in size from small pebbles upward to masses a yard or more in diameter, generally cemented together by a coarse dark red brown or purple ferruginous sandy cement, more rarely by a calcareous cement. The nearer we approach to these centres whence the quartzite pebbles were derived, the coarser and more shingly do the lateritic conglomerates become, and finally where they abut on the old Sattavedu conglomerates, the lateritic material is far less than the included masses of quartzite in quantity, and can only be regarded as a cementing material. The cementing material of the old conglomerates being also generally more or less ferruginous, renders it exceedingly difficult and often impossible to distinguish between them and those recent laterite conglomerates where the two are at all much weathered.

The compact laterite generally shows the characters of a true conglomerate, the contained pebbles being rounded and water-worn; but not unfrequently small patches of a few square yards in extent, present all the characters of a *breccia* all or very nearly all the included stones being sharply angular fragments. No reason for this change was apparent in any case noticed.

The thickness of the lateritic formations so far as they have yet been examined in this part of S. India is not by any means large. Even if the Cuddalore Sandstones and grits be *bonâ fide* a member of the lateritic series as they appear to be both at Cuddalore and the Red Hills (near Madras) the utmost aggregate thickness most likely falls far short of 150 feet. The section in which they are most fully exposed is, that in the cliffs on the south bank of the Corteliar near Yermootapolliam about 2 miles west by S. of the ford by which the Madras Nellore road crosses that river. The cliffs there are from 30 to 60 feet in weight.

The Implements have as yet only been discovered in the laterite which is the uppermost member of the whole series

and which no where exhibits a thickness of more than 15′ or 16′ at the greatest.

The lateritic conglomerates, gravels and sands all exhibit the appearance of deposits rapidly accumulated, for although the formation of the prodigious quantities of quartzite shingle and gravel they contain, must have required a period of considerable duration for their production, yet can such period not be referred to the laterite age, but to one of far greater antiquity.

As already before mentioned, this shingle was derived from the Sattavedu conglomerates which belong to the Stri Permatoor series.

The evidences of the artificial origin of these Indian Stone Implements are the same as those already so often given of the flint Implements in Europe—namely their all showing, however rude, that there was design in the shape given to them. This cannot be doubted by any one who has had the opportunity of examining even a moderate number of these Implements—and the figures given of some selected specimens will, it is trusted, amply satisfy even the most sceptical that design is clearly traceable in all, however various their shapes may be.

As Mr. Prestwich originally pointed out in his admirable paper read before the Royal Society in May 1859,* the casual resemblance of a piece of naturally broken flint to an Implement for warlike or industrial purposes is not an impossibility, though such resemblances are of extraordinary rarity—for no natural causes that are known would produce such an effect.

If a pebble of flint or quartzite, which in its fracture differs from flint only in so far as depends on the greater coarseness of its grain, is exposed to blows and friction in the current of a rapid and powerful stream, it is either gra-

* See Philosophical Transactions 1860, p. 277.

dually ground down to a smaller size or is split into irregularly shaped fragments which in their turn are worn down and rounded at the edges, and in course of time become smaller pebbles themselves, and if the operation be sufficiently long continued are perfectly rounded off.

An angular fragment of any hard rock submitted to such a process of attrition becomes a pebble—*i. e.*, becomes rounded by wear.

The characteristic feature possessed by all the Implements is that they are shaped to show a cutting edge lying in one plane with reference to the axis of the Implement, and this without regard whether their shape is oval, discoid, pointed like a spear, or broadly wedge-shaped like a hatchet. In some of various types this edge goes entirely round the Implement as in those figured in Plates IV, VI, VII, IX and X; in others it occurs on three sides and a blunt base is left; in a third type only two edges exist tapering to a point and with a blunt base—in a fourth three sides though evidently trimmed are obtuse, and the fourth has a sharp cutting edge.

In those Implements which have themselves been exposed to the action of moving water, the process of conversion into true rounded pebbles is clearly visible.

Various persons to whom the quartzite Implements have been shown have objected that they bore an air of newness and were not weathered. It suffices to show a freshly chipped surface of the same stone to satisfy any one that this is not the case, but that in most of them a very perceptible amount of weathering has taken place and given the surface a genuine appearance of antiquity.

In many cases the alteration of the stones extends inward from a twelfth to an eighth of inch, and the stone is seen to have lost its semi-vitreous lustre and to have

altered in color—generally having become darker—many however have undoubtedly been bleached.

In a few specimens, this bleaching process has gone so far that the stone has in parts become perfectly white and its texture closely resembles that of fine loaf sugar, but it is not quite clear that this may not have been the state of the stone when taken in hand to be converted into an Implement.

The specimens found exposed on the surface by denudation of the rock in which they had lain imbedded are almost invariably much more weathered than those discovered *in situ*—showing thus that the greatest amount of weathering results from perfect exposure to atmospheric influences.

The color of the Implements is considerably affected by the nature of the matrix: especially in the massive lateritic conglomerate by the amount of iron contained in it.

The dendrites on the chipped surface which are regarded as one proof of genuine antiquity in the case of the European flint Implements, occur rarely if ever on the Indian Implements. Out of nearly 100 specially examined not one showed these dendritic markings.

Films of carbonate of lime encrusting the Implements are of very common occurrence; indeed in various places the cementing medium of the conglomerate consists largely of Kunkur which adheres strongly to the surfaces of the enclosed Implements, as in the case of the hatchet shaped Implements figured on Plates XI and XII.

The numerous quartzite Implements derived from the quarternary formations of the Madras and North Arcot Districts present as already mentioned a considerable variety of form.

Three leading classes may conveniently be distinguished, which generally coincide with the divisions recognized by

Mr. J. Evans, the eminent Archæologist, among the European flint Implements, but which contain forms he does not describe.

These three principal classes are:—

Class I—Implements with one blunt or truncated end.

a. Pointed weapons (spear-heads).

b. Wedge shaped weapons (axes—hatchets, &c).

Class II—Implements with a cutting edge all round.

a. Implements pointed at one or both ends.

b. Oval or almond shaped Implements.

c. Discoidal Implements.

Class III—Flakes.

Of these three classes and their sub-classes Nos. I *a*, II *a*, and *b* and III agree with those adopted by Mr. Evans—the remaining two sub-classes include forms which apparently have not been met with in Europe, and mention of which I have been unable to find in the few books on the subject to which I have had access in Madras.

Among the Implements assigned to the first sub-division of the 1st class, two varieties may again be distinguished corresponding with the two varieties pointed out by Mr. Evans, whose description of them and their probable uses is perfectly applicable and may be quoted with advantage.

Speaking of these weapons, he says, "Of these there are two varieties; the one rounded at the point, its outline presenting a sort of parabolic curve, the other acute pointed with sides curved slightly inwards. The edges of both kinds are to a certain extent made sharp, but not so much so as the points, and altogether they appear better adapted for piercing than for cutting. Both shapes are usually

truncated at the base, and at that end frequently show the original form of the flint."

"It is of course impossible to say for what purpose they were intended; but they may have been attached to the end of poles so as to form spears or darts, or used without any handle for grubbing in the ground, or as wedges for spliting wood."

"I know of no analogous forms among the Celtic Implements; some of the rudely chipped arrow-heads found in Ireland and elsewhere present the nearest approach to it, but are far smaller in size, the weapons from the drift being usually from 5 to 6 inches in length. The ordinary form of Stone Celts is, as you are aware, intended for cutting at its broad end, the narrow end being inserted in the socket of the handle; these on the contrary cut or pierce at the narrow end while the broad end appears intended to rest against a step or bracket or to be held in the hand."(1)

To this sub-division I *a* belong the Implements figured in Plates III and VIII.

The form of Implements constituting the second subdivision of the first class, the wedge shaped, is as before mentioned, one not described by Mr. Evans, nor so far as I have been able to ascertain, known in Europe.

In type the wedge-shaped Implements approach slightly to the stone weapons of the Celtic era by possessing one broad cutting end—but the other rarely tapers to a sharp point—on the contrary it is often as broad as the cutting end, and sometimes much broader, nor is there any attempt to round off the angles of fracture produced by the chipping, much less to polish the general surface.

(1) NOTE.—See Letter from J. Evans, Esq., F. S. A., published as Appendix A to Mr. Prestwich's paper in the Phil. Transactions for 1861, page 311.

Occasionally the Implement is found to ha.e been trimmed all round, but the sharp cutting edge occurs only at one end, and is then as in almost all cases caused by the meeting of two large plane surfaces, each apparently the result of one well applied blow of the trimming instrument.

Wh ther these Implements were used as axes or wedges, in other words were fitted with handles or held in the hands only, it is of course impossible to decide, but they certainly ive the impression of having been effective instruments. ere is no evidence yet to show whether or not the makers these rude stone Implements used canoes, but it seems improbable that they did. If they were acquainted th the art of hollowing out tree stems with fire, the larger d heavier specimens of wedge shaped Implements would rnish admirable tools for scooping and chopping away ie charred wood from the sides so as to allow of fresh applications of fire till the excavation of the canoe had progressed sufficiently. The larger specimen of this form ould more especially have been suitable for such a purpose, *g.* a specimen found by Mr. King at Kircumbaddy, which measured 12 inches by 4 or 5 inches and is of considerable weight.

The smaller specimens such as those figured in Plates XI and XII must have been very formidable weapons if fixed to handles like axes—and would have served to inflict terrible wounds on any foe.

For cutting wood, if they ever were applied to such a purpose, their power would probably be very inferior, as they would most likely lose all their edge after a very few blows. In some few specimens the cutting edge is quite on one side and suggests the idea of their having possibly been used as adzes, with the edge placed transversely to the axis of the handle to which they may have been adapted.

A variation of this form of which I found one example in a ravine in the Sattavadu hills N. W. of Woodecottah, shows a rather sharp point opposed to the sharp cutting edge.

These two forms, the spear-heads and hatchets, are of much rarer occurrence than most of those which must be referred to the second principal class.

The second class of Implements which now demand ou attention includes as before stated three leading variatio of form—but all furnished with a cutting edge all roun The first of these varieties includes such Implements are worked to a sharp point at one or both ends. The ol ject of this form of Implement is far less easy to divine tha that of the two foregoing forms—more especially with re gard to the smaller specimens of short proportions; for i they were inserted in a notch at the end of a pole or bam boo to be used as spear heads, the sharp edge would ten to split up the wood, when thrust against any resistin body. This difficulty is less apparent in the case of thos of more elongated shape, *e. g.*, those figured in Plates I, II and IV, which may possibly have been employed, not as spear-heads, but as hammers or picks, being attached to a handle transversely so as to form a T shape.

This sub-class is connected with the following one which comprehends the oval and almond shaped Implements by many intermediate shapes to which it is often hard to assign a place. By far the greater number of our Indian quartzite Implements belong to this sub-class. The purposes for which they were constructed of this more or less elongated oval shape are by no means obvious. The absence of corners such as occur in the hatchet head figured in Plate XI would certainly give the cutting edge greater power of en-

durance; and possibly it was found easier to obtain the requisite amount of acuteness for the cutting edge by chipping the stone into an oval shape. In the best finished and best preserved Implements, the angle of the cutting edge will be frequently found to be less acute than in the rougher Implements made with may fewer blows of the chipping instrument. Experience no doubt had shown to the workman of that ancient period that the less acute edge was of far greater endurance.

Mr. Evans thinks that the large sized specimens of the logous flint Implements may have been used as axes—smaller as sling stones propelled either from an ordinary ng or from the end of a cleft stick.

He also points out that frequently the variation of form pended on the defects of the flints. Such is unquestionly the true reason for the variation in form of many of ie quartzite Implements—the workman had to adapt iemselves to their materials, and in some cases where the iginal form of the stone or pebble suited them, they reined it. The greater or less degree of skill possessed by e workmen would also inevitably appear in their several productions.

From the smaller and rudely made oval Implements, such as may have been employed as sling stones, the transition to the sub class *c* of discoidal Implements is obvious.

These certainly exhibit less of skill and design than any of the other unequivocal Implements—and this renders it increasingly difficult to assign the objects for which they may have been fashioned into a rudely discoid shape. Like the smaller oval weapons they may have been prepared for sling stones. A Native to whom one was shown by my colleague Mr. King, suggested it had been used as a flint for striking fire with.

They have also been thought to be possibly the too used by the ancient Implement chippers in producing th other Implements.

In size they vary considerably—the largest I have see was a little more than 4 inches across and rather less tha 2 inches thick in the centre. There is also considerabl variation in the proportion between the central diamete and the circumference of this form.

The third class finally includes *Flakes*, the simplest form of stone fragments which could be used by man for warli or industrial purpopses, and such as do not exhibit uneq vocal indications of human design, because their shapes such as might have been produced by accident in the oper tions of nature.

Still as such unfashioned Implements are found in th European Implement gravels as well as in the graves people living at much later periods of the earth's histor and of much greater degrees of civilization—it may be a well to draw attention to the occurrence of similar fra ments occurring in intimate association with the spea heads and axe-heads, in the laterite formations. They al not very numerous, and generally of smaller size. Th forms which have come under my notice appear to hav been used as knives and arrow-heads, and were probably chips formed in the preparation of more elaborate Imple ments. They present clean cutting edges and points o much greater sharpness than do the best even of th fashioned Implements, and for this reason would be bette suited to serve the purposes of knives or arrow-heads. A sharp strong edge like that shown in Plate XIII *a* would be no inefficient instrument for skinning an animal killed in the chase—or for scraping a piece of wood or bone.

The flake figured in Plate XV bears great resemblance to some of the ancient knives found in caverns in Europe

as figured in the Geologist Magazine for 1861, page 25, and is but very little more rude than the analogous obsidian flakes used by the Aztees as razors at the time of the Spanish Conquest of Mexico and up to a later period.

The total absence of organic remains from the formations containing these specimens of human workmanship, renders it very difficult to arrive at any satisfactory conclusion as to the circumstances existing during their deposition over so wide spread an area.

There seems reason to believe, however, that the lateritic conglomerates and sands were deposited at the bottom of a shallow sea studded with mountainous islands between which flowed strong and rapid currents. This sea flowed over up among the quartzite mountains of Naggery and Pallastry. The few islands which raised their heads above its surface, were probably only those points exceeding 400 feet in elevation above the present sea level, including in the immediate neighbourhood of what we now know as the city of Madras, the Palaveram, Vendaloor and Mullapode hills.

Further South only the Apoor Hill, and the summits of several hills at Condingee, Chingleput and Tirukarikunum formed a sporadic Archipelago.

In a westerly direction the laterite sea probably broke against a generally low gneiss coast trending in a N. N. E. direction, from near Covrepauk to the neighbourhood of Naggery Nose. East and N. E. of the Naggery Nose mountain, three or more rather large islands lay off the coast and in a great measure yielded the materials of which the lateritic deposits are formed. These islands which now form the Alicoor and Sattavadu hills were very probably inhabited or visited by the people who made the quartzite Implements which are at present the only record of their existence.

Of the Flora and Fauna of these islands, and the main land, no remains have as yet been discovered, a few fragments of fossil wood excepted which will probably prove to belong to the same species as the fossil trees of Tiruvakkarei near Pondicherry(1).

We have therefore no indications of the climate then prevailing nor any means of further correlating the relative age of the lateritic formations.

The numerical distribution of Implements, over a great part of the area(2) in which they occur, appears to have depended less on the distance from the mainland and islands of the period than upon the direction of the currents whatever else may have been the distributing agency. The agency, whatever it may have been, would appear to have acted chiefly in an easterly direction from the flanks of the Alicoor and Sattavedu hills, for the lateritic deposits lying South-westward, Southward and South-eastward of those hills contain far fewer Implements than those lying to the East of the hills in question which doubtless formed a group of three or four rather large islands in the laterite depositing waters(3).

That very many of the Implements if not the majority owe their present positions in the lateritic deposits to the moving power of water is amply proved by their showing marks of attrition, which in some few cases had been continued so long as nearly to obliterate the chippings and so almost to re-convert them into water-worn pebbles. Other

(1) NOTE.—These have been described and figured by Professors Schleiden and Schmidt under the name of Peuce Schmidiana in their work on Silicified Wood (Überdie Naturüder Kiesel Hölzer.)

(2) NOTE.—The Implement bearing laterite formations which I have personally examined and which alone are here referred to lie between the Palar river on the South and a line drawn from Naggery, through the village of Sattavedu, to the Pulicat lake on the North.

(3) NOTE.—The laterite deposits lying Westward of the Alicoor hills are mere debris of the probably extensive formations which have been removed by denudation.

specimens however of these Implements retain their sharp thin edges so perfectly and the irregularities of the chippings are so fresh that it is evident they can have been drifted only a very short distance, or not at all. With regard to such Implements it appears more reasonable to ascribe their presence to other agencies. What these other agencies may have been is as yet quite unknown, and in the absence of any evidence bearing on the subject all attempts to explain the occurrence in places of great numbers of perfectly preserved Implements must be purely hypothetical.

The most probable hypothesis appears to be that these perfectly preserved Implements owe their positions to human agency, for we cannot conceive of any other power distributing them over the bed of the sea, the action of rapid and strong currents and the carrying power of ice being inadmissible in these cases.

The next step in the hypothesis is to explain how human agency may reasonably be supposed to have been instrumental, and the question now presents itself. Were the seemingly mud-banks which now constitute the laterite beds (more especially those lying between the present Narnaveram and Corteliar rivers, to the North of the former river and at the North end of the Red Hills laterite area) permanently below the moderately deep sea of that period or were they left partially or entirely uncovered by the ebb of the tide? Unfortunately the evidence as yet obtained does not suffice to answer this question.

If the former condition of moderately deep water is supposed to have prevailed, recourse must be had to the supposition that the Implement-makers were accustomed to go out to sea in canoes or on logs of wood tied together, like the Catamarans now in use all along the Coromandel Coast.

By the upsetting or foundering of these during sudden squalls, numbers of Implements in the best state of preservation may have sunk to the bottom to be imbedded in the mud-banks. The fact of these ancient men having possessed axes and adzes(?) certainly lends color to the supposition of their having been able to make canoes and catamarans. If the laterite mud-banks be regarded as having been inter-tidal, the hypothesis of the boats is in no way invalidated, for without them the people could not have ventured to wander so far away from *terra firma*, as we find perfect preserved and unrolled Implements, *e. g.*, the laterite plat on the right bank of the Corteliar immediately west of present Madras, Nellore high-road, and the laterite gra and conglomerate at Palaveram.

It might be objected to this that these eastern spreads laterite were of much younger date than those around a near the base of the Alicoor and Sattavedu hills, (tl principal islands in this portion of the laterite sea) and th the former were deposited only after the elevation above se level of the latter more westerly parts of the formati around which they formed as it were merely an interti fringe of shoals during part of the period of elevatory mo ment :. hence these extreme easterly beds might have been visited during ebb-tide from the higher lying and permanently uncovered mud-flats without the use of boats.

But there is no evidence to prove such a great difference of age and the mineral and strati-graphical characters tend to prove that the eastern parts of the lateritic formations were deposited at a considerable distance from land, and that if they were not absolutely synchronous with, they were of but slightly less antiquity than the more elevated western portions of the formation.

That the ancient men should have wandered over the mud-flats left dry by the ebb-tides in search of food, &c., is

highly probable, and their having done so would go far to explain the presence of so many implements close to the surface, nor would it require much ingenuity to imagine numerous reasons for the stone weapons having been lost.

It will be seen in the notes appended to this paper by my colleague Mr. King that he inclines to explain the presence of great numbers of the stone weapons in certain places, as in the valley of the Attrampakkam nullah and in locality he refers to, lying northward of the Narnaveram r, near Cupedoo, by supposing that those localities were ts of manufactories of Implements for purpose of barter. is idea founded on the presence of some rude and half ished Implements, among many perfect ones and of merous flakes, is not in any way improbable, but more idence is wanted on the subject.

The very perfect state of preservation of most of the tremely numerous Implements in the former locality is a eat difficulty in supposing the laterite occurring on both es of the nullah to be a re-constructed conglomerate, as ich both Dr. Oldham and Mr. King are inclined to consider it.

In many places the beds contain both water-worn Implements and others which have not been worn by drifting, the latter underlying the former, which indicates that accumulation of laterite mud and quartzite shingle continued after the deposition *in loco* of the unworn Implements. The ferruginous materials of which the laterite mud and shingle banks were constructed were in the case of the formations lying east of the Alicoor hills brought down by rivers occupying nearly the present positions of the Trittany, Naggery and Narnaveram rivers, aided by the marine currents flowing through the depressions in

those hills, o e of which may now be recognized in the Alicoor valley, and the Narnaveram valley representing another.

The quartzite boulders and pebbles were evidently derived from the conglomerates of the islands of the Naggery and Narnaveram coasts.

The absence of all animal remains in these very interesting formations in which relics of human art are so numerous may in part have been due to the presence in the of large numbers of powerful predaceous fish, and, in p also, may we ascribe it to the decomposing effect of t peroxide of Iron, which is so large a constituent of th laterite.

The area over which the lateritic formations were spre has undergone as already stated great changes since the deposition. A great part of the formations has been r moved by denudation and deep valleys cut into them, nc occupied by the alluvium of various rivers, as the Soorr mookey, the Narnavaram River, the Corteliar and Palar

If the lateritic deposits of Pondicherry, Cuddalore, Woodiarpolliam and Tanjore belong to the same series as those in which Implements have been found, and were once continuous, and we have every reason to believe that they were so,—the excavation of the present vallies of the Punniaur, Vellar and Cauvery through these lateritic deposits, and the accumulation of their respective alluvia must also have commenced subsequently to the appearance of man on the earth.

Of the age of the very extensive deposits of lateritic minerals on the Western coast of India, a considerable part of which certainly appears to be of truly sedimentary origin, we have as yet no information, but it seems not unlikely

that they will turn out to be synchronous with those we have now been describing.

The same will probably be the case with the Detrital laterite of Cuttack and the S. W. frontier of Bengal—indeed if these widely distributed lateritic formations should eventually be found to belong to the same series as the typical laterite of the neighbourhood of Madras, but little doubt can remain that the whole or very nearly the whole Indian peninsula has undergone a considerable elevation since man's first advent.

The non-discovery hitherto of any remains of the animals contemporary with the Implement manufacturing men of Southern India, render it as already stated above, impossible at present to correlate the lateritic formation more nearly with the European formations which contain remains of ancient man. There is no reason why we may not yet find such remains and ascertain whether any representatives existed in India of the gigantic extinct Mammalia which were the congeners of ancient man in N. W. Europe—such as the Elephas primigenius, E. antiquus, Rhinoceros tichorhinus, a species of Hippopotamus and the ancient cave inhabiting bears, hyenas and lions.

On the period of time required for this great elevation to be accomplished, it is impossible to speculate safely in the absence of any satisfactory data.

The greatest well ascertained elevation at which our Implements have been found is about 370 feet above mean sea level at Kircumbaddy, and at about 1¼ mile East of Arcoonum Junction at an elevation of very nearly 300 feet.

If we attempt to form an estimate of the time required for the elevation of the lateritic formations to such a height

above the existing sea level—by adopting Sir Charles Lyell's standard rate of oscillation of 2½ feet per century(1) we should obtain a period of about 14,700 years—assuming the rate of elevation to have been constant throughout the whole period.

The first appearance of the human race in Southern India would then have to be referred back to a period yet more remote, but the standard rate of movement adopted is one confessedly arbitrary, and it cannot be doubted but that a far higher rate of elevation than 0·3 of an inch per annum might have prevailed over an area as large as the Indian Peninsula without inducing catastrophes and cataclysms on the scale required by the cosmogonists of last century,—without, indeed, inducing any paroxysmal phenomena whatsoever. If we may conclude from the striking resemblance of the objects of their respective manufacture, that the people who made the quartzite Implements of Southern India were contemporaries of those who manufactured flint Implements in Northern France and other parts of Europe, it is not unreasonable to argue that the climatic conditions existing in India may have been analogous to those which prevailed in North-western Europe at that ancient time. It has been shown by Mr. Prestwich and other Geologists who have treated the subject, that the climatic conditions in North-western Europe at that period were those of great cold accompanied by copious deposition of atmospheric moisture, this would indicate by analogy the prevalence of an extremely wet climate in the tropics. The prevalence of such an extreme climate during the period of emergence of the lateritic deposits, would go far to account for the immense denudation they exhibit, having been effected in a

(1) NOTE.—The rate of 2½ feet per century assumed by Sir Charles Lyell as his standard of oscillation, is the ascertained rate of elevation of the land now in progress in part of the Scandinavian Peninsula.

comparatively short period, and which the existing atmospheric agencies may appear totally unequal to. To quote the words of Mr. Prestwich(1) "we should have, Agencies in operation so far exceeding in power any now acting in these countries that it is impossible to apply the same rules to the two periods; the changes described must have progressed with a rapidity of which we in the present day, can in these latitudes hardly form an adequate conception."

R. BRUCE FOOTE,
Geological Survey of India.

December 1864.

(1) NOTE.—In his lecture at the Royal Institution, 26th February 1864.

INDEX TO THE PLATES.

Plate I.—The first Implement discovered at Palaveram 10 miles S. W. of Madras in May 1863—it consists of moderately fine grained cinnamon colored quartzite. One point is broken off. The figure is of the actual size of the Implement.

Plate Ia.—Shows the same Implement edgeways—the edge shown being the right hand one of full view (Class II a).

Plate IIa.—Pointed Implement of slightly coarse brown purplish quartzite from the Atrumpakkam nullah, of the same type as that figured in Plate I.

Plate IIa.—Shows the left hand edge of the Implement turned forwards. This is a very rare form of Implement. (Class II a.)

Plates III and IIIa.—Quartzite spear head of greyish stone from the Atrampakkam nullah. The left hand edge is that shown in plate III *a* (Class I a.)

Plates IV and IVa.—Long oval Implement pointed at one end with a cutting edge all round (Class II b.)

The edge view in Plate IV*a* shows the right hand edge of the Implement which is somewhat water-worn. It consists of yellowish brown compact quartzite.

Plates V and Va.—A large Implement from Moderimbedu, near Sattavedu, with one end oval and the other worked into a very sharp hatchet edge. Found on the surface but evidently derived from the laterite, some of which adheres to the sides. This Implement, which is intermediate between the Class Ib and IIb, is made of slightly coarse quartzite and appears to be stained externally of cinnamon brown color.

Plate Va.—Gives a full view of edge.

Plates VI and VI a.—A long, pointed, oval Implement (Class IIb) of greyish buff fine grained quartzite.

Much water-worn found in situ in lateritic conglomerate in the lime kiln gully north of the Atrumpakkam nullah. The left hand edge is shown in plate VI *a*.

Plates VII and VIIa.—A large and rather rude, long oval, broad pointed Implement of very fine grained quartzite of brownish yellow color with greyish bandings.

This fine specimen which is a link between the sub-classes IIb and Ib was obtained at the Atrumpakkam nullah. Plate VIIa shows the right hand edge.

Plates VIII and VIIIa.—Spear head from the Atrumpakkam nullah.

This extremely well shaped and sharp edged Implement approaches very nearly to the parabolic curve-pointed weapons mentioned by Evans' (See ante page 17.) It is made of fine greenish grey fine [redacted] quartzite.

Plate VIIa.—Shows the right hand edge.

Plates IX and IXa.—Well-shaped oval Implement with cutting edge all round (Class IIb.) slightly pointed at one end. This Implement which shows an unusual amount of care to have been bestowed on its manufacture was also found at the Atrumpakkam nullah section.

It is made of greyish brown stone with fine greyish bandings.

The right hand edge is shown in Plate IXa. The color is only external, for a slight chip shows the interior to be of grey color—which has thus been weathered brown.

Plates X and Xa.—Small oval Implement from the lateritic gravel at Palaveram—broken at one end.

The cutting edge very sharp and well chipped. The quartzite is externally weathered—a light cinnamon color—but the freshly broken end exhibits a pale dirty-pink. Plate Xa shows the left hand edge.

Plates XI and XIa.—A hatchet head Implement from the Atrumpakkam nullah, found a few yards away from the foregoing one in a freshly formed rain gully.

This Implement shows much calcareous incrustation. Plate XIa is a side view.

Plates XII and XIIa.—Fine axe or wedge-shaped Implement. (Class Ib.) found *in situ* in the side of the Kalingula gully, tributary to the Atrumpakkam nullah (see ante page).

The main part of the Implement which consists of light grey stone is very little weathered, but the base has assumed by bleaching a saccharoid appearance. A few pellets of laterite adhere strongly by a calcareous cement to the figured side of this axe head. The edge view given in Plate XIIa is that of the right hand edge.

Plates XIII and XIIIa.—A flake knife or spear-head from the Atrumpakkam nullah of compact purple quartzite.

The right hand exceedingly sharp edge is shown in Plate XIIIa.

Plate XIV.—Sling stone? An Implement of rudely discoid shape from the Atrumpakkam nullah of greenish grey quartzite.*

Plate XV.—Flake knife? from the Atrumpakkam nullah—of very fine grained light greyish brown quartzite.

* Front and side views of arrow head?) From the high lying lateritic conglomerate at Cunjalum; the Quartzite is of a smokey grey colour.

34

List of places where Stone Implements have been found in the Madras and North Arcot Districts, South of the Corteliar River.

Palaveram.	10 miles S. W. of Madras.	Among lateritic gravel.	Mr. Foote.
Ooratoor	13 miles S. W. S. of Palaveram.	Among Kunkurry lateritic gravel.	Do.
Panjur river Section.	4 miles S. W. by W. of Poonamallee.	Among slightly lateritic gravel.	Dr. Oldham. Mr. King.
Stri Permatoor 1½ mile W. of	28½ miles W. S. W. of Madras.	Among slightly lateritic sandy shingle and lateritic gravel.	Mr. Foote. Mr. King.
Parundoor Tank outflow.	8 miles N. of Conjeveram.	Among lateritic sandy shingle.	Mr. Foote.
2½ miles E. N. E. of Parundoor.	.....	Do. do.	Mr. Foote.
N. of Trimullavoil.	3 miles from Avady Railway Station.	Among lateritic gravel.	Mr. Foote.
On the top of the cliffs N. E. of Yermootapolliam.	7 miles W. N. W. of the Red Hills.	*In situ* in solid glazed surfaced laterite and lateritic gravel.	Dr. Cornish. Mr. Foote. Mr. Fraser, C. E.

North of the Corteliar River.

At Paliamungalum.	1¼ mile E. of Arconum.	Lateritic debris.	Mr. Foote.
S. E. of Arconum.	(4 miles.)	Do.	Do.
S. and S. W. of Chinamapet Station.	Madras Railway.	Lateritic shingle conglomerate.	Do.
N. of the Station.	.....	Do.	Do.
Pyanoor.	2½ miles from Chinamapet Station.	Do.	Do.
N. W. of Tumbool.	8 miles from Tripassore.	Do.	Do.
Sides of bed and gullies of Atrampakkum nullah.	9 miles from Trivellore.	*In situ* in shingly lateritic conglomerate and weathered on the surface.	Mr. King. Mr. Foote.
Cunjalam village.	10½ Do. do.	Among debris of lateritic conglomerate.	Do.
N. of Davendavaucum.	11 Do. do.	*In situ* in lateritic gravel.	Do.
N. E. of Goompollium.	2½ miles N. of Atrumpakkum nullah.	Among debris of very lateritic shingle.	Do.
S. of Malandoor.	3 miles N. E. of Davendavaucum.	Do.	Do.

At Waramderry and 1 mile W. of tank.	3 miles S. W. of Arnee.	Do.	Do.
Munjakaranei.	1½ mile N. W. of the Yermootapolliam cliffs.	Weathered out of solid typical laterite.	
South of Cupedoo W. of Nagloperam.	(6 miles W. of)	Lateritic gravel.	Mr. King.
North bank of Naggery river at the bend.	4 miles East of Naggery Station.	In lateritic gravel.	Mr. Foote.
On the crest of the pass between Alicoor and Panoor.	Alicoor Hills.	In shingle laterite debris.	Do.
1 mile N. W. of Naikenpollium.	Do.	Do.	Do.
Near Maundoor.	5 miles N. E. of Trittany Station.	Among laterite debris scattered over the surface.	Do.

North of the Narnaveram River.

1 mile N. of Woodecottah.	14 miles N. of Trivellore.	Debris of shingly lateritic conglomerate.	Mr. Foote.
Sirsalpilly ravine in Sattavedu Hills.	Do.	Do.	Do.
Near Moderimbedoo.	5 miles N. of Woodecottah.	Do.	Do.
S. of Boodoor.	1½ S. of Sattavedu.	*In situ* in lateritic conglomerate.	Do.
Caradepootoor tank N. end.	6 miles S. by E. of do.	Do. Do.	Do.
Sattavedu.	27 miles N. by E. from Trivellore.	In shingly Do.	Do.
Paundavaucum.	3 miles N. E. of Sattavedu.	*In situ in* Do.	Do.
Cunumbaucum.	2 miles N. E. of Paundavaucum.	Solid laterite, *in situ*.	Do.
Santapore.	4 miles N. E. of Sattavedu.	Solid laterite.	Do.
Maderapaucum.	Do.	Do. *in situ*.	Do.
1½ mile East of Roshannuggur.	2½ E. of Sattavedu.	Solid laterite, *in situ*.	Do.
Amerumbardoo.	5 miles E. S. E. of Sattavedu.	Do. Do.	Do.
Ingawarpolliam high grounds.	8 miles E. of Sattavedu.	Do. Do.	Do.
Survaydoo.	3 miles S. E. of do.	Laterite gravel.	Do.
Pulloor.	6 miles S. E. by E. of do.	Do. and solid laterite.	Do.
2½ miles N. of Cupedoo	6 miles W. of Nagloperam, Madras Ry. N. W. Line.	Lateritic gravel.	Mr. King.
Kircumbaddy.		Solid laterite and lateritic gravel.	Mr. W. R. Robinson, C. E.

NOTE.—Excepting Kircumbaddy, all the above localities lie within the limits of sheets 78 of the "Indian Atlas."

35

List of places where Stone Implements have been found in the Madras and North Arcot District.

APPENDIX.

Notes on the occurrence of Stone Implements in North Arcot District. By WILLIAM KING, Jun., B. A., *Geological Survey of India.*

After our discovery of these Implements in the Trivellore Taluq of the Madras District, my attention was naturally directed to any area over which might be spread debris, or shingle, of quartzite at all resembling that lying round the base of the Allicoor hill-group, and from which we knew that the Trivellore Implements had in all probability been manufactured.

The country to the North West of Trivellore Taluq is frequently strewn with much shingle, and it was not long before I found several specimens: first, in several parts of the valley between the Nagloperum and Naggery Hills in the Narnaverum Taluq of the N. Arcot District; and second, in the neighbourhood of Kirkumbady on the North West Line of Railway, about a mile or so north-west of Tripetty Station.

A. Narnaverum Area.

Over the first, which may be designated by the above name, worked Stone Implements and other evidences of their manufacture were found in three places not very far apart.

Locality (1) is situated on a tract of low rising-ground which stretches out from the eastern side of the Naggery Nose hill-mass. At about two and a half miles S. S. W. of Cupedoo (ten miles along the new high road running east from the Pootoor Station, N. W. Line) there is a small old pond or tank lying between some irregular and rocky trap dykes, and among the gravel and earth dug out of the bed of this tank were three Implements. They were associated with loose shingle and pebbles of quartzite and a few flake-like fragments or splinters of stone.

To the east of the tank, on the road between Nonra and Cupedoo, I saw occasional flakes of quartzite as well as an oval Implement which had evidently been once embedded in the lateritic deposit now forming the substratum; the implement was stained of a dark ferruginous color and partly encrusted with ferruginous sand and gravel. This laterite is a highly ferruginous conglomerate and breccia, containing rounded and sub-angular fragments of quartzite besides debris of other rocks.

Locality (2). Again, at about three quarters of a mile north of Cupedoo, I found five† Implements (four or five others were picked up by my men) of the longer pointed oval form, lying scattered round the edge of another small shallow tank, together with much quartzite gravel, shingle, and some

†1. Tapering oval, with sharp end broken off.
2. Small long oval.
3. Broad tapering oval.
4. Tapering oval.
5. do. do.

flakes. These Implements and debris had evidently been dug out in the excavation of this tank.

Here, the ground is not altogether made up of gravel and breccia as is the case to the south of Cupedoo, but consists of alluvial sandy and clayey deposits of a grey and yellowish-grey color with two or three layers of quartzite gravel and shingle as well as lateritic gravel. Rounded and sub-angular fragments of quartzite are also irregularly scattered through the most superficial layer of alluvium. This tank, like the first described and many others in the neighbourhood, is not an ordinary bunded tank or reservoir of water formed by throwing a bund across a shallow stream-valley, but is merely a pond made by digging out the earth for two or three feet from a natural depression, while the earth thrown out at the sides helps to retain more water. It will be thus seen that the raised banks of earth and gravel whence my Implements were procured are not likely to be made of material brought from a distance, as is sometimes the case in an ordinary tank bund, and therefore the conclusion is that the weapons in question have either been made on the shores of the tanks or that they were dug out with the earth. The latter supposition seems the more likely one, for the few Implements found at both tanks were scattered about very irregularly among the other stones of the gravel, and required very long and careful search before they were recognized. In coloring and weathering too, they were not to be distinguished from the other stones lying about: the distinctive characters being the regular form and, more particularly, the plane-edge all around the Implements, the latter character being unknown in any naturally-formed fragment of rock. Besides, in the case of the tank under description, the ground for long distances from it was thickly strewn with rounded and other fragments of quartzite without, as far as I could see, and my research was extremely close, a single flake-like fragment, or Implement any where except near excavated ground.

A short distance further north of this tank, nearly two miles N. by E. of Cupedoo, and at the southern end of an irregularly rocky ridge, there is another small and shallow pool close by which, at the time of my visit,‡ the villagers were digging a 'bowri' (well); and among the shingle thrown out was a chipped fragment of quartzite. The layer of shingle whence this had been dug is eighteen inches below the surface and would nearly correspond to the depth of the gravel and shingle from the bottoms of the tanks already referred to.

The next locality (3) of Stone Implements is a most interesting one in so far as it seems to have been a place of manufacture. It lies towards the north end and on the west side of the rocky ridge mentioned above, two and three quarter miles N. by E. of Cupedoo. The flat ground at the foot of the ridge and extending nearly to the stream flowing southwards to the Narnaverum river, is formed by a deposit of lateritic sand, gravel, and breccia, partly overgrown with scrub-jungle. Sub-angular and rounded fragments of quartzite are frequent on the surface, but, as far I could see, there are no Implements. This general level of the ground is, however, broken by a shallow depression; the result of the scouring out or denudation of an extensive patch of the lateritic deposit down to the underlying gneissic or crystalline rocks. The thickness of the deposit is very variable owing to the irregular surface of the rocky ground on which it rests, but it may be taken on an average as between one and three feet.

‡ October, 1868.

Numerous fragments of quartzite were lying on this denuded surface as was the case on the adjacent level ground; but, in addition to these, were plenty of flakes and Implements (of which I picked up ten) besides a number of imperfect and broken specimens. The weapons brought away are very well made and trimmed to a more regular shape than the generality of those which we have found. The specimens referred to as imperfect suggest the idea that they had been discarded or left unfinished; for some of them have the whole of one side uniformly chipped, while the other side is trimmed only for a short distance from the edge, leaving a ragged lump which only requires knocking off to make the Implement symetrical as to its sides. Another example (No. 5) illustrating incomplete manufacture presents nearly three quarters of the plane edge reduced by repeated chipping to a pretty regular straight line; while the rest is a decidedly wavy line, the result it would seem of preliminary dressing.

One specimen (No. 3) from this locality is a very perfect example of the long and flat oval or almond-shaped variety. It has been very much chipped so that the surface of both sides is somewhat smoother than is usual in these weapons; the edge, continuous all round the stone, is almost an uniform line without any irregular waves. This Implement is so sharp on its edges and so fresh-looking that many people in Madras to whom it was submitted for examination were rather doubtful as to its antiquity: and I am sorry to add that when it was returned to me this hitherto beautifully uniform edge had been slightly chipped by the graver doubters, so that the light reddish grey color of the fresh surfaces thus exposed bore strong witness to the genuine antiquity of the dark purplish brown hue of the old surface.

The Implements many of which were left on the ground lie scattered irregularly over the dunuded area; but I was struck by the more frequent occurrence of these as well as of chips around some low hummocks of gneiss rising out of the surrounding ferruginous gravel and laterite on the northern side of the denuded area. I noted three of these hummocks of protruding rock at short distances from each other and beside these were evidences of stone-chipping.

Such assemblages of weapons and flakes around hummocks of rock may be most reasonably accounted for by supposing that they had been collected there by the action of moving water, just as gravel and shingle are piled up on the sheltered side of a rock in a river bed. I did not note any particular arrangement of the stones lying about these rocky spots, indeed as far as I recollect they were so few and so scattered that scarcely any arrangement could be recognized. In the excitement and hurry of picking up the specimens I neglected to observe this; in fact, a good many were collected before I noticed their special mode of occurrence beside the hummocks. I must confess, moreover, that at the time of my examination a very different reason for the occurrence of the fragments

§1. Square-edged axe-head (ferruginously stained.
2. Do. do. (do.)
3. Large flat tapering oval (do.)
4. Small round oval (do.)
5. Medium sized round oval (do.)
6. Small round oval.
7. Heavy tapering oval.
8. Small tapering oval (much water-worn.)
9. Tapering oval.
10. Tapering oval.

at these spots was apparent in my mind; for, as I sat there on one of the knobs of gneiss looking at the scattered fragments and stone hatchets, or spear heads (whatever their use may have been), I could not help thinking that the Implements might have been manufactured beside the groups of rocks.

There were not nearly so many Implements in this locality as we found and saw in the supposed site of manufacture in the Trivellore Taluq, but there was likewise not the same enormous amount of suitable material; and when the two regions are compared my Narnaverum area becomes a very insignificant place of work. However, in comparison with other places where I have found stone weapons, with the exception of the locality to be described next, the number found at this little area of denudation is large.

Unfortunately, I found no specimens *in situ*, *i. e.*, embedded in the lateritic gravel and breccia from which I suppose them to have been derived; even in alluvial deposits which looked much more promising, we had to dig away some yards of a river bank before our implement was found, while the chances of finding anything among the already broken ground are very variable. For instance, I have examined the little gullies along a river bank for more than a mile without success; when suddenly in the bottom of a rift in the bank I found a little gem of a weapon, and close by five large implements, all of the same shape, which had evidently fallen out of a layer of shingle just above.

It cannot at present be said whether the weapons lying about over the denuded area at Loc. 3 were originally enclosed in the laterite which once extended continuously over the depression, or whether they had been manufactured subsequent to the formation of the hollow. The ferruginous coloring of the implements is a slight indication in favor of their having been enclosed in the laterite, as is also the fact of their being only as yet found lying on this denuded area; though, indeed this last condition may be as plausibly used to show that they are newer than the laterite and that the scoured-out patch of ground was a most convenient place for manufacture as the stones were at hand, having been worked or worn out of the laterite.

If stone weapons should hereafter be found enclosed in the lateritic deposit it would then in all probability turn out that they are more ancient even than those found in the drift at Trivellore, because the corresponding drift deposit in the Narnaveram valley is newer than the lateritic breccia on Loc. 3.

B. Kirkumbady area.

The old Kirkumbady Fort (Loc. 4) on the Madras N. W. Line of Railway may be taken as a land-mark for this area.

Some coarse lateritic road material was being dug up close to the railway, where it passes by the fort, during my short stay in that neighbourhood in October 1863; and amongst the heaps of this material were two rough stone implements one of which was very large and of a rude axe-head form. It was about 12 inches long and 4 or 5 inches wide at the square edge. The finding of these two specimens led me to look for others in the neighbourhood, but it was not until the beginning of this year that I succeeded in finding several of the pointed oval form. These were lying scattered at intervals over the rising ground, to the west of the line of rails, on each side of the stream which flows down between the Tripetty Station and the Engineer's bungalow at Kirkumbady fort, and were associated with a good deal of quartzite debris and shingle.

At the finding of these last, my friend Mr. W. Robinson, of the Madras Railway, was with me, so that he had an opportunity of seeing how the chipped stones generally occurred. Since this, he has not only found many about the same place, but also numbers immediately in the neighbourhood of his bungalow at the fort; so many indeed, that he was able to send me about thirty very good specimens which are now in the Geological Museum in Calcutta. Some of these were found among the ballast diggings near the fort, but there is not sufficient evidence from the workmen to show how the implements were exactly situated.

It must not, however, be supposed that the specimens have been found by the workmen in that part of the ballast which is decomposed granite *in situ*; rather that they have been found in the superficial gravel or drift covering the rising ground whence the Rail-road material is obtained. Within my own observation the diggings have been very much extended superficially, the granite being only decomposed to a moderate depth; so that it was doubtless from the superficial gravel freshly opened up that the weapons were extracted.

The finding of such large numbers of implements in the Attrampakkam and Kirkumbady (Loc. 4) areas, as also to a smaller extent in the Narnavaram region (Loc. 3), while only isolated specimens have been collected in other places has caused some little speculation as to the reason for such assemblages of artificially worked stones; the main idea being that they were collected in these places by the action of currents, or that the localities were sites of manufacture. In the case of the Narnavaram region (Loc. 3), there may possibly have been some current action in order to bring about the arrangement of the weapons, &c., round the hummocks of gneiss; but the number of worked stones in so small an area is in favor of its having been a place of manufacture. More observation will however be required before anything satisfactory can be said about the place.

In the other two great localities (Attrampakkam and Kirkumbady) there does not seem to be any system of distribution of the weapons over the ground; at least we did not observe any. There must of course have been some drifting but it would be very local, and we could hardly expect to find implements drifted on to the higher grounds in such numbers as we have found them. The Kirkumbady area is about the most elevated low-ground in the Soornamookey valley. It is also sometimes easy to distinguish stones which have been drifted when found *in situ*, from the way in which they occur: for instance, when found together in layers of gravel in the alluvial deposits, or when they are found in the bottoms of river gullies in cases of two or three or even five specimens which have evidently fallen down with the clay and gravel forming the sides of the gully; whereas, in the localities which we suppose to have been places of manufacture, the specimens are found scattered here and there in numbers among the rounded quartzite debris over open and elevated ground without any apparent arrangement in groups or lines.

One of the great reasons adduced against the idea of sites of manufacture is that people in such a low state of civilization, as the workers of these rude weapons must have been, had not arrived at the idea of manufacturing certain commodities in one place for purposes of barter with other tribes. In fact, that each tribe, or family made its own commodities; or, for example, if a man wanted a stone weapon he looked about for a suitable stone and made the weapon then and there.

This would, of course, be the ordinary mode of procedure where material was always at hand or where it was only procurable in small quantities at chance places: but, in this age of Stone Implements in S. India,

when as far as we know the only material used was quartzite even at long distances from any place where quartzite occurs in the required form, the people must have been in many cases compelled to resort to places where material was procurable. Here then, each would probably make his own weapon on the spot in preference to carrying away a few suitable stones—in which case there would in time be a large collection of finished, unfinished and broken weapons lying about the neighbourhood besides a great quantity of chips—or, as I am inclined to suppose, the people of the place (if it happened to be a settlement) manufactured weapons for the others. Supposing too, and there is some reason for this supposition, that some of the places where stone was abundant were islands, the inhabitants would have an incentive to prepare articles for barter, in so far as they might be supplied with articles of great value to them which were only procurable on the mainland. This coincidence of the abundance of implements and of the raw material for their manufacture certainly occurs in the districts we have named, for we found that the suitable material (shingle and rounded debris of quartzite) occurs close by these localities in large quantity, while it is not so easily procurable in adjacent parts of the country. These are, however, the present condition of the country regarding it as an area of dry land. There is good reason nevertheless, to argue that its aspect must have been very different either when the implements were in use or subsequently: for, as has already been shown by Mr. Foote, the stone weapons were found regularly deposited at different depths in the alluvial lateritic drift(1). Hence, it may be assumed that so much of the country as is covered by these apparently younger lateritic formations was under water at the time of their deposition. It cannot, however, be definitely ascertained that the country was thus partially submerged at the time of the manufacture and use of the worked stones, though this was probably the case; the very fact that most of our specimens which were not buried in the alluvium were found on the higher grounds is somewhat in favor of the contemporanity of the period of manufacture and such an aspect of country.

The Kirkumbady area is very interesting in this way, for the wide valley of the Soornamookey, in which it is situated, must from the great extent of its alluvial deposits have been an area more or less covered with water and probably not unlike the present swampy and lagoon region of Pulicat and the coast area further north: except that it was enclosed by the fine ranges of the Tripetty, Calastry, and Naggrum Hills. Along the shores of this partially submerged valley, and here and there even towards the middle were low sand banks and rounded rocky islands. The elevated ground of Kirkumbady Fort was one of these larger islands, and upon it there was a large quantity of material fit to be made into stone implements, abundant refuse of which we have found on the highest parts of the ground and in the neighbourhood.

Much of the Soornamookey valley was already geologically surveyed before I became acquainted with the appearance and mode of occurrence of these ancient evidences of man's existence, so that many bits of rising ground on the south side where we might expect to find remains of this kind, were passed over (as far as looking for weapons was concerned)

(1) Note.—No implements have been met with in the much younger true fluviatile alluvium with which the "alluvial lateritic drift" must not be confounded—R. B. F.

carelessly. The country about the Poodi Station on the N.W. Line might be, from the quantity of quartzite debris &c. scattered about almost down to the Soornamookey, a locality for these chipped stones, and would be well worthy of a close search.

The physical features of the Nagloperam and Narnavaram valleys are etty much the same as those of the Soornamookey area but on lesser ales. The valley of the Narnavaram river extending between the two llages named above, and the spread of country which lies between the aggery and Narnavaram rivers are quite flat, being covered with luvial deposits.

At the time when this country was thus submerged, the broad spit of igh ground already described as lying to the south of Cupedu must ave been a long promontory of land with water on all sides except the estern which rises upon the east side of the Naggery Nose hill-mass; hile the area (Loc. 3) in the lateritic breccia to the north was probably ist on the shore of an irregularly swampy bit of country into which the eapons dug out of the tank (Loc. 2) north of Cupedu must have some- ow found their way.

VEMANA. BY MAJOR K. M. MACDONALD, MADRAS STAFF CORPS.

వేమన పద్యములు. *The verses of Vemana, Moral, Religious and Satirical, translated by* CHARLES PHILIP BROWN *of the Madras Civil Service, Madras. Printed at the College Press*, 1829.

IN the whole range of Telugu literature there is perhaps no author whose writings have attracted so much notice among Europeans as those of Vemana. The Christian divine carries on his warfare against heathenism with weapons drawn from the armoury of this Hindoo moralist. The young civilian makes his acquaintance in going through the course prescribed for the honorary reward. The teacher finds him read in every school supported by Government. The greatest living Telugu scholar has translated, and annotated a large portion of his writings.

The first edition of Vemana was published in 1829 by Mr. C. P. Brown, who informs his readers that after collating nine manuscripts, he succeeded in collecting about 2,000 stanzas, which he arranged in five divisions, religious, moral, satirical, mystic and miscellaneous. The two last, which constituted more than half the work were considered by the compiler devoid of interest. Six hundred and ninety-three stanzas selected from the first three parts were printed with an English translation and notes. Mr. Brown published a second edition of Vemana in 1839. In this edition the translation and notes are omit-

Religious.....	200
Moral.....	214
Satirical.....	279
	693

Religious.....	416
Moral	468
Satirical.....	279
	1163

ted, but great additions are made to the religious and moral sections. Since then several small editions of Vemana have issued from the London Mission Press at Vizagapatam and the Public Instruction Press. With the exception of a few verbal discrepancies they are all identical and contain 201 stanzas taken in the proportions noted in the margin from Mr. Brown's second edition.

Religious.....	68
Moral.....	51
Satirical.....	82
	201

Little or nothing seems known regarding Vemana. Mr Brown at first supposed that he was by birth a Kapu or farmer, that he lived about the beginning of the 17th century, and that he was a native of the South Western parts of Telingana. "Some assert" he observes, "that he belonged to the family of Ana Vêma Reddi, a chief in the Candanul (or Kurnool) country; and the brother of the poet is said to have commanded the fort of Gandicota. Some believe him to have been a native of Crishtipad in Cadanul, others of Innaconda in Guntoor, and I have also heard it said that he was born at Chitwel in the Cuddapah District. Yet I have had opportunities of enquiring at all these places and have after all gained no information whatever. Yet his dialect in a few passages renders it probable that Vemana was a native of the South Western part of Telingana, where these towns are situated." In his second edition Mr. Brown states that it is the general belief that Vemana's writings are fully four centuries old, and adds that if the Jungums are correct in making him coeval with the writer of the Telugu Basava Puranam, this would give an era still more remote. According, therefore, to Mr Brown's first hypothesis, Vemana must have been nearly contemporary with Bacon and Shakespear, according to the second, with Chaucer. If these dates could be relied on, they would show that Telugu has undergone much less change in modern times than English, as the language of Vemana differs little, if at all, from that now in use, but they seem to have no foundation beyond rumour and tradition.

The Abbé Dubois, writing in 1806, assigns a somewhat more modern date to Vemana. "It is worthy of remark," he says, "that amongst the philosophical writings found in this country, where the authors are pleasant and satirical on the subject of religion and ceremonies, there is not one, as far as I know, which has been written by a Brâhman. All that I have seen or heard of are the works of Sûdras. One of the most celebrated in the whole country is Vemana, whose poems were originally written in Telugu, and are now translated into many other dialects. It is affirmed that this philosopher lived within these one hundred and fifty years, and was born in the district of Kadapa, of the caste of Reddi. His poems are interesting and written in a philosophical style."

"It is also material to observe that all the philosophers who have turned the religion and customs of the country into ridicule, are modern authors, at least as far as I have been able to obtain correct information. There may have been ancient authors who have treated such subjects as philosophers, but their works have perished; and I am led to believe that all the earlier works that tended to expose the absurd worship of the Hindus have been destroyed by the Brahmans of late times, in order to arrest the progress of infidelity. They shew themselves equally earnest to discourage the circulation of the modern philosophical writings."

Cavelly Venkata Ramaswami, the greater part of whose life was spent in collecting manuscripts for Colonel John Mackenzie, and who published a small work entitled Biographical sketches of the Deccan poets, makes no mention whatever of Vemana, although he gives some account of no less than 108 poets.

Having recently had occasion to make a tour through the Ceded Districts, I made enquiries about Vemana at various places, but obtained no information which seemed to me of any value, except at Proddatur in the Cuddapah District. The Tahsildar of this place, who happened to be a Reddi, stated that Vemana was an inhabitant of Kondavid, a place near Guntoor, and that he had himself described his birthplace in the following stanza.

వీడు కొండవీడు వీడె పశ్చిమ వీధి
మూలచింతలకెల్ల మొదటి శ్రీన
శ్రీన దెలిసినవారికి దొరుకున యోగలాభంబు
విశ్వదాభిరామ వినరవేమ॥

I shall make some remarks hereafter on this verse, but will at present content myself with observing that there is no such passage in the published edition.

"It is not easy," says Mr. Brown, "to ascertain anything regarding the history of Vemana, which is the personal name of the author and sometimes occurs, though rarely, among the Telugus of the present day. His family name he never discloses; and I hence imagine him to have been a Zungum. The sect of Sudras known by this name are seceders from the common religion; they worship Siva alone, and on embracing the Zungum sect they give up their family appellation, and are then usually called by the name of the sect alone. This creed also corresponds with that taught

by Vemana, and this is the only one not satirized by him."

Yet Mr. Brown himself remarks in another place, that the following verse is a satire on the Lingum worshippers, a sect who are devoted to Siva.

బూది పూతలేన్న భుజముల పెంకాలు
ప్రాలు లింగములును వరుస గట్టి
ఇక్కడదగు గాకెక్కడ దగదెట్లు వి॥ B. II. 193.

All this smearing your bodies with holy ashes, these sectarian decorations on your shoulders, and images dangling from your necks; in short, your entire creeds are of avail in this world alone, not in the next.

In his second edition he makes the following remarks. "It appears that he was not a Junguma, as is indeed shown by his silence regarding their great teacher Basava. But his tenets coincide more closely with those of the Jungums, than with those of any other sect. Vemana, indeed, belonged to no sect." And in his essay on the creed, customs and literature of the Jungums, he gives additional reasons for concluding that Vemana did not belong to this sect. "The Jungums sometimes claim the poet Vemana as preaching their creed, but though he evidently held the Brahmans in detestation, and shows a partiality to the tenets of Basava, he does not embrace the Vira Siva tenets. The insulting manner in which he speaks of the female sex furnishes another proof that he could not be a Vira Siva. He also speaks of future transmigrations: but the Jungums believe transmigration to have terminated."

The creed held by Vemana is shown in the following passages.—

బ్రహ్మమేడదనుచు చలు మారునాడేరు
వెలి మూర్ఖ జనుల విధముఁజూడ
బ్రహ్మమన్నిటందు పరిపూర్ణమయుండు వి॥ B. I. 188.

Mad and idiotic are those who are perpetually enquiring where the deity resides. God dwells in all things in his complete fulness.

ఆత్మలోన శివుని వస్తువుగా శోధించి
నిశ్చలముగ భక్తి నిలిపెనేని
సర్వ ముక్తుడౌను సర్వంబుతానౌను వి॥ B. II. 88.

He who seeks aright the God who dwells in the heart and fixes unalterable faith on Him, he shall attain utter absorption; he shall be resolved into the universe.

His creed is in fact Pantheism. He identifies nature or the universe with God and teaches that "as every vessel contains a portion of the universe, which after a temporary separation, is reunited to the great whole, so spirits released from the body are again mingled with the deity." B. III. 71.

Mr. Brown remarks that the following passage in Pope's Essay on Man conveys the precise ideas entertained regarding the deity or ruling spirit by those who hold the Vedantist creed.

"All are but parts of one stupendous whole,
Whose body nature is, and God the soul;
That, changed in all, and yet in all the same,
Great in the earth as in the ethereal frame,
Warms in the sun, refreshes in the breeze,
Glows in the stars and blossoms in the trees;
Lives through all life, extends through all extent,
Spreads undivided, operates unspent."

Thomson expresses very similar sentiments.

What is this mighty breath, ye sages, say,
That in a powerful language, felt, not heard,
Instructs the fowls of heaven and through their breast
These arts of love diffuses? What but God?
Inspiring God! who, boundless spirit all,
And unremitting energy, pervades,
Adjusts, sustains and agitates the whole."

The terms Maya, Tutvam and Yogi frequently occur in connection with this creed. Maya means illusion and is applied by Vemana to the material world and everything connected with it, all of which he treats as having no real existence.

మాయనుబెరసాల, మనసనుగొలుసాము;
భేదమనెడు బొండబెరసియుండు
యిట్టి బద్ధ జీవికెన్నడు మోక్షంబు, వి॥ B. I. 171.

We are imprisoned in delusion; our inclinations are as chains; empty distinctions are the shackles attached to us. When shall be the deliverance from this life of bondage,?

సుతులు సతుల్ మాయ; సుఖదుఃఖములు మాయ
సంవృతియును మాయ జాలిమాయ
మాయబ్రతుకుకింత మాయ కవ్వి స్థివి, వి॥ II. 43.

Sons and wives are a mere delusion, pleasure and pain are a deception; a family and the affections we feel, are unreal. Thou hast filled this delusive life with empty forms.

Tutvam is the divine wisdom or truth which Vemana is in quest of. The following quotations show what it is, and how it is to be attained.

నిన్నుజూచుచుండ నిండును తత్వంబు!
తన్నుఁజూచుచుండ తగలు మాయ
నిన్ను నెరిగినపుడె, తన్ను దా నెరుఁగును. వి॥ B. I. 45.

By looking to thee, is wisdom perfected: by looking to ourselves, we fall into delusion; when we know thee, we shall know ourselves.

తను చా దెలుసుట తత్వము
తనకన్యులు బోధ సేయ ధరలో గలరే ?
తను చూ దెవియక నుండిన
తన కెవరుఁ దెలుపలేరు తథ్యము, వేమా. వి॥

To know oneself is the chief object. Is there any other who can explain this to us? If we know not ourselves, none can teach us.

The Yogi is the perfected saint, who, having found his wisdom, and being delivered from Maya, is united (Yóga Union) to the Deity.

పగలు రేయి మరచి, భావంబునుమరచి,
తానునేపనియెది తలపుమరచి,
యుండు వానినెంచు నుత్తము డొగి రా. వి॥ B. III. 44.

The man that has attained perfection draws no distinctions between day and night, the mind and universal nature, or himself and another man.

మనుసులోనివాని మూనుగాదెలిసిన
ఋర్వి జనులు వాని దొగి యండ్రు ;
నీవునాన్మ యుంగనీవె పోశిపుడవు వి॥ B. III. 46.

He alone among the sons of men merits the title of saint (Yogi) who knows the deity that dwells in his heart; know thyself and thou shalt become the deity.

ఆశ గాని వేసి యనలంబుసల్లార్చి
గాచిబిగియఁగట్టి మోపమడచి
యాస విడిచెనేని యతడుదా దొగి రా. వి॥ B. III. 102.

He who has cut off his lusts, and quenched their fire, who has bound his loins, crushed his anger, and given up every desire—this is the only true hermit (Yôgi.)

Mr. Brown remarks that in some passages the doctrine of transmigration is very strongly inculcated, but he doubts whether these verses were written by Vemana, who has, he observes, elsewhere pointed out the absurdity of this belief. If there are any passages of this latter tendency, they have certainly not been printed, and as far as can be judged from the following and other similar verses, it would certainly appear that Vemana believed in the doctrine of metempsychosis.

పూర్వ జన్మమందు పుణ్యంబు సేయని
పాపి ధనము కాశ పడుట దొల్ల
విత్త మురది గోయ వెదికిన చందము వి॥

If a sinner in his former birth performed no virtue, all his longing for wealth is like seeking to reap when you have forgotten to sow.

పూర్వ జానన గల పుణ్యాత్ము నకలిమి
దొంట చెలిమ రీతి నూరు నెప్ప
డెందరికిని నంగ నెప్పటియట్లుండు. వి॥

The wealth of him who is virtuous and retains a consciousness of his former births shall flow continually like a well spring. To how many soever he gives, he shall still remain wealthy.

Vemana has no respect for the Vedas.

వేదవిద్యలెల్ల వేశ్యలవంటివి
భ్రమల బెట్టి తేటు పడగనియవు
సుప్త విద్య యొకటి కులకాంత వంటిది. వి॥ III. 155.

The books that are called the Vedas are like courtezans, deluding men, and wholly unintelligible; but the hidden knowledge of God is like an honorable wife.

He disparages the Hindoo gods and goddesses.

మునియుండెదు జపమెల్లను
చని పోయిన వారి పుణ్య నక్ష్మ-ధలెలమిఁ
బిన వలె కవ వలె మఱు వలె
ననిమిషులకుఁ జేత దెలియదంత్యము వేమా॥

Let us listen to the histories of those who have lived of old and attentively read the holy legends regarding those who are dead. Let us live accordingly. The gods themselves know not what shall hereafter happen.

He declares all castes equal.

పరగ బ్రహ్మగుడ్డు బరికించి చూచిన
కులములన్నియందు గూడ బుట్టె
నంద రొకట గల యనన్న దమ్ములేకదా. వి॥ III. 217.

If we carefully observe and examine the universe, we shall see that all castes equally originated therein. Then all are equal. Surely all men are brothers.

He scoffs at the Bramin's pretensions to superiority.

జనన మరణములను సంధ్యత్రాడునులేదు
సంధ్యత్రాడులేదు జననికెఱుడు
తల్లిశూద్రురాలు తానెట్లుబాపడు. వి॥

The daily prayers and the braminical cord are wanting both at birth and at the time of death. His mother never enjoyed either of these. And if his mother be a Sudra how can he be a Bramin?

Although himself a Sudra, he never places himself above a Pariah.

మాలవానినేల మహిమోదనిందింప
నెడల రక్తమాంస మొకటిగాదె
దానిలోనమలుగు జ్ఞానికులంబేది వి॥ III. 227.

Why should we constantly revile the Pariah? Are not his flesh and blood the same as our own? And of what caste is he who pervades the Pariah as well as all other men?

He is unsparing in his denunciations of idolatry.

గట్టు రాళ్ల దెచ్చి కాళ్ళచేతులఁదొక్కి
కాసి యులుచేత గానిజేసి
మొరపురాళ్ల కెరగు మొప్పులనేమందు. వి॥ III. 238.

What can we think of the fools, who bring mountain stones together, knock them about with their hands and feet, and after tormenting them with masons' chisels, bow down to the rugged slabs?

He laughs at the religious observances of the Hindoos.

కుక్క యేకతంబు కొక్కర ధ్యానంబు
గాద్దె రాగమెన్న గప్ప మునుగు
ఆత్మమెరుగు భావ మది యేల జేయరో. వి॥

The recluseness of a dog! the meditations of a crane! the chanting of an ass! the bathing of a frog! ah, why will ye not try to know your own hearts!

He ridicules their periodical offerings to the manes of their ancestors.

పిండములను జేసి పితరుల బలపోసి
కాకులకును బెట్టు గాడ్దిలార
పిండ్లు దినెడు కాకి పితరయెట్లగునయా. వి॥ III. 192.

O ye asses! why do you make balls of food and give them to the crows in the name of your ancestors! How can a dung-eating crow be an ancestor of yours.

He points out the folly of pilgrimages.

కొంకణంబుఁ జొచ్చి కుక్క సింహము గాదు
కాశి పోవ పంది గజము గాదు
వేరజాతి వాడు విదు ప్రభు గాడ్డగా. వి॥

Though he roam to Concan, no dog will turn into a lion. Going to Benares will make no pig an elephant. And no pilgrimage will make a saint of one whose nature is different.

He thoroughly disbelieves in omens and other similar superstitions.

గడ్డి గణకు నిద్ర కలలు కొరి కెలుకు
ముదమొసంగు శకున ములుకుఁ జెలగు
ప్రశ్నలు పది వేలు పరికించి చూడంగ
నబుధకాకపోలు నవనివేమా III. 9.

Fortune-telling, possession by a demon, dreams of sleep, idle wishes, and pleasing auguries, with divinations of all sorts, turn out true or false, as it may happen. Who can rely on them?

He has a great contempt for hermits and Suniassies.

ఆకులెల్ల దిన్న మేకపోతులెల్ల
గాకపోయెనయ్యో కాయసిద్ధి
లోకులెల్ల వెఱ్ఱి పోకిళ్ళ బోవుదు. వి॥ III. 137.

Even a goat can attain to such corporeal perfection, as consists in living on leaves; how apt men are to fall into foolish whims.

వేష భాష లెరిగి కామాయ వస్త్రముల్
బోడి కొఱ్ఱి గర్ణి బొరయుమండ్రు
తలలు బోడులైన, కలుములు బోడులా. వి॥ III. 175.

Saniassies acquaint themselves with particular words and vests. They wear a brick red garb, and shaven pates. On these they pride themselves. Their heads look very pure; but are their hearts so?

It seems strange, amidst these numerous attacks on Hindooism, to come across a passage like the following:

మొదల తప మతము వదలక
తుదనెవ్వరి మతము నైన దూషింపక యుఁ
పదిలుడయి కొల్చుఁగోరక
ముదమున జరియించు చాడే, ముఖ్యుడు వేమా॥ II. 53.

He who in the first place swerves not from his own religion; who in the second place reviles the creed of no other man; and who cautiously refrains from forming any evil desire. He shall live in happiness. He is the first of men.

The above specimens sufficiently illustrate Vemana's style and manner. It seems therefore unnecessary to quote any of his reflections on friendship, marriage, gratitude, charity, wealth, poverty, debt, sorrow, gluttony, theft, adultery, backbiting and the numerous other topics on which he has touched.

Dr. Pope in his edition of the Abbé Dubois work on the manners and customs of the people of India, remarks that "nothing can exceed the sweetness and rhythm of Vemana's versification." Mr. Brown's verdict on him is that he is "a familiar writer, useful to a beginner, though neither poetical nor classical" and he not only comments on his prosaic versification (p. 32 and 81) but points out numerous instances in which Vemana has been guilty of using false elisions and rustic (gramia,) forms (p. 30, 32, 33, 34, 42, 43, 49, 53, 59, 63, 64, and 79.) Singularly enough no less than two of these false elisions occur in the very verse which Dr. Pope quotes as a specimen of the beauty of Vemana's versification and

which Mr. Brown dismisses with the significant remark that "critical exactitude is not to be expected in an author who disregarded eloquence of style."

ఆరు రుచులు వేరు సారంబు దొక్కొక్కటి
నత్య నిష్ట లేరు నత్యమొక్కొక్కటి
పరము బుద్ధులేరు భావ్యంబు దొక్కొక్కడు. వి॥ I. 122.

Mr. Brown's verdict certainly represents the opinion of all native critics, and Vemana may, without disparaging his real merit, be admitted to stand higher as a philosopher than he does as a poet.

Mr. Brown compares Vemana with Lucian and Rabelais. No doubt, like the former, he laboured to undermine the religion and philosophy of his countrymen by his satire, and, like the latter, had a special hatred of monks and hypocrities. He also resembles both these writers in the profanity and indecency with which his writings are so often tainted. But there is little else in common between them. Lucian and Rabelais are prose writers, and the former is an elegant writer. Vemana is a poet and not a good poet. Lucian and Rabelais are eminent for their wit and humour. There is but little wit and no humour in Vemana's satire.

Mr. Brown remarks that "Vemana has in many passages called himself a madman with a view, we may suppose, to securing himself from the vengeance he was likely to incur by his unsparing satires on Hindooism and the Braminical hierarchy." The following is one of these passages,

సద్ద వారలమని సృష్టి లోపలి వారు
వెఱ్ఱి వేషుని గని వెరగు పడిరి;
తనకు గలుగు నిగ్గు దైవమెరుంగురా! వి. II. B. 45.

Those who consider themselves decent and reputable, look upon the mad Vemana with astonishment; as the deity

knows his real humility, while he appears only to deride others!

It is remarkable that throughout the whole of Vemana's published writings, there is but one allusion to the Mahomedans. This occurs in the verse beginning

తిరుమలకును బోవ తురక యొనరి గాడు III. 253.

Though a Turk go to the sacred hill of Tripety, he does not become a palmer.

The Hindoos boast that the sacred soil of Tripety has never been profaned by the foot of a Mussulman or a Christian, and although this may not be strictly true, it is not likely that such visits as those noticed in the verse above quoted would have been ventured on before the period of the Mahomedan Conquest. The first invasion of that portion of the Carnatic, in which Tripety is situated, took place in 1310, but the country was not actually occupied until the beginning of the 18th century. So far therefore as any inference can be drawn from this allusion, it seems probable that the Abbé Dubois is right in assigning a comparatively modern date to Vemana.

Nearly all Vemana's verses have one uniform chorus and are written in the Ataveladi metres, but other metres such as the Tetagiti and the Kunda (corresponding with the Ariyâ Gati of Sanscrit prosody) occasionally occur.

Dr. Caldwell in his Comparative Dravidian Grammar observes that in Telugu the principal grammatical writers and the most celebrated poets have been Bramins, and that there is only one work of note which was not composed by a member of the sacred tribe. The work alluded to is no doubt the Vasu Charitra, by Ramarauz, surnamed Bhattumurti, and though it may be admitted that in a certain sense such writers as Vemana are not authors of note, few

will doubt that the influence of their writings is far more extensive than that of the great rhetorical poems. As might be expected from a Sudra, Vemana is fond of using words corrupted from Sanscrit (Tudbhava) in preference to pure Sanscrit derivatives (Tutsuma). One of these, గుడారము for గృహము house, which occurs in Book II. v. 177 and 192, seems, as observed by Mr. Brown, to have been coined by Vemana and occurs in no other writer. Vemana also uses certain words in a sense which they do not generally bear. Of these Mr. Brown notices పచ్చ yellow, which appears to mean gold in the verse beginning

పచ్చమూచువారు B. III. v. 142.

and తెలుపు whiteness, which appears to mean quicksilver in the verse beginning

తెలుపుమూర్ఖుడే. B. III. v. 148.

Vemana also uses certain words which appear to be peculiar to the South Western Districts of the Telugu country and which he therefore was likely to use, if as has been above supposed, he was a native of Condaveed. Among these may be named దుడ్డు, to strike, which occurs in the verse beginning

దూర దృష్టి గనరు దుడ్డిన దనుకరు. B. III. v. 55.

and దిగ్వస్త్ర, naked, which occurs in B. III. v. 143. The following may be quoted as samples of his frequent use of Gramia (rustic) forms.

పుట్టింది. B. I., v. 118.

ఉండేడు. B. I., v. 127.

వచ్చేది. B. II., v. 166.

కొంటి. B. VII., v. 12.

తెల్సు. B. III., v. 85.

తెలియకున్నే. B. III., v. 85.

Mr. Brown observes that the expressions used by Vemana are sometimes such as cannot with propriety be translated into English, and that he has wholly omitted some epigrams on account of their objectionable character. Those, who penetrate beneath the veil, which the translator has thrown over certain portions of Book III. among which may be named v. 249, 256, 258, 261 and 270, will probably be of opinion that some of the verses which have been retained might, with advantage, have been omitted. Of the number of such passages in Vemana, some idea may be formed from the following notice which is extracted from Mr. Taylor's Catalogue Raisonné of Oriental Manuscripts V. II p. 719.

"6. No. 31, Vemana in four volumes, and a fifth, as a supplement."

"These volumes seem to be the early copies from which the first edition of Vemana's ethics were printed at the College, Madras, in 1829; a thin 8vo. volume, with half pages Telugu, and English translation at the foot of each page. In these MS. volumes, the Telugu is on the left hand page, and the English version is on the right hand. The 5th volume or supplement appears to contain obscene matter, which unhappily mingles with all native ethics; and, as such, was considered to be unfit to meet the public eye."

Dr. Pope observes that the writings of Vemana are extremely popular among the Telugu people. His popularity is, I believe, entirely confined to the Sudras, and even among them, every true believer in Hindooism regards him with much the same feelings as an evangelical curate looks on Colenso. This feeling was very apparent when Vemana was first made a text book in Government Schools. Both teachers and pupils did all they could to evade the order. In some instances the introduction of it into the classes, for which it was prescribed, was postponed under various pretences. In others, the teachers took on themselves to omit

certain verses on the ground that they contained profane attacks on their religion. Brahmins, in particular, most cordially detest this author, and, in support of their view, often point with triumphant scorn to the vulgarity of his style and the libertine character of his matter.

I will now recur to the verse quoted by the Proddatur Tahsildar. It may be remarked that, as it stands at present, there are three errors in the metre. Mr. Brown's manuscripts appear to have been full of similar mistakes, which in many instances he has corrected conjecturally. A native critic suggests that three very slight alterations will make the verse scan

వీధు కొండవీము వీధి పశ్చిమవీధి
మూల చింత కెల్ల మొదటి త్రోవ
త్రోవ దెలియు ప్రజకు దొరుకును లాభంబు వి॥

This verse may be literally translated as follows :—

The town is Condaveed ; the street is the western street ;
It is the first road to all the tamarind trees in the corner ;
Those people who know that road shall reap benefit therefrom.

In this sense it may be considered as containing an enigmatical announcement of the town and street in which Vemana was either born or lived. It may however also be intended to bear a secondary or mystical meaning. If so, the sense becomes still more obscure, as the following is the least unintelligible of the various versions which have been suggested to me.

The town is Kylas ; the street is the road to heaven ;
It is the first road to the chief meditation.
Those people who know that road shall reap benefit therefrom.

Since my return to the Presidency I have had an opportunity of examining the manuscript noticed by Mr. Taylor

and have found the following verse and translation in the fifth volume (v. 2036 ــ00).

ఊరు కొండవీము యమునికి పశ్చిమ వీధి
మూఁక నేత కెల్ల మొదట్ల యిల్లు
యరసి చూడఁజూడఁనది కు త్తిమార్గ మౌ వి॥

The village of our body in which the deity dwells is hill town (the head.) Therein his (abode?) is in back street (the spine.) Therein silence is the first house. As we gaze and continually view it, this is the road of beatitude.

The similarity between this verse and the one above quoted is sufficiently obvious. They are probably only two different versions of the same passage. It will be observed that Mr. Brown takes it entirely in a mystical sense, and the verse has probably been omitted for that reason, as may be gathered from the following remark in his preface. "A system of obscure and unprofitable doctrines regarding mysticism is much studied among the Telugus; in such reveries Vemana has indulged at great length, and there his meaning is often doubtful. Of such verses I have retained only a few of the easiest." Mr. Brown remarks elsewhere that the "carelessness of style in this writer often leaves passages thus doubtful, and has led to the erroneous idea entertained among the natives that his verses are all riddles, conveying a different meaning from that which appears." I doubt, however, whether this idea is altogether erroneous, and will conclude this paper by citing two unpublished verses from the manuscript, the first of which seems to me remarkable as containing another enigmatical reference to the time and place of Vemana's birth, and the second, as showing that Vemana was often intentionally obscure,

నందన సంవత్సరమున
బొ ద్దుగనాశ్వీజ శుద్ధ పున్నమనాడు
బృందారకాద్రిసేతువు
సందునకొకవీర వరునిజ న్మముజేసె Vol. II. v. 707.

"In the year Nundana, exactly in the full of the increasing moon of Aswija, between mount Meru and the mound of Rama, the birth happened of a chief of heroes."

This is probably the date of Vemana's birth. This is either 52 or 112 years before 1824, *i, e.*; either A. D. 1772 or A. D. 1712 or 1652; which last seems to be the truth.

వేయువిధములమర వేమన పద్యంబు
లర్థమిచ్చు వాని నరసి చూడ
చూడ జూడ గల్గు బొద్యమా జ్ఞానము. వి‖ Vol.V. v. 208 3

"The verses of Vemana may be interpreted in a thousand ways, if thou closely consider them. By reading and again reading, thou shalt attain curious wisdom."

An account of parts of the Nullamullays, a range of mountains in the Kurnool District.—By W. King, Esq., *Geological Survey of India.*

Part I. General Description.

The following paper is embodied from observations which I made on different excursions with some friends,* and by myself, during the ordinary course of my duties.

For the proper illustration of the subject-matter, the reader is referred to the map in sheet 76 of the Indian Atlas, wherein nearly all the places and routes described may be found.

These mountains are of interest in many ways, but mainly as follows:—the higher parts possess a climate severe enough to make them pleasant places for Europeans to sojourn on during a few months in the year; parts of the jungle are very valuable as forest land, and these and others may in time be made more so; and this elevated region is known with more or less truth as an area whence diamonds and some metals are obtainable.

It would seem that the Nullamullays have been traversed at different periods by several explorers. Probably by most of the Government Officers placed in the District; and more especially, by Messrs. Newbold, Arbuthnot, Minchin and Beddome,† who in their several ways have visited them

* Messrs. E. C. G. Thomas, C. S., J. H. Latham, and J. Ferguson, (Irrigation Company); and R. B. Foote, Geological Survey of India.

† Captain Beddome has given an account of these mountains in the Annual Report of the Forest Department for 1862-63. We differ somewhat about the heights, more particularly concerning that of the most elevated point of the Nullamullays. Mr. Foote, who has been around and over great part of them, agrees with me in considering Mantyconda as the highest point; and this is also Mr. Minchin's idea.

as a region interesting to the naturalist, botanist, sportsman, or climate-seeker. Some of the Engineers of the Irrigation Company, particularly Col. Cotton* and Mr. Buchanan, have also made like explorations. Unfortunately, writing as I am in camp, I am unable to ascertain whether any of these gentlemen, with the exception of Captain Newbold and Captain Beddome, have written any accounts of their excursions. Captain Newbold's observations are, as far as I remember, mainly geological.

The Nullamullays lie for the most part in the Kurnool District, between the Khoondair valley on their west side and that of Cummum on the east; though they also extend southwards into the Kuddapah District as far as the Pennair, and northwards into the Hyderabad territory beyond the Kistnah. This description is, however, chiefly of parts of the range as it lies in the Kurnool District.

The area is thus rectangular in shape in the southern part, having a long north and south axis extending between the two great rivers, a distance of about 108 miles, while it has an average breadth of about 16 miles for a little more than two-thirds of this length from the Pennair, after which it spreads out to the north-east beyond Cummum. Being of this shape, the range consists of a main series of ridges and valleys running parallel to the N-S. axis, whence run off a few lateral ribs and openings east and west into the Cummum and Khoondair low-country respectively.

The average height of the mountains is not more than 2,000 feet above the sea—the two valleys on either side

* I have since heard from Mr. H. Cotton, that Col. Cotton made a thorough exploration mainly to see the capabilities of the country as a sanitarium for the Engineers; and that he looked upon the Brumeshwar neighbourhood as the most suitable.

being from 6 to 800 feet—though there is no very great area of ground, even at this height, owing to their peculiar ridgy configuration; the main valleys being much lower than this, while the ridges run up to between 2 and 3,000 feet. From observations which I have made myself with the aneroid and the thermometer, and from a list of others made by a former officer* of the Irrigation Company, the highest point in the main mass of the Nullamullays appears to be that marked in the map as Mantycondah, which is within 3,000 feet above the sea. Mr. Minchin used to have a bungalow on another ridge, a mile or so south of this, which was unfortunately burnt down last year.

Mr. Arbuthnot, when Head Assistant at Cummum, had another bungalow on a small plateau of the range, about 12 miles east-north-east (as the crow flies) of Mr. Minchin's place, which, from the list of observations already referred to, would appear to be only 2,341 feet above the sea.

I think the highest mountain in all Kurnool is Byrenconda, part of an outlying range of the Nullamullays to the west of Cummum. On the summit my boiling-point thermometer stood at 205°, which, at the usually adopted rate of 500 feet for a degree, gives 3,500 feet as the elevation; and from all I could see this must be about the height. Between this height and that of Mantycondah there may be an intermediate one in Eeshwarnacoopum, a flat dome-shaped mountain about 20 miles north-north-west of Cummum.

The range of mountains is traversed by several paths and roads, all of which run generally from east to west, the main ones being the Budwail road in the Kuddapah District and the Nundycunnama road in Kurnool. The rest are

* I believe, Mr Buchanan.

mere footpaths, or timber roads, most of the former having been thrown out of use when the two trunk roads were made. In the Kurnool District, the Jotee Conva, Yellagode Cunnama, and the Dorenaul pass are still in good use; while the flanks of the mountains on either side are penetrated for some distance by jungle paths and timber tracks.

The Nundycunnama road is the main artery of communication between Kurnool and Guntoor, and it is very well laid out; but, for the mountain distance, it is very long (20 miles), and owing to the wildness of the country must generally be done in one march. There is no convenience at all for an European traveller on this road. What little water there is is bad, or at any rate allowed to go bad, through having no proper reservoir, and there is not a bungalow between Cummum and Kurnool, much less any sort of shelter between Gazerpilly and Kistnumshettypilly, a distance of 23 miles on a mountain road. For Natives, there is the dirty water and a Chuttrum about half way across. This resting place is at 1,500 feet above the sea, while the highest point of the road is at about 2,000 feet. There is an enormous amount of traffic by this road; and, looking to what it may be hereafter, owing to Canal and Railway, it might be as well for Government to make it a more agreeable route. There are the good walls of a small bungalow at Gazerpilly, and another might be easily built at Kistnumshettypilly; while a decent well might readily be sunk, or a small reservoir made, at the half-way resting place. It may also not be out of place to mention here, that, for communication between Cummum and Kuddapah, between which places there is a great deal of traffic, it would be comparatively easy and of the greatest use, to open up the old road or path (marked by a double line on the Ordinance Map), which crosses the

Nullamullays between Chintacoonta in the Khoond valley, and Poremaumillah in the Budwail taluq, where there are only about 8 miles of difficult hilly ground (easily to be worked) between the two villages.

The Nullamullays are to a certain extent inhabited, though there are no absolutely fixed villages. The people belong to a tribe or variety, called Chensulahs; or rather, there is about these mountains such a people, dwelling here and there in an unsettled state in the belts of jungle lying along the bases of the hills. I, myself, have only seen inhabited villages of these people in the jungle round the flanks, though I have passed through many other deserted villages on the hills themselves. A tribe, which I saw camped at Bolapilly on the Cummum side of the mountains, considered itself distinct from what it called "Hill Chensulahs." The probable state of affairs may, however, be that these latter people were Yanadis; and that the Chensulahs are an off-shoot from that family, for they are occasionally so called by the adjacent low-country people. The Chensulahs say that the Yanadis always live near villages outside the jungle, whereas they themselves never do so. They are small and weak-looking, but can apparently go through much exertion in the way of walking, and can do without food much longer than the low country native. I had three of these men as guides, from a village near Yellagode, who were apparently very stupid, and only knew one road. They did not seem to care about game and had no weapons. Again, on two other occasions, three guides were brought to us. The first, from Busswapoor, was a most intelligent savage. He had a bow and three arrows, was very quick at seeing any game, or at comprehending where we wanted to go, and talked as little as possible, preferring to make signs to us with his

hands, or smile or frown as the case might require. He knew all the paths up to a certain point, and then became useless. The next two men were very much after the model just described. One had a matchlock, the other the bow and three arrows.

Generally, the men tie their hair up in a small knot behind the head, and some have the leather skull-cap so commonly worn by shikarries. Any other clothing they have is very scant, and the wonder is how they manage to stand the very severe cold of November and December. They talked to our people in a low kind of Teloogoo, but their own language seems to be different. Their bows are made of bamboo, and a long thin strip of the same material is used for the string, loops of cord being used only at each end of the bow. The arrows are of bamboo and tipped with iron, some of the tips being winged, approaching a barbed head.

The huts met with on the hills are merely ridged roofs covered with thatch, and there is occasionally a low bamboo platform at the bottom on which to lie. I went into one of these deserted huts as a shelter from the sun, but in a few minutes was driven forth by the sudden appearance of countless spider-like insects of a most peculiar form. They had small round black bodies with very long hair-like legs, say from 1½ to 2 inches long, and they came swaying about the place in the most overpowering and airy way possible. At the same time, I became aware of some large fleas, one of which had already seized hold of me before I could rush out of the place.

There is a great deal of game; but I only met with the sambur and spotted deer. The tracks of tigers and leopards are not uncommon: of the former we saw frequent examples, particularly on the banks of the Kistnah, where

These are not Chensulah, but are left by jungle-cutters, &c., who work on the hills at certain seasons.

old and young animals of the family appeared to have been romping about on the sand only a short time before we reached the scene of their gambols. The wild pig, bear, muntjack (called the goat-antelope here), and neelgai leave their traces; and the pretty little dark brown Malabar squirrel is not uncommonly heard screaming among the trees. We saw no traces of bison; but these animals are said to have frequented the mountains many years ago.

The vegetation of these mountains is not generally very luxuriant, though there are little spots here and there in the narrower and deeper valleys where it becomes almost, tropical, and there are evidences of its having been formerly more luxuriant than it is now. The climate of the District is a dry one, and, for some months before the rains set in, fiercely hot; while the nature and position of the rocks composing the mountains render them incapable of holding water at or near the surface. Consequently, vegetation has not much chance of holding out in any richness; and the systematic clearing of the jungle, without, until lately, any restrictions, has not tended to make this any better. Throughout the rains,—that is, from May until November—there is a great effort on the part of nature to clothe these hills with rich jungle, and from that time until the beginning of February they are quite green with vegetable life. During this latter period, however, nearly all the water which has fallen is being used up, or absorbed into the vertical fractures and convoluted foldings of the rocks. Then the hot and dry season begins, when the hills become brown and yellow with the dried-up bamboos and great spreads of mountain hay, while most of the trees are shedding their leaves previous to their dead life of the hottest months; whereupon the fires begin and there is soon exposed a great mass of tolerably bare mountain land.

Still, there are areas which would seem not to be entirely dried up, where there are somewhat extensive tracts of forest land; and it is to these I should wish to draw attention further on, as I detail how we saw them during our several excursions.

The rocks are Quartzite (altered sandstone) and Clay-slate. Generally speaking, they are arranged thus:—a great series of clay-slates resting on or overlying a great series of quartzite, the latter occupying the western side of the mountains, the former the eastern. They lie in a series of great folds or undulations (sometimes almost reduplicated), with a general dip to the eastward, so that occasionally, we have the older quartzites rearing themselves up in the higher parts of the mountains, the slates, which once overlaid them, having been denuded; while the lower parts of the hills and the valleys, which have been protected, still have the clay-slates as their foundations. At the same time there are thin series of slates intercalated in the bottom quartzites, as there are also thin bands of quartzites in the clay-slates, thus giving to an ordinary observer the idea that the mountains are a confused jumble of the two kinds of rock. Still, there are the two distinct features of the Nullamullays being slaty on the east side of a line drawn through the highest ridge, running north and south, that is, through the Hoblum Pagoda (south) and Nimuljeery Conda (north); while to the west they are of altered sandstones. And one effect of this is that the jungle on the eastern half is thin and poor, except in the bottoms of the valleys; while there is tolerably thick forest on the western side. At first sight, one would wonder at this, the quartzites being such hard intractable rocks, while the slates are so much softer.

Perhaps much of this barren character of the slates may be owing to their being such bad holders of water. In the Nullamullays they are so fractured in a nearly vertical

way, that all the water sinks down rapidly, until it is caught up by the quartzite intercalations in the slates, or by the quartzite series below; and this last may also be a reason for the fertility of the quartzite area, as most of these rocks would fetch the water up to their outcrop by means of their undulations.

Regarding the diamonds and the lead of which we occasionally hear as occurring in this part of the Kurnool District, there is not much to be said. A peculiar band of silicified and calcareous rocks is interbedded with the clay-slate series, and it is in these that traces of lead and copper have been found. There are, or were, two mining regions in the mountains; one in the Kuddapah District, the other near Busswapoor in Kurnool. The first certainly seems to have been the best and most extensive; but in both cases I believe they have been thoroughly worked out by the old Native rulers of the country. Mr. Wall, the late Government Mining Engineer, has written papers on the mines in this Journal; and the results of his examinations may be taken as a close approximation to the condition and prospects of these metalliferous regions.

The diamond-mines also used to be near Busswapoor; but they have been long deserted, and are now grown over with bamboo jungle. They generally consisted of alluvial washings. The gravel and sand of an alluvial deposit which filled up a small valley to the east of Busswapoor used to be dug up out of pits and washed and examined for the precious jems, pretty much in the same way as the diamonds were worked in the village of Chenoor, a few miles north of Kuddapah, in the neighbourhood of which, by the way, it is said that the famous Golcondah* mines were situated.

To the east of Busswapoor traces are still left of the

* There are no diamonds found at Golcondah near Hyderabad.

diamond-bearing rock (quartzite) lying unconformably on the low quartzite hills, and it was from the debris of this among the gravels that the diamonds were obtained. In some cases the rock appears to have been worked *in situ*; but the gravel washings were evidently the favorites.

Before concluding this sketch of the geology, it may be as well to notice the occurrence of stone implements in the alluvial deposits lying round the bases of the mountains. I have found only one rude and much-weathered implement, of the oval shape, on the elevated ground; but they are common enough at some points on the plains immediately below. They generally lie scattered about over the surface of the ground, or in ploughed fields, and in such cases must have evidently been in a very superficial alluvium: or else, as is most likely, they are from a very superficial deposit of gravel, the remains of which may be seen here and there in the small spreads of soil and gravel left standing over the general level. The first locality lies immediately north-east of Bolapilly, 16 miles north-west of Cummum, where I found numbers of undoubted weapons in a freshly-ploughed field; and it was on the low ridge, north-east of this village that I found the worn-specimen mentioned above. Among those from the field was one which shews very distinctly the "cone of percussion," or peculiar surface of fracture common to many of the British and Continental implements, said to have been produced by the original blows given by the manufacturer to the chipped stone. This specimen is also remarkably like the Danish and Esquimaux "Scrapers," figured in Lubbock's 'Prehistoric Times.'

Again, about 6 miles south of the last locality, in the Aukiveed valley, I found more traces of weapons, and 15 miles further south-south-west at a point about west-north-

west of Kistnumshettypilly, there were numerous very good specimens lying scattered about in the fields, one of which is a very flat oval with a beautifully sharp edge all round, and seems to have been a cutting implement or a scraper.

On the western side of the mountains I also saw many traces (Mr. Foote when with me, on one occasion picked up a fine weapon a mile or so west of Roodrar, and saw many others); and I dug out in January last from the bank of the Madaypoor stream, near Busswapoor, two weapons (one a very perfect spear-headed form) at 7 and 8 feet, respectively, below the surface soil. These last were in layers of very coarse gravel and shingle.

As yet, I can say nothing definite about the age of these implements; but it is not a great stretch of imagination to say that the men who used them must have lived on these Nullamullays, or their flanks, when the Koondair and Cummum valleys were under water; and these valleys are now, as I have said already, from six to eight hundred feet above the sea.

From what I have said about the geological structure of the Nullamullays it will be seen that the water supply is on the whole a poor one. For some two or three months after the rains, of course, there is plenty of water; but after that it gradually disappears, and only reappears at rare intervals, when small streams flow for some distance down a few valleys and ravines; and these are generally at outcrops of the quartzite, above which are more or fewer series of slates. Most of the watering places will be found noticed in the second part of this paper; but I have no doubt that wells might be sunk with advantage in many places, particularly wherever there is a synclinal, or hollow saddle of undulation, among the beds of rock.

The western base of the hills is also peculiar in having four or five localities whence issue springs of slightly tepid water.

Those which I have seen are two in number; Mahnundy about 8 miles east-south-east, and Vankarum 13 or 14 miles north-east of Nundial, and there are traces of others along the same line.

Mahnundy is the famous spring, and is, at certain seasons, the resort of thousands of people, who take part in the religious festival of washing themselves. A pagoda has been built over or around the spring, the shrine, or most sacred place, being built immediately over it; while a small tank, about 30 feet square and 5 feet deep, has been built to receive the water, as it passes away. The water is beautifully clear and limpid, and of a faint blue colour, showing the sand and stones at the bottom of a marvellously clear grey with the edges quite irridescent in the sunlight. It is seen quietly welling up from the bottom in one corner of the tank; and thence, outside of the pagoda, it rushes in a fine stream to the Nundial tank. The temperature of the water being about 89°, it is apparently warm in the cold weather, and cool in the hot; and, altogether, Mahnundy Pagoda tank is the most delicious bathing place in the District. I saw it first in April 1865 at 11 o'clock in the day, and the sun overhead could not keep me out of the beautiful water.

The other spring is a much smaller one, having also a pagoda and tank which are now in ruins; but the supply of water might be much improved if the tank were cleared out. Both localities are, as might be expected from the supply of water, perfect oases of vegetation in this dried up part of the district. The trees are magnificent in size and foliage; and there are a few which are not to be seen in other parts, including the grand and beautiful Sago Palm. These watering places are also great resorts of tigers and deer.

A few remains of old tanks are to be seen around the foot of these hills, which are worthy of notice; for in one

case, at least, the bund could be repaired without any very enormous expense, and the country below it again made the fertile garden it is reported to have been in former times. To the east of Yellagode there is the old bund of a large tank, the bed of which is now covered with forest. This must be a very old tank, and there are evidences that others with their cultivation existed between it and the above village. In fact, all along the foot of the hills in the Khoondair valley there are traces of old and discarded tanks, some of large area. In the large valley inside the mountains whence the Nundial stream flows, I also saw the bund of an old tank, now overgrown with forest.

The particular instance I wish to draw attention to is that of an old tank which used to lie inside the outer low ridge of hills, 4 miles south-east by south of Roodrar, on the road to Diggoo Hoblum. There is no delineation of this tank on the map, but it is plain enough, when one stands on the long bund traversing the stream as it runs across a depression in the Roodrar ridges. The bund is about 30 feet high and nearly half a mile long, and apparently only breached at the stream. The people about tell some wonderful stories of the way the water used to lie back behind the ridges so as to form a large lake, and say that the cultivation, of which there is scarcely any evidence now, was very extensive.

The Nullamullays are, like most other low ranges of highland in India, more or less feverish at certain times of the year*. The feverish period appears to be that which comes

* Captain Beddome gives a more favorable account:—"The higher portions of these hills appear to be healthy all the year round. Mr. Arbuthnot, Head Assistant Collector of the District, has a bungalow on a part of the range near Cumbum. He informed me that he has been on the hills at all seasons, and has never caught fever. The natives do not appear to suffer from it, &c."

on after and during the rains (from May to November); though the people in the low-country alongside will tell you that they are always feverish in some degree, and that the cold months are the most feverish ones. My people have in some cases had what they called fever during the cold months; but this was merely a severe cold brought on from their not having fed or clothed themselves properly.

Up to the time I am now writing (April), I have not heard of any of ourselves or our people having been laid up with fever.

Mr. Minchin generally used to live in his bungalow at Mantycondah through the hot weather, and on into June when the rains had commenced; and I do not think he, or his family, were ever attacked. Of course, it would not be a sensible proceeding for any man to sleep in the forest valleys, if he could help it; though Mr. Thomas and I had generally to camp in such places during our two trips. I may also mention that I drank water at nearly every place (many miles distant from one another) where it was running and clear, and our people did so too; but Mr. Thomas had the usual prejudice against jungle water, and would not touch it, except in two cases, where he supposed for some reasons of his own (just as I did!) that the water was innocuous.

PART II.—DETAILS OF EXCURSIONS.

Having thus described these mountains generally, as far as they are already known; I shall proceed to give a short description of each of the excursions we made, as that will perhaps be the shortest way of giving the results, as far as they may be useful to any future tourists, or interesting to the general enquirer.

It will be seen that one object of this paper is to bring into more notice the forest capabilities of the range

and its adaptability as a small sanatarium for the residents of Kurnool and the district; these being, as far as I can see, the present main ways of turning the mountains to account.

The last Report of the Conservator of Forests shews that the forests are worked considerably for timber, and may be made much more productive, while there is a large surplus revenue to the credit of the department; and with such an immense area of country to the westward (where there is scarcely any timber) needing wood more or less for its many requirements (the railway more especially), there is little doubt but that the forest land, with very little more expenditure and care, may be made much more valuable.

The desirability of a sanatarium is not a matter of such great importance now that the hill-stations of Southern India are more within reach of Kurnool through the gradual approach of the railway; but there will still be some people who are necessarily left during the hot weather in the station or district, and it is for these that a few bungalows with their gardens, perched upon the mountain scarp opposite Yellagode, would be very pleasant places of retreat.

Cummum and the Yellagode Cunnama.

Mr. Foote and I made our first expedition into these mountains from Cummum on the east side, by the Bolapilly valley in December 1865. Cummum is famous for its splendid tank, an extensive spread of water dammed in behind one of the outlying ridges of the Nullamallays. This ridge has two narrow rifts or passes in it, through one of which the Cummum river used to flow; but across these, and especially across the river pass, great bunds have been built. The calingula is built in the smaller ravine. When we were there in December, the waters were getting low, but even under this disadvantage the tank with its low hilly

islands, was a most lovely feature in the scenery. It is a much nearer approach to a lake in size and physical features than any other artificial piece of water I have seen in Southern India, and I have seen most of these. As one stands on the main bund, the picture presented is that of a lake partially studded with conical and ridgy islands, and bounded by hills, with the grand Byrencondah in the background.

This mountain (3,500 ft. high) is a difficult one to get at and ascend. We got at it from the village of Aukveed on the west side; but, though starting about seven in the morning, we did not reach the summit until midday. In the evening we got down to the low ground in about an hour, by a path on the Cummum side; but this is such a frightfully steep descent that we had generally to hold on by bushes, or long grass, and occasionally to proceed in a sitting posture, lest we might slip away into some of the ravines alongside. The best way to go up by this path would really be that of harnessing oneself to a pony, and driving him up in front.

Both the tank and the mountain are well worthy of a visit, but unfortunately there is a good deal of inconvenience and exposure to be undergone before it can be accomplished. Cummum is a completely isolated town, or large village, and there is only one decent residence in it; there are two other houses, but they are wretchedly tumbledown and very small.

From Bolapilly, we followed what is called the Yellagode Cunnama, or pass, which leads across the Nullamullays to the village of Yellagode in the Khoond valley, for about half its distance; and, then, some months afterwards, I completed my examination across by entering on the west side

from the latter village, and getting as far as the stream we had stopped short at in December. The valley leading up to the pass was quite green and luxuriant with moderately sized trees, the forest being so thick that we could scarcely get a sight of the hills, or headlands, on either side. There were numerous small teak trees (say 30 feet high) scattered all through this forest, especially alongside of the stream, but all were badly grown and chiefly from stumps. The Goomer Teak was very common, as also the Nullamudday; and there were occasional open glades with very large trees in the midst and all round, while belts of bamboos were very common over the forest.

In one of these glades we saw a curious object sitting out in the open, beside the dead embers of a fire, which turned out to be an unfortunate Chensulah, who was utterly unable to walk on account of a fearfully enlarged abdomen, probably the result of a diseased spleen. It appeared that his tribe had left him there with a little food and fire, until some providential means of transport should be found. And so it happened; for on our return in the evening the man was gone, and, some miles further on, we found him sitting on the roadside, near the encampment of the tribe, having been brought on by one of the wood-cutter's bandies. We also met another of these people, a miserable half-starved specimen of a man, lying down with his hungry dog beside the watering place. This man certainly seemed to be taking no thought of the morrow as to what he should eat, until he saw us, when he began to pat his stomach and make other signs for food. He subsequently turned up in a mysterious manner at our breakfasting place where he got something to eat, which I suppose carried him on to his people. He had no apparent means in the shape of hunting weapons for obtaining food.

These people are supposed to feed on almost anything, vegetable or animal, which they can get.

After getting out of the valley and rising up on the elevated ground of the plateau between the Bolapilly and Brumeshwar valleys, the jungle becomes thinner, with trees that are not of much value. But the path does not follow the higher part of the plateau; and the ground to the south or towards Brumeshwar seemed to be well-wooded.

From the Yellagode side I worked in February, and then the jungle had become much more open, owing to the burning of the long grass, and the trees shedding their leaves; but this part of the range is not at all well-covered with forests, except just in the depths of the stream valleys. The Yellagode Cunnama does not rise above 2,250 feet. On the west side of the mountains, it is evident that there was a great track, from the rut which has been worn in the middle of the path by the dragged timber. There are two watering places on this road, about half way across; but one of these was drying up rapidly in February. In December there was a large dark pool of water in this place and plenty of shade from the trees; now, with the water nearly dried-up, the forest was tolerably open. This apparent opening or clearing of the forest is due to the wonderful falling of the leaves as the hot weather comes on, the ground being quite yellow and crackling with the debris of foliage, among which are principally to be recognized the leaves of the Teak, Goomer Teak, Bauhinia (gigantic creeper), and Bamboo.

The Goota Cunnama.

In January we made an expedition by the Goota Cunnama pass, which used to lead across the mountains from Roodrar in the Khoondair valley to Kistnumshettypully on the Cummum side. We hoped to have done this in one day,

leaving Roodrar early in the morning and walking across by night-time. But when evening fell we were not half way over, so we had to make ourselves as comfortable for the night as possible on the side of the mountain, and manage through the next day with a bottle of warmed-up tea and a couple of biscuits, finally getting into camp very tired and hungry at about 5 P. M. Our ten coolies behaved very well. They, poor creatures, after their one meal the first day, had to manage as well as they could on three of our cheroots and water.

This path is now quite out of use and cannot be traced along a good part of its old route, while it is not ridable, except on the eastern side of the Nullamullays. For some miles on either side it is used as a timber track.

About 6½ miles north-east of Roodrar we got into the broad valley of the stream which flows (during the rains) down to the ruined tank south of the same village, and there we found a belt of forest land something like, only not so thick as, that of the Bolapilly valley; with, however, very decided belts of small teak trees growing along the banks of the stream and its tributaries. The hot weather had not commenced, the time when the teak begins to cast its leaves, so that at a distance the belts were quite distinct through the forest with the green of the great leaves of this tree. Here also, the teak is generally grown from old stumps, which must have been cut down some years ago, as the present trees are mostly 20 to 30 feet high, and about a foot in diameter; the old trees having been from 5 to 6 feet in circumference. All the rest of the hills about this valley was covered with the usual jungle, amongst which were good-sized trees of Nullamuddy, Chiriman, Jitigi, Billoo, Yippa, and Goomer teak; while there was a good deal of bamboo. There is a great north and south timber road down this valley.

On the east side of this depression, following the mapped line of the Cunnama as closely as possible, and near the two places marked in the map with round marks, like those put for villages, we came to the first watering-place, where a small clear stream with several pools flows over the outcropping edges of the metalliferous band of rocks, already noticed as running nearly down the middle of these mountains. Just here the stream and ravine through which it flows are most picturesque. There has formerly been a good deal of Kunkar or Travertine deposited on and about this rocky ravine, much of which has since been denuded, until a great shelf of the Kunkar remains lying over and across the narrowest and most vertical-sided part of the gorge, as a natural bridge spanning the stream. One can only come suddenly on this curious feature by turning a corner; and then, as you look up the stream, there is this great square arch of rock in black and gloomy shade, beyond and through which is just a glimpse of sun-light and foliage, while over and around all this is beautiful green woodland. Even after going over the bridge (for you cannot pass under it, owing to the deep pool of water lying below) to get up the rest of the ravine, there is presented another picturesque bit of water, dammed back by a high natural bund of rock, until there is in the dry weather a little tumbling stream, with pools here and there, for the bright green moss to gather round their sides.

After leaving this spot, with no prospect of water until the eastern side of the mountains should be reached, we began to walk up the slope of the main and loftiest ridge of this part of their area; and there we passed through a thinnish and open jungle of all the trees I have mentioned above. We had now lost the road, but eventually got across the ridge, somewhat to the north of the little fort marked in the map. In this place there are some very fine and large trees.

About this time of the year, the mountains are generally

covered with longish grass, which is beginning to burn, the conflagration of course commencing with the fires left by the wood cutters. At our sleeping place on this trip we burned a good deal of the grass round about, but the fire did not run far, as the grass was hardly dry enough. After all, I do not think that the annual burning of the jungles on these mountains does much real harm, except to the young trees, and, really, these require to be kept down, to allow the other, or larger trees, to grow properly. At present it would be utterly impossible to prevent the jungle fires, for the long hay which covers such immense tracts is ready to take fire at the least spark. Were the forest to attain any size and denseness overhead, there would then probably be a much smaller growth of grass, and in this way the jungle fires would be diminished.

On the eastern side, the Goota Cunnama passes through a jungle generally more open than that described as prevailing on the other side of the mountains; but there is still a good deal of fine timber. After crossing the main ridge we now came to a stream of water about a couple of miles from the summit, which is probably dry later on in the year; and when we had recovered the path, at the head of the valley leading out to Kisnamshettypully there was a second watering place.

From the head of this valley the country is a slaty one, and it was observable that the jungle became much thinner on the hill sides than we had found it to the west; though there was some large jungle in the bed of the valley, consisting chiefly of Yippa and Goomer-teak. As the valley became wider, we got into tracts of lately-cleared jungle, now under cultivation; while more of the forest was even then being cut down and carried out. This clearance of the jungle, however, has not yet driven away the fiercer animals from the flanks of the hills, for we saw, for some miles, the marks of a

large cheetah and its young one, as they had walked before us along the road, right up to and beyond the cultivated fields and where the men were at work clearing fresh jungle.

Mantyconda.

By the end of February, the grass had become so long and thick, and the jungle was still so full in foliage north of the Nundycunnama pass, that I almost gave up hopes of being able to see my way about sufficiently for my work. In some places, the grass was nearly up to my shoulder, and it was almost impossible to find the smaller paths. Indeed, the village shikaries and guides from the low-country strongly advised me to wait until the jungle fires should be over, as they, themselves, found it difficult to distinguish any of the paths, except the well-marked ones. However, just as I was beating a retreat, I was joined by Messrs. Thomas, Latham and Ferguson, when we thought it better to make a trial trip.*

Mantyconda is an inconvenient place to get at from Kurnool. First of all, Nundial is to be reached, a distance of 48 miles, with a ghaut, and with no convenient resting places; and then there are still 20 miles to the hill-station, 12 of which are in the low-country. About 8 miles north-east of Nundial, there is a village called Singwarum (not marked on the map) which is the nearest place on that line to Mantyconda.

We got away from this village about 7 A.M., with 30 coolies, and in an hour and half reached the foot of the ghaut at a point north-east of Singwarum, where there is a deep well sunk in slates with bad and dirty water at the bottom. From this point, a ghaut has been made up to the bungalow,†

* Mr. Sheffield, the Assistant Conservator of Forests, was with the Collector, and gave us much useful and interesting information concerning the forest.

† Mr. Minchin's bungalow in ruins.

which, for the first two miles, is a most aggravating series of nearly horizontal zig-zags, and one feels naturally inclined to turn up the bed of the nullah every now and then to cut off a few of them. All this zig-zagging can, however, be avoided, by toiling up the timber track, as it ascends tolerably directly to the longer and more gently-rising road. This, from the top of the zig-zag, leads up a long valley, without any watering place, to the foot of the little hill on which was the bungalow; and the whole ghaut occupies in its passage about three hours. The usually adopted road at present, is partly the timber track and partly the made ghaut, the people having, as they generally do, adopted so much of either as made the road best suited to themselves.

This is evidently a much used timber road, the village of Singwarum being a depôt for the material, which is mostly brought from the interior of the mountains to Mantyconda, and then dragged down. The jungle is thin on the slope of the ghaut, but it thickens out somewhat in the long valley leading from the first and steepest part of the ghaut up to bungalow.

Mantyconda is on the western edge of the mountains, a little inside; and from it one looks out over the Khoondai valley, though there is not much open view in this direction, owing to the intervention of neighbouring ridges. But, to the north, south, and east there is a perfect sea of green-wooded jungle on roughly undulating highland. Perhaps much of this greenness of the jungle disappears in the hot weather; though, from what I saw a fortnight afterwards, I should think that a good part of the verdure remains all the year round. The bungalow-hill is bare of trees and covered with coarse grass, but all round and below is jungle with a good deal of bamboo.

The timber road of the ghaut runs round and past the

hill, and by following this, or taking a shorter path direct from the bungalow, the well or watering-place is reached, some 300 feet below, on the eastern side. A well has been partly sunk and partly built up on the outcropping edge of some quartzite beds, but the supply of water seemed very small at this time, and it was dirty looking. Perhaps, however, both the quantity and quality may be improvable by clearing out the place. At any rate, beside the well, a large garden has been cleared, railed in, and planted in the forest; and though it is now much overgrown with jungle and partly destroyed, we saw mangoe lime and peach trees growing very well, and even gathered a few roses and some hard and diminutive peaches. There were also the unmistakable marks of a large tiger, near the bony fragments of a sambur which he had been devouring in the middle of the garden.

Hence, we wandered for some miles eastward, and saw some splendid forest land full of fine timber trees, as Nullamudday, Chiriman, Yerramudday, Jitigi, Goomer-teak, some Tumki (Blackwood), and a good deal of Teak. A great many felled trees had been most ruthlessly cut away to give the small bauks (about 10 to 12 feet long), which alone the woodcutters can carry out, owing to their small means of transport. They will cut down a splendid Nullamudday with a clear stem of 30 or 40 feet, 3 or 4 feet from the base, leaving a good stump of timber; and then cut the great trunk into two logs, thereby wasting a lot of wood where it has been cut across. There is also a good deal of fine and large bamboo in this forest basin to the east of Mantyconda.

Occasionally, in wandering along here, we came on more open tracts of forest in which the teak tree is prevalent, but, as is usually the case all over these mountains, grown from stumps. Here, some of the trees are good,

that is, they are from 1½ to 2 feet in diameter, and 40 feet high. They are seldom straight-grown trees, however, being much twisted and gnarled; and they are horribly mutilated by a most relentless creeper (Bauhinia), which is the bane of the more elevated tracts of forest.

The Bauhinia is a very pleasing adjunct to the scenery in some respects, with its long and festooning snake-like trunks, and beautiful, large, bilobate leaves. The old stems ramify about, very much in the way a number of the new "Pharaoh's Serpents" might do, if they were started from one point. They are seen stretching through the forest along the ground, or up to the highest twig of a tree, or right across the fork of two great branches, or coiled up the trunks, or looping in festoons from tree to tree, and covering every thing with a most luxuriant foliage; until trees die, are split up or are finally dragged down by the superincumbent weight of this gigantic parasite. It is really a cruel picture, that of these grand trees, utterly ruined, and rearing their dead or leafless branches out of the midst of the rich foliage of the creeper. The young shoots have a most eager tendency to lay hold of any unfortunate tree, stretching themselves up for 20 and 30 feet at a time; and when a tendril has once wrapped itself round a twig or leaf, it requires some force to unwind it.

The leaves of this creeper are largely gathered in the forest, and sent into the low-country to be used for leaf-plates, for which they are much prized; and the bean, enclosed in a large pod of very hard material, is used as food by the Chensulahs. On one occasion, we met the native contractor with his party of coolies coming up from the low-country to gather the leaves, and at another time, I met some Chensulah women gathering the fruit.

Having wandered about 4 or 5 miles east of the bungalow

through this sort of jungle, without, however, coming to a second stream (as it turned out afterwards, we were just at the water), our guides objected to go any further, any paths we met being reported to lead nowhere, or, as they put it "that road went into the forest and came back again;" and as, in a subsequent excursion to be made about a week hence, we were to return by Mantyconda, we turned back on our path.

On our descent by the same ghaut, there was plenty of experience of the burning grass on the side of the mountain, for the villagers had apparently fired it then, instead of before our ascent, as they had been ordered to do. At one point, as the fire came roaring and crackling up the face of the hill-side, we had to run through it, as it flared along on each side of the path with its fearfully scorching heat.

The Brumeshwar valley.

In the meantime, and while preparations were being made for our more extended excursion into the interior of the mountains from Nundial, I went off to Yellagode and thence worked into the mountains by the Yellagode Cunnama, and up into the Brumeshwar valley. To get at this last, I had to pitch a temporary camp about 8 miles east of Yellagode, near the site of the deserted village of Boogapully. There is low-country even beyond this for a couple of miles or so, until a pool of running water is reached at the foot of the ghaut; and then the timber track (or rather "slip" in this case) rises very steeply until an intermediate terrace is reached.

Looking east from Yellagode, the mountains, for about 4 miles, appear to consist of a long horizontal plateau, at the southern end of which is the little irregular mass of Mantyconda, and to the north the saddle, over which the Yellagode

pass leads to Bolapilly. The path to Brumeshwar leads over this apparent plateau.

As I rose from the intermediate terrace, mentioned above, towards this plateau, I really felt that morning something of the "sweet, half-English, Neilgherry air," as the fresh breeze swept past me; but this was doubtless owing to there having been a heavy shower of rain three or four days previously, and to the fact that the interior of the mountains since then had been covered with a light cap of clouds during the night. From the terrace, the path ascends rapidly to the seeming plateau, which turned out to be the tolerably level crest of a long slope rising up from the Brumeshwar valley; and when I stood there in the fresh breeze, looking over the plains, I thought how much more preferable a site this would be for a bungalow than Mantyconda, if we could only get water.

At present this crest of the Brumeshwar basin is covered with jungle of bamboo and tolerably large trees of the kinds usually found on the Nullamallays; and it is about 2,700 feet above the sea, or nearly 300 feet lower than Mantyconda. Descending gently to the eastward towards the Brumeshwar valley through a tolerably open jungle with large trees, and then getting into the head of a narrow valley, I found myself (in 20 minutes, from the top) beside a stream of water.

This little valley deepens and narrows, and the stream becomes a brook of clear running water, quite charming to look at in these generally dry mountains, whose stones are covered with ferns and moss, and which is buried in a tolerably close growth of great trees and bamboos.

There are very large mangoe trees, as is usually the case in these water valleys, only that here they are more numerous. The bamboos are very fine, many of them 4 and 5 inches in diameter at least; while the sago palm shows its beautiful plume of leaves and ropy droops of fruit here and there

amongst the other trees. The Chensulah guides told me that water runs here all the year.

Then I got down to Brumeshwar, the site of a ruined pagoda and small tank, in a wide valley of fine timber jungle. Between the stream just described and the pagoda, there is an open bit of forest in which the teak trees must formerly have been very good; some of them were 7 and 8 feet in circumference at the base, and there were stumps of larger growth. Those in the open appear to have grown much better than what I have hitherto seen.

The point where I found the flowing stream was at 2,300 feet above the sea, 400 feet below the crest; so that the conditions are pretty much the same as those of Mantyconda and its watering place. Still, there is much superior water at Brumeshwar, and more space to move about in, on the crest, than on the little hill of Mantyconda. There are also admirable sites between the latter hill and the plateau north of Brumeshwar for three or four bungalows, with some driving and plenty of riding ground.

There is a good deal of timber dragged to the crest of the Brumeshwar ridge from the wide basin on the east side of it, and then slipped down by the ghaut, to be carted to Yellagode. At the foot, near the stream, I saw several bauks of the dark brownish-red Nullamadday and the pale yellow or white Chiriman timbers, which were then being carted away.

The Cotta Cunnama.

Early in February last, Mr. Thomas and I started for a five days' excursion to the interior of the Nullamallays. There being no fixed villages, we were obliged to take every thing with us necessary for food and shelter, except water, which we could only depend upon at certain points; and for these thirty coolies were required though in

a subsequent trip we reduced this number somewhat by using the "canât" of the beechobah (rigging it up in the form of a merchant's tent) instead of the whole tent, as on the present occasion. We had one guide, a Chensulah, who came from near the village of Busswapoor, where his tribe was dwelling at this time. He was a very sharp, willing and intelligent man, and was armed with a bow and arrows. Should any future excursionist want a guide, let him send for "Gurrupoo" of Busswapoor.

We started from Nundial, entering by the valley whence the stream of that village flows, and this brought us on to the Cotta Cunnama. This broad valley is like the others of the Nullamallays in being well-wooded with the usual trees for about two miles east, when the forest becomes thin and open, up to the foot of the Nimuljeery ridge; though over this open country there are frequently very fine specimens of the Yippa. This tree is not used as a timber by the people on account of its hardness and the difficulty of working it, but it is a very valuable and handsome wood. Mr. Sheffield, the Assistant Conservator at Nundial, tells me that the bark only of the Yippa is used by the people for making rope, but that it is a capital timber, well suited for railway sleepers, and that he can float any quantity of it down to Kuddapah by the Khoond river at the proper season. Except in this inner part of the mountains, the Yippa is generally most mercilessly cut down and pollarded by the people over the whole of the Kuddapah and Kurnool mountains. This is more particularly the case on the Yerramallays, which flank the Bellary District, where every shrub and tree is wanted as much as possible to shelter and either attract or keep any little moisture that may be formed.

We camped in the broad valley, at the usual watering place on the Nundial stream for the night. Here, the water is ra-

pidly drying up and there must be scarcely any left a month later for the numerous wood and hay-cutters frequenting this part of the mountains.

There is a very large quantity of coarse dry grass carried out by this road in huge bandy-loads to be used for thatching, but it seems not unlikely that the finer grass may eventually be carried out for fodder. Our horses had no other grass on these hills, and they appeared to eat it with avidity. It would also seem to be splendid food for cattle; perhaps, too, it is owing to the fact of their being let out to run over a hay of this kind, that the mountain-fed cattle of this and the western parts of the Nellore and Guntoor districts are so well conditioned as they are reported to be. Further north, on the western side of these Nullamallays, about Atmacoor, &c., there is an immense tract of jungle-grass-covered country, farmed, some years ago, by the late Captain Nelson, upon which great herds of cattle are allowed to feed. The future canal boats would be a good means of transport for this resource of the mountains, if it were ever used for fodder.

The open ground on the west side of Nimuljeery ridge is extensively covered with fine yellow hay, and is thus very dry and bare-looking. Even the generality of trees are quite leafless now, the Yippa being the only one in a flourishing state of verdure. The yellow and red flowering cotton trees, quite leafless, though in full flower, are also common over this bare jungle.

Here also we saw frequent evidences of the presence of the Neelgai; but, with our great band of coolies marching along with us, we were not likely to see much game.

We now began to rise suddenly up the flank of the Nimuljeery Conda, and here found a most welcome stream of running water, reported to from all the year round.

The water shows nearly up to the top of the ravine, where it appears to rise from some out-cropping beds of slate intercalated with quartzites. The ravine is well wooded, but only close along side of the bed of the stream, whence rise up some splendid mangoe trees. Near the top there is a sufficient elevation to allow of the Bauhinia creeper growing most luxuriantly, spreading mischief all round with its parasitic stems.

Remembering what we had seen of the ravages of this creeper about Mantyconda, we brought an axeman to try and stop its growth in a small way, and here the woodman set to work with a will. The dark-coloured gnarled stem gives one the idea of a hard wood, while, on the contrary, it is quite soft and spongy, the cut surface looking extremely like raw beef; consequently, the ordinary narrow and thick headed woodman's axe of the country is not suitable for cutting the creeper down. Just where the stream commences to ooze out of the rocks, the Bauhinia had almost overpowered every thing but a few gigantic mangoe trees, though with these it was getting on pretty well; and in such a labyrinth of ropes and festoons of stems, we could do little else, but free the mangoes from one or two of their greatest enemies, when it was quite a pleasure to see the great pendulous trunks swing away free and death-smitten, as they were severed from the parent root.

We then got over the Nimuljeery ridge on to an elevated plateau of open jungle with long crops of hay, after crossing which, and some minor wooded valleys and ridges, the path began to descend the eastern side of the mountains by a dry ravine of slaty rocks, and so passed on into a broad valley. Here also the jungle is open and thin, with a crop of long and fine hay, but there are at intervals belts of thicker jungle of trees among which are many Yippas, the courses of the stream being, likewise, clothed with thick jungle.

This valley possesses the peculiar feature, according to the map, of having a stream without an outlet! and we camped beside it for the night at a watering place. The stream, as far as I could make out, runs south-south-east to Kistnumshettypilly. The water was not running, but lay in a dark pool, which probably becomes dry later on in the season.

From this point, we wished to move our camp in a north-west direction, somewhere on the path which our guide reported as leading up to Mantycondah, so as to get up to that hill, and come to a halt in the Brumeshwar valley, beside the flowing water. But before we ourselves could follow the camp, we wanted to see the whole of the Cotta Cunnama, and, if possible, the Nemilly Goondum waterfall to the north of the road, reported by Mr. Foote to be a place well worth seeing. Unfortunately there was only one guide, and it was necessary to send him on with the coolies; so, with the understanding that he was to cast a branch or some leaves on any turning of the road which he might follow we started by ourselves for the ghaut and waterfall.

As soon as the Cunnama gets out of the valley in which we had slept the night before, the path becomes more defined as a timber road, and begins to rise over a country of slates, when the sudden thinning-out and almost complete disappearance of the thicker jungle is surprising. Except in the bottoms of the ravines, and over a ridge or two of quartzite beds which are intercalated among the slates, the hills were most bare and arid looking. There was not even the rich crop of hay, but only a very poor and thin dried grass, scarcely concealing the rocky ground. The path now turned southwards, in order to get down a ravine, and so through a stream-gorge (where there was good water) into an extensive open flat valley, surrounded on all sides by low hills, except to the east-north-east, whence it opened out towards Aukiveed.

From this open bit of plain we turned northwards and

after a most hot and fatiguing ramble (there is no sheltering jungle) up the back of a rough quartzite ridge, found ourselves on the crest of the western side of the Nemilly Goondum valley, about one o'clock in the day. There, we saw the stream of the waterfall about a thousand feet below us, but at the bottom of a most extraordinarily steep-sided valley. We had lost the path, and the wonder was how to get down such a precipitous slope; nevertheless we must get down, for I wanted water badly, and it would never do to give up now. So, down we went, first scrambling through a thin jungle of bamboo at the bottom of a little ravine, then for a good distance down a sambur path; until by sliding, creeping and slipping, holding on by the way at tufts of grass and bushes and avoiding the very hot rock we finally got to the bottom and found temporary shelter under a tree.

Hence, up the dry bed of the stream (wondering if we were to see water again), round a corner of rocks and trees; and then came in view half an acre of a deep pool of water, lying below a thin dribbling stream, which worked its way over and down the face of one of the finest geological features I have seen. Let me try and describe it. Nemilly Goondum valley has been formed in a U-shaped curve or synclinal of quartzite and slate beds, the slates being above the quartzites. The arms of this curve rise up on either side at great angles: on the west side, at any rate, at 60 degrees. The slaty beds which formed the nucleus of the curve have been denuded for some distance up the axis of the synclinal, thus leaving a U-shaped valley of quartzites, along the bottom of which the stream above the fall flows. At the fall, the quartzites themselves, for 30 or 40 feet in depth all round the curve, have been carried away, leaving a tolerably vertical face, down which the water runs to the great basin of the pool below. Thus, in looking over the pool at the fall, one sees in front 30 feet or so of quartzite beds curving up

from the level water for 700 feet or more, as the steep sides of the valley. So steep is the rising up of the beds on either side, that it would be utterly impossible to get into the valley above the fall from below, except by scaling the vertical wall over the pool, or by coming from outside over either of the ridges bounding the main valley.

Very long ago, some old Brahmin or Saniasi came to this place, and was equally struck with the grandeur of the scenery according to his light, and the suitability of it for a place of pilgrimage; so he made a beginning of the small pagoda which is built at Nemilly Goondum, some way up, the side of the hill, where, probably, there is a finer view of this physical feature and the valley beyond, only I was too tired to go up to the temple to see. Indeed, I would have given much to have rested here until the next day, especially with that climb back up the ridge in the hot sun before us, but there was neither food nor shelter.

We were, however, fortunate in finding the path which we had lost at the top of the ridge, and so ascended much more easily than we expected; but, it was dark when we got back to our camping ground of the night before, and there were some six or seven miles to be got over before the new ground could be reached.

North-west road to Mantyconda.

Our road was tolerably clear for some distance (we had lit up some bamboos as torches, though there was soon no need of these, as the moon shone out in a short time) where it traversed a fine open forest of large trees and bamboos, with the usual accompaniment of long dry grass; and as, at times, we came to a diverging path, there was the now-withered branch, which our guide had left lying on the road to warn us from straying.

There was, to me, something very grand and mysterious

in wandering thus through these forests in the quiet night, the silence only disturbed by the occasional barking of the deer, or the crackling of some burning tree. These burning trees, too, were a strange feature. Now and then, there was a little flame away on one side of the path which, with a few solitary stumps of trees, looked so excessively like a group of men beside their fire, that our people on one or two occasions shouted out at the supposed friends. Or, at times, solitary trees would burst out into flames from top to bottom, as the breeze rose a little; or the more frequent sight was the stump glowing red close to the ground, while, stretched away from it, was a broad line of ghastly white ash deposited on the sward, all that was left of the great trunk. But I think the most solemn sight of all was a great tree standing up in the air, from root to the furthermost twig a red smouldering mass within the dark shell of bark. As the breeze fluttered up, we saw the open seams and crevices in the bark redden out, casting off sparks of fire; and long after passing it we could see this natural bit of pyrotechny throwing out, as the wind freshened, thick showers of sparks from the branches and trunk which would so soon all sink quietly to the ground. I call this a solemn sight, because all this destruction was going on so quietly, as it were without an effort, in the great forest, which appeared to be endless in the distant darkness of the night, quite a different sight to the spirit-stirring roar and flare of the forest fire in the day time.

All this time, the path had been going along a tolerably level valley without rising much; but now, the branch cast on the road directed us away to the north-west over such a rocky bit of ground, leading straight for a high ridge of hills which we did not expect to cross until much further north, that we began to doubt the sign we had seen. There were however, more dead branches lying on the path; and we rose

higher and higher, through small belts of thick jungle, and along plateau terraces of more open country covered with long dry grass. The outlines of the ridges were also becoming so much more indefinite as to shape and distance in the moonlight, that we soon lost most of our confidence in these as guides, and began to be almost as despairing of reaching any camp before next day as our men, one or two of whom began to want to sit down, or say they had got fever.

However, there was no good in going back, as we had now proceeded some six miles; so on we went, keeping the men well in front to prevent their lagging behind or sitting down, and getting higher and higher into an atmosphere that was quite fresh in its coldness, until at last we turned up a valley which seemed to be in the right direction. This led us eventually up to a high saddle on the main ridge; and about 10½ P. M., our shouts were at last answered, when we emerged from the forest on an old camping ground with deserted huts,* where our people had pitched the tent.

This camping place was about 2,250 feet above the sea, among thickish jungle, and there was a poor spring of slightly milky-colored water in the bed of the little ravine close by.

The Mantyconda Forest basin.

Our march, next day, to Mantyconda and the Brumeshwar valley showed that the above watering place, which, as far as I can make out, must have been about eight miles east-south-east of Mantyconda, lies on the eastern edge of a great forest basin extending up to that hill. This is the area of best forest land on the mountains; and it may be considered roughly as limited on the north by the Yellagode and Brumeshwar wartershed, while to the east it gradually thins down into the valley leading out to Nundial, thus giving at least a hundred square miles of good forest.

* Said to be huts of Wudders, or of people who work in the forests.

The path now led through continuous green forest, generally thick and full of large trees of all the kinds already detailed; and when we occasionally ascended a high point to make out our position, there was nothing but this sea of forest-covered hills spread out before us. The Teak and Nullamudday were often very large; but wherever they were so, in nearly all cases, the over-reaching Bauhinia was battening on them. Indeed, the way in which we found out that our guide was leading us aright was by coming on an unfortunate teak-tree, which had been remarked by Mr. Thomas, on our previous walk eastward from Mantyconda, as having been so peculiarly split down by this creeper.

There are three good watering-places on the path through this forest basin, the head-waters of the Nundial stream. The middle one, about 4½ miles from Mantyconda, is a large and deep pool of water that, with a little trouble, might be made a good station for one or two elephants, which might be most effectively used in dragging the large timber up to the western edge of the mountains. It is this difficulty of dragging their timber out, that causes the wood-cutters to divide the large trees into such small pieces.

Early in the evening, our guide brought us to the garden of Mantyconda, and there, to all intents and purposes, washed his hands of us. He said he could guide us no further; and from this point, in his eyes, the roads went into the forest and came back again: but we were determined to get at the flowing waters of Brumeshwar, whether there were a road or not, so took him with us.

Mantyconda to Brumeshwar and Yellagode.

After a few trials along other paths (when it was amusing to see the mixed look of doubt and resignation in Gurrupoo's face), we found a fine old road, along which one might drive for a mile or so, leading to the very place we wanted

to halt at. For this mile and more over the water-shed the path is very level; and then it descends slightly into a lower basin of forest, along which it runs, until the head of a pretty glen of almost tropical vegetation is reached, down one side of which the road goes by an old but well made and built ghaut.

This glen is certainly not of any great extent, being about a quarter of a mile long, but it is very deep and narrow, and densely grown with dark-green foliaged trees, among which are very large bamboos and fine sago-palms, presenting a vegetation quite as tropical as what I have seen myself in the south of Ceylon, and which Mr. Thomas likens to that of the western coast of India. Unfortunately, it was getting too late in the evening, to explore the bottom so as to ascertain the amount of water. As it was, we just got to our camping ground by night-fall.

At the bottom of the ghaut the road appeared to be trending too much from the desired direction (it probably runs down into the eastern part of the Brumeshwar valley), so we turned off to the north by a side path. This became very indefinite, but still went in the right direction, leading us into a widish and nearly hill-locked valley of even wilder-looking forest than we had hitherto seen. The path took us past great clumps of bamboos which appeared to extend generally over this little basin; in fact, it is more a bamboo valley than otherwise, though, scattered through it, are large Goomer-teaks and many stumps of teak trees 8 or 9 feet in circumference. The wood-men do not appear to have meddled much with this little valley for some time. The path is evidently very little used; and it appears to be the only one leading over a low saddle into a very dry and open bit of the Brumeshwar valley, where there is an old camping ground, not far from the head-waters of the Brumeshwar stream, or

the stream valley which I had reached 10 days previously from Yellagode.

Our people had got gloomy (Gurrupoo particularly so) in the bamboo valley, on seeing me follow a path so indistinct, while the evening was gathering fast, and they looked still more gloomy, when I led them over the low ridge into the baren open; but the sight of the flowing water soon restored them all. The Chensulah was delighted with the valley—he said there was no other place like it on the mountains for water and trees, and was apparently thankful for the additional bit of road information he had got from me.

Another good stream from the north-west joins the one I had previously seen, and the two flow away in a broad belt of jungle as the feeder of the Nemilly Goondum water-fall.

Next morning, we worked up the stream by the path to Yellagode, and so to the crest of the mountains overlooking that village. From this point, 2,700 feet above [illegible] at least, we reached the watering-place at the [illegible] in an hour, rested there for breakfast, and when [illegible] heat of the day was passed rode into Yellagode [illegible] hours and a half.

I have been thus particular in describing the route from Mantyconda to Yellagode, because the villagers [illegible] there is no path. I think, also, that the route from Yellagode to Mantyconda is much pleasanter than that from [illegible] the same place. There is an old bungalow at Yellagode, and it is a large village, whence supplies and coolies may be got. In a night one could drive from Kurnool to Yellagode and next morning, by 8 or 9 o clock, be up on the mountains. Yellagode is also very well situated between the two taluqs of Nundial and Nundycotkoor for a good Jummabundy station; and it would be a very good depôt for timber. A short path might easily be made direct from the

crest of the Brumeshwar basin to Mantyconda; and this would just be along the line of country best suited as a situation for bungalows. Water might also possibly be found by sinking wells on this line. Captain Beddome rightly says, I think, in his report on these mountains: "that they are in no way adapted for the cultivation of Coffee, Tea, or Chinchona;" but it would be an interesting experiment to try the last in a garden on some of the ground between Brumeshwar and Mantyconda, and what a great thing it would be for Kurnool, if potatoes could be grown at Mantyconda, a feat in gardening which seems not impossible.

Irla Conda.

There was still one more excursion to be made before the conclusion of our hill-trip; and this was to look at part of the range to the north, on the right bank of the Kistnah, which had occasionally seemed to me to be rather elevated. This is the plateau range of hills marked on the map with "Irla Conda" station as the highest point.

Our camp was moved north from Yellagode to Atmacoor, about eight miles; and thence, having collected coolies and guides, we started nearly direct for Irla Conda. It turned out that this plateau of hills is much lower than any we had been on yet; Irla Conda itself being hardly 2,000 feet above the sea. That part of the hills south of the trigonometrical station is very well represented on the map, being a peculiarly flat plateau; but, the country between the Irla Conda stream and the Kistnah is much broken up into smaller valleys and hills.

We camped for the night in the narrow valley south of Irla Conda, near a stream of good running water; I think the best water we had tasted on the Nullamullays. It rises near the top of the ravine, issuing from the outcrop of almost horizontal beds of quartzite, which make up the

plateau. There is not much forest to speak of over the Irla Conda group of hills.

Next day, we got down into the bed of the Kistnah, about east-north-east of the peak, intending to work up the river to Veerabudr Droog: a journey which we managed to do in two days' hard walking, as no horse could be ridden over such rocky ground. The area on the left or north bank of the Kistnah, marked in the map as "Impenetrable tract, unsurveyed," does not answer exactly to this description. It is not at all impenetrable, being much like the rest of the Nullamullays, with thinner jungle; but it would be a difficult country to get at for surveying, and in which to procure supplies, hence, perhaps, the reason for its having been left unsurveyed. There is also, however, the other story; that, by some remarkable coincidence, the field books of the surveyors were lost.

The Kistnah.

The Kistnah, about here, does not flow in a narrow gorge, as is often supposed, but merely in a deep and wide mountain valley; and there is, as a consequence, no cliff scenery of any note. At the time of our visit, the water was probably near its lowest; but, when the freshes are down, it must be from 30 to 40 feet higher, as is clearly shown by the water-mark along the banks. Then, indeed, the river must be a grand sight, with its swollen and turbid waters sweeping quietly along; for the surface would be then far above its rocky bed, while its width must be great at some points.

There cannot, at such a time, be a very swift current—or the water must be very heavily loaded—for the deposits of rich silt all along the steepest banks are frequent and extensive. At flood time also, the great mass of water must form quite a wall or barrier, against which the side streams, as they come down from the hills, are backed into quiet water in

which thick deltas of sand have been formed, with their steep shore-edges just in a line with the edge of the flooded river.

As it was, we saw the true channel of the Kistnah throughout this part of its course which, except for a rapid here and there, is often cut, like a canal, in the nearly horizontally-bedded quartzite rocks. In one case, we walked along a reach of smooth water for nearly six miles, as it flowed in a vertical-sided channel. The other reaches were also tolerably long; and at no points were the rapids of much length.

The rock-exposures in this river bed are wonderful. Looking at the way the beds lie; at say 5° east-south-east, we must have walked, on one occasion, over the successive edges of at least 2,800 feet of quartzite beds, all fairly exposed. One might almost reckon the height of some of the hills to the north at sight, as the outcrop of beds from the river is seen contouring along the valleys and up the slopes to near the crests of these hills. And nearly all these miles of rock-surface are polished and varnished, as it were with a coating of black-lead; the combined action of the river and atmosphere having formed on the surface of the usually white and buffish-colored rock a deposit of peroxide of iron. The smoothing and polishing are easily accounted for, but it is extraordinary what little effect this long-continued wear-and-tear has had in rubbing down the edges of the outcropping quartzite beds. These have almost lost their ordinary sharpness of angle, it is true, but they are as square as on the day they became exposed.

Towards Veerabudr the river bed becomes a perfect museum of true geological effects: as they are seen in the way the rocks are lying, the form into which they have been worn down, their constitution, and the manner in

which they have been altered or metamorphosed. The first is exhibited splendidly in the low cliffy banks, where the beds are lying in horizontal steps, or in great curves which rise up from under the hill sides. Denudation is seen, not only in the effects of the old action of the present river, but in more ancient stream-beds, now filled up by a conglomerate of the coarsest and most varied constitution, which has since been itself again scoured out for the channels existing at the present day. This conglomeratic sandstone has been metamorphosed into a beautiful quartzite and jaspideous rock of most opposite colors, owing to the number and variety of its constituent pebbles and shingle; rendering the now polished bed of the river a splendid natural mosaic, or a rougher concrete, of a general red color, marbled with pinks, greens, greys, and browns, quite astonishing to behold. Further up the river, nearer the Droog, there are other varieties of rocks rising up from underneath the quartzites already walked over, such as sheets of igneous rock (trap) and volcanic ashes; which not only give interest to the geologist's study of this part of the Kistnah, but bring about some slight changes in the scenery and physical aspect of the country.

The hill country to the north of the Kistnah, for the length of river I traversed, appears to be but thinly covered with jungle, except in the ravines. Further investigation will tell us more of the country to the eastward of this; but, from all I can learn, the Mantyconda forest basin is, so far, the richest area on the mountains. Next to this, the broad valleys of the Nundial and the old Roodrar tank streams are fine dry forest lands; nor should I forget the valley on the western side of the Nundy Cunnama (the trunk road across the mountains), which is connected by its forests with the two valleys just mentioned.

Here we finished our rapid run over the Nullamullays,

leaving, unfortunately, much country that is still to be explored, especially the region to the north of Cummum and along both banks of the Kistnah to the eastward of Irla Conda. I do not expect that there will be any higher regions found than those already noted, or even better tracts of jungle; but it is reported that there are many interesting ruins and some fine scenery; and the Natural History, Botany and Geology of this part of the country seem to promise every reward to the searcher. The mere navigation of the mountain valley of the Kistnah from end to end (a feat, I believe, yet unaccomplished), apart from the novelty and peril of the journey, would be of interest, as one of the Irrigation Company's former Engineers has thrown some doubt on the accuracy of the course of the river, as laid down in the Atlas Sheet.

NOTE.—I have throughout this paper generally used the Telugu names of trees. Captain Beddome has in his Report given a list of all the trees known on the Nullamullays, from which I take the liberty of extracting the scientific terms for a few noted by me.

Billoo.	Satin wood (Chloroxylon Swietenia).
Chiriman.	Conocarpus Latifolius.
Goomer-teak.	Gmelina Arborea.
Jitigi.	Rosewood (Dalbergia latifolia.)
Nullamudday.	Terminalia Tomentosa.
Tunki.	Ebony.
Yippa.	Hardwickia Binata.
Yerramudday.	Terminalia Arjuna.

A Report by J. E. Mayer, Esq., Deputy Inspector General of Hospitals, on the quality of the water supplied from the so-called Seven Wells, the real number of which is ten, for the use of the Troops at Fort St. George.

The general characters of these waters are that all of them contain animal and vegetable organisations, and that the amount of these organic matters varies from 3·90 grains to 7·85 grains in the gallon, *i. e.*, that the smallest amount found at present doubles that which the Authorities at Home consider passable.

No attempts have in these examinations been made to ascertain the respective amounts of animal and vegetable matter (both being included under the head of organic matters), nor, on reflection, will this appear necessary, as the total amounts found are so much above that which is henceforth to be permitted in water that may be pronounced fit for internal use. Had the total amounts found been smaller and nearer the prescribed limit, the question of respective amounts would then have assumed a practical bearing and have become one of importance: but we are of opinion that it can be scarcely so regarded in waters which all of them contain organic matters so much in excess of the recognised limit; and for that reason alone must in their present state be regarded as unfit for internal use.

On the total amounts of impurities in these waters, a few words will suffice, as the Reports shew that they vary from 23·10 to 70·10 grains in the gallon, and that these impurities contain, besides the organic matters, chlorides and sulphates in various quantities. The quality of sulphates in each water has not been determined, the qualitative

examination, taken in conjunction with the absolute determination of solids; and then of organic and inorganic matters; with the determination of the amount of chlorides volumetrically, being for all practical purposes, we believe, sufficient. Had there been any reasonable doubt as to the character of these waters, then, undoubtedly, the absolute determination of the sulphates would have been not only desirable but necessary. It is well known that sulphates and chlorides, together present in quantity in any water, act injuriously both on men and cattle; and, further, that many sulphates in the presence of organic matters, especially in tropical temperatures, are subject to a process of reduction, and are thereby converted into sulphurets, which last, by the simultaneous oxidation of the carbon of the organic matters, and by continuance of the other processes, are converted into oxides, while sulphuretted hydrogen is given off—a gas that is notoriously hostile and deadly to all animals endowed with the higher forms of organisation. For these reasons, all waters in which sulphates and organic matters are present, especially in tropical countries, are unfitted for internal use. It will, then, be only necessary, in order to form an accurate estimate of the qualities of these waters, to bear in mind; 1st, that they contain large quantities of animal and vegetable matters; 2nd, that chlorides and sulphates are present in various quantities; and finally, that, independent of the deleterious combined action of chlorides and sulphates on the human body, organic matters with sulphates are present.

It does not appear, after the general considerations now submitted, that there is any necessity for dilating on the individual characters of the waters of any one of the wells which have been examined. Well, No. V. is the least objectionable, but even this water, independent of other impurities, contains double the amount of organic matter that is regarded as passable. It only remains to offer a few remarks

on the question of filtration. The received opinion has been that all impurities which are soluble cannot thus be separated; and this is undoubtedly true so far as relates to the mechanical effects obtained by the use of paper, cloths, sieves, sand, &c., all of which have no chemical or special action on the fluid passed through their interstices; but if the filter be made to consist partly of a porous substance such as sand, and partly of another capable of exercising a chemical or special action, such as powdered charcoal or magnetic* oxide of iron,—then the case is altered, and the degree of purification to be obtained by these means remains to be determined by repeated experiments on a large scale. It may be said that the numerous experiments of Doctor * * * and others for the various Water Companies at Home have already determined this point. It appears to us, notwithstanding, that this point has not been so satisfactorily or clearly settled as could be wished; inasmuch as the results obtained immediately after new filter beds have been set up, and those obtained some time afterwards, have been greatly at variance, and further, that the results obtained by different experimenters have not always coincided. It is evidently nothing beyond the truth for Mr. A. or Dr. B. to give a certificate to the effect that a certain apparatus will cause the most striking and wonderful improvement in bad and foul water, &c. &c.; but in practice and on a large scale, it is not possible to renew the sand and charcoal every few hours, and to have sets of sponge constantly undergoing a process of purification, so as to be ready for constant change. Thus it happens that what can be obtained by careful operative Chemists in the Laboratory far exceeds that which the practical Engineer can obtain on the large scale outside, where the constant care, watching, and change resorted to in the Laboratory (the re-setting up of the apparatus as it were), is impossible.

*Vide Note appended.

Professor Parks, in his late work, published for the benefit of the Medical Officers at Netly, gives the statement shewn in the margin: it remains to be seen how far further experiment will confirm these statements, and whether by percolation through large beds of sand and charcoal such impure waters as those now reported on can, even at first, be deprived of 88 per cent. of organic matter and 10 per cent. of inorganic.

[e] Of all these substances, charcoal is the best; it can remove 88 per cent. of organic matter, and 28 per cent. of mineral matters. It has removed 7·48 per cent. of chloride of sodium, 8·5 per cent. of lime salts and 2·8 per cent. of sulphuric acid (Witt).

There is one fact bearing on this point which we think it our duty to bring prominently before the Committee, and through them before Government. Repeated borings (not less than 150) in every part of the thickly inhabited localities of Madras, with the examination of the soil thus turned up, have proved that, however pure the water at certain depths might originally be, it could not long remain so, as the superincumbent and surrounding soil is saturated with filthy decomposing organic matters of every kind, and it is scarcely necessary to observe that water, by percolating through such soil, will, of necessity, become loaded with organic impurities, and thus rendered unfit for internal use. The evidence on these points is so conclusive and so easily obtainable, that it does not seem needful to insist on them further. A little consideration will show that if these statements are really true of Madras, they will obtain in a more or less marked degree, wherever there is a dense population with habits and customs such as those of the Madras people; and that the soil will be soddened and fouled with organic decomposing matters in like manner: the facts, therefore, admit of generalisation, and it may be received as a law, that, wherever there is a dense Native population, there the soil will become foul; and that it is from this cause impossible to obtain, for any length of time, good water from the wells sunk within the polluted area, however good the water may be when first drawn. From this the natural and only sound inference to be deduced seems to us to be, that it will be necessary for Government to look for water beyond this polluted area: and if the supply be required only for the Fort, probably the simple apparatus now in use at the so-called 'Seven Wells' would be sufficient, supposing that the wells be sunk a mile or thereabouts beyond the limit of dense population.

Note on the Magnetic Oxide of Iron.

As this substance has lately been brought prominently before the public, and has been much lauded on account of its special action in purifying waters; and as, moreover, a Committee of the National Exhibition have lent the sanction of their names to it, as a voucher for the above mentioned special quality, it appears almost necessary in a paper of this kind to offer a few words respecting it, particularly in reference to the two questions of Natural and Artificial supply.

Magnetic Oxide of Iron, it is well known, is a natural product found largely in certain localities; but it is very questionable whether it can every where be so readily obtained, and in such quantity, as to make its use practicable on a large scale. All the reliable information on this head, that has been procurable, will be given at the end of this note; and if it should turn out that this product can only be had here and there, and in places at considerable distances from those situations, whereat filter beds are to be made:—then, the only resource will be the artificial product—and in order to afford a clear view of the practicability of resorting to it, the shortest way will be to

give the mode of preparation. This is as follows: and the description of the process, with the information in the note* given below, will enable any one to manufacture the compounds under consideration.

Process.

To obtain artificially Magnetic Oxide of Iron, having the Formulæ $\overset{Fe.\ O.}{3\ 4}$, such quantity of the green Proto Sulphate of Iron as will afford the required quantity of Oxide being taken, the crystals are to be dissolved in pure water; two-thirds of the solution thus formed is to be poured into a second vessel, and to this portion, which is to be boiled, Nitric acid is to be added till brown vapours are no longer given off. The Iron contained in this portion will now be in the form of Sesqui Oxide, while in the one-third, which has not been boiled, the Iron remains in the form of Protoxide. The two solutions are to be mixed together; the mixed solutions are then precipitated by the Volatile

* Every equivalent, or 139 grs., of the crystalised green Sulphate of Iron contains 36 grs. of the Protoxide of Iron; therefore 1 lb. Avoidupois, or 7,000 grs. will contain $x = 1813$ grs. or 4 oz. 65 grs. of the Protoxide, and any other quantity in proportion; but it is not the Protoxide of Iron that is wanted; it is the magnetic oxides, of which there are two.—Now, to understand how these oxides are formed, as well as the reasons for the process here given, it will be advantageous to set down in order the various oxides of Iron with their appellations and Formulæ, it being premised that Fe stands for Ferrum, Iron, and O for Oxygen.

Protoxide Fe. O.: Sesqui Oxide $\overset{Fe.\ O.}{2\ 3}$.

These Formulæ convey, in short, the important information that the

1 Fe. O. Protoxide of Iron is composed of one combining quantity of Iron,

Fe. O.
2 3 and one combining quantity of Oxygen; and that the Sesqui Oxide is composed of two combining quantities of Iron, and three combining quantities of Oxygen. This being understood, the composition of the magnetic Oxides will be at once evident, their respective

Fe. O.
3 4

2 (Fe. O.) Formulæ being $\overset{Fe.\ O.}{3\ 4}$ and $\overset{Fe.\ O.}{4\ 5}$ since it is patent to every one

Fe. O.
2 3 that one atom of the Protoxide and one of Sesqui Oxide, when united, equal the first magnetic Oxide, and in like manner it is

Fe. O.
4 5 plain that two atoms of Protoxide, and one atom of Sesqui Oxide, when united, equal the second magnetic Oxide.

The above composition having been clearly demonstrated by repeated and careful analysis, they suggested the artificial process, of which the dominant conditions are, that the protoxide and peroxide should be brought together in the particular proportions shewn, and in a recent state. How this is effected will be seen in the text of this paper.

Alkali or Carbonate of Soda, and are boiled: during the boiling the mixed Oxides unite and form the black Magnetic Oxide. $\overset{Fe.\ O.}{3\ 4}$. To form the Magnetic Oxide $\overset{Fe.\ O.}{4\ 5}$ the processes are precisely similar, in all details, except that only *half* the quantity, instead of *two-thirds* (as in the first case), is peroxidised by boiling with Nitric acid.

After the details above given, it does not seem necessary to enter further into the question of whether the artificial Magnetic Oxides can be obtained so readily and economically as to render their use practicable on the large scale, as any process involving accurate weighing, solution, accurate division by graduated measures, boiling and precipitation, besides some expenditure for re-agents, would be inapplicable.

The process has, however, been made available for the manufacture of a sufficient portion of artificial magnetic oxide, to test its efficacy as a filtering and purifying agent.

The same water in the same quantity was used in each of the experiments recorded in the Table of Results marked Y.

TABLE Y.

The water selected for the following trials was notoriously bad. It was taken from a Well in the compound of the Madras Medical College. The quantity experimented on was the 16th of an Imperial Gallon.

Previous to any filtrations, one-sixteenth of a gallon was evaporated to dryness, first on a porcelain dish and finally in a Platinum capsule of known weight. It left a total amount of residue=grains 15·08, and after ignition (with the usual precautions) grains 12·52, which was taken as the inorganic impurity present, and the loss, grains 2·56, as the organic. Nine separate sixteenths of a gallon of the same water, were then carefully filtered through the materials

noted below. The filtrates were then separately evaporated, and the residues left weighed and set down opposite the filtering material used. These various residues were then ignited, and the respective residues again weighed are set down in order—the loss in each case being the organic matter. The figures thus obtained by being respectively deducted from the amounts originally present, shewed by the difference how much had been separated by each filter material.

Total impurity present previous to filtration 15·08 grains, *i. e.*, in the gallon 241·28 grains. This total represent organic and inorganic impurity.

Residue left after ignition found equal to 12·52 grains, *i. e.*, in the gallon 200·32 grains.

Difference, *i. e.*, organic matters burnt off, equal 2·56 grains, or, calculated on the gallon, equal 40·46 grains (☞ *Vide note.*)

A	B	C	D	E	F	G
Material Used for Filtration.	Total left after evaporating filtrate.	Residue left after ignition of B.	Difference B and C.	Organic matter separated by each agent, *i. e.*, difference between D and original amount present.	Percentage amount separated	Amount separated by each filter calculated on the Imperial Gallon.
	Grains.	Grains.				
1. Ordinary filter paper... ...	14·69	12·36	2·33	·23	8·98	3·68
2. Swedish filter paper	13·87	12·24	1·63	·93	36·36	14·88
3. Clean white sand	15·14	13·09	2·05	·51	19·19	8·16
4. Sand and Charcoal	14·93	12·94	1·99	·57	22·35	9·12
5. Natural Magnetic Oxide of Iron...	14·18	12·49	1·69	·87	34·00	13·92
6. Artificial Magnetic Oxide of Iron...	14·14	12·50	1·64	·92	36·00	14·72
7. Finely divided mica or tale...	14·22	12·39	1·83	·73	28·51	11·68
8. Swedish paper and Magnetic Oxide of Iron	13·99	12·37	1·62	·94	37· nearly.	15·04
9. Swedish paper, Maguetic Oxide of Iron	13·94	12·33	1·61	·95	37·10	15·20

Column F has been inserted for the sake of the comparison which can thus be made between the results here set down and those obtained by other experimenters, who have

recorded their results in this way,—"inter alios," Doctor Parkes,

Column G. has been inserted, 1st, because many experimenters have chosen this mode of expression, and secondly, because the results thus shown will probably be more readily appreciated by those who are not professed Chemists.

☞ *It being remembered that, in the 16th of a Gallon, 2·56 grains of organic matters are present, therefore 40·96 grains will be present in one Imperial Gallon.*

A few remarks on the Table just given seem to be called for, in order to point attention, in the first instance, to the differences in the materials employed. Nos. 1, 2, 3 and 7 are materials to which no other than mechanical action has ever been attributed. By this agency, they separated from one-sixteenth of a gallon of the same water respectively,—

	Grains.
1 Ordinary paper	·23
3 Clean white sand, ...	·51
7 Finely divided mica ...	·73
2 Swedish filter paper ...	·93

These figures, if the original amount of organic matter present in one-sixteenth of a gallon be taken as 100, give the per centage proportions shown in Column F. Thus it appears that of these four mechanical agencies, No. 2 is by far the best; No. 7 the next best, and so on; and that out of 100 parts, the best mechanical means tried was only able to separate 36·36 parts. Nos. 5 and 6 are materials to which special purifying powers have been attributed. The percentage quantities separable by their means are shewn in the same column of the Table to be 34·00 nearly, and 36·00 nearly; *i. e.*, these special agencies are neither of them quite so powerful as the best mechanical means. Finally, the

results of filtration by mixed agency, as shewn by Nos. 4, 8 & 9, shew not only great diversity of results, but that those obtained by means of sand and charcoal, (No. 4) require, in order to make such materials effective, certain other precautions which could not be adopted in this or that case, without vitiating the first principal of comparative investigation,—that, *viz.*, of placing all the substances experimented on under "precisely similar conditions,"—and it will be observed that in none of these experiments has this canon been departed from. The simplest means, the same sized funnels and the like quantities of materials were in each instance employed. In no instance have special arrangements, packing, or adjusted pressure been resorted to; but without these means, the filtration by double agencies, as shewn by Nos. 8 and 9, appears to exceed in a slight degree the purification that is obtainable by single mechanical agencies. Whether the magnetic oxide of iron acts by its insolubility and specific gravity in such a manner as to form very minute pores through its mass,—or by any special mode of action, has not been investigated by us. The artificial product is a finer powder than the natural magnetic oxide, and it acts both singly and in conjunction with Swedish filter paper better than the natural product, which considerations tend to impart the idea that, after all, it acts mechanically, and not from its possessing any peculiar purifying power. From a partial examination of Spencer's Filtering Apparatus, it was evident, 1st, that a sponge under a graduated pressure was employed as a preliminary mechanical means of intercepting impurity, 2ndly, that pieces of sponge cut very small, were interspersed through the material in the body of the filter. What further special arrangements may have been employed we are unable to say,—as it was not thought worth while to destroy the Apparatus for the sake of such information. It was sufficiently evident that all the precautions, before adverted to, and generally deemed necessary in the manufacture of Filters, had been carefully attended to. With all these advantages, however, the results obtained by its use, were above those obtained by the use of Swedish filter paper alone, only in the proportions shewn by the figures below:—

Swedish filter paper, 1·63.

Spencer's filter, 1·60.

A further experiment was made to ascertain if double filtration through Spencer's Filter and Swedish Filter paper would make any difference in the results. It was found to do so, reducing the quantity of organic matter left present in the filtrate to 1·57, and the amount separated would thus equal ·99, which, represented as a percentage, = 39·00, nearly. From this experiment viewed in connection with what has been previously advanced, we are strongly inclined to look upon filtration generally, excepting that through various kinds of charcoal,* as essentially a mechanical act, and we believe that, the finer the pores of the filter, the more insoluble the filtering materials, the greater its specific gravity, and the less, its liability to be disturbed,—the more perfect will be its action. We doubt the utility of any material like sponge, either on the small or on the large scale, as, however perfect it may render an Apparatus for a while, it is well known that very frequent renewal and careful washing, as well as exposure to the air (ozonisation) to get rid of fœtid odours, is necessary to keep these machines in good order; but, notwithstanding all the objections that

* Even with reference to charcoal, and its well known power of condensing gases in its pores, it is scarcely necessary to observe that its series of special actions (which generally commence with the condensation of the atmospheric air) are only to be kept up by a renewal of the primary conditions, and that if these be not renewed, its special actions merge into those of a mechanical agent.

we have here urged to particular views relative to modes of action, or to forms of Apparatus, we think, with reference to the manufacture of filter beds for Towns, &c., that Table Y. shews undeniably that the natural magnetic oxide of iron holds a high place as a filtering agent. By its means nearly 34 per cent of organic matter were separated: it is superior to finely divided mica, and inferior only to the artificial magnetic oxide, and to Swedish filter paper; both which are inapplicable for all but Table or Laboratory experiments.

If the statements made at page 110 by Dr. Parkes (noted by us in a former part of this paper) have been held in mind, it will be observed that we have not been able to confirm them. The utmost amount of organic matter that we have been able to separate by filtration is less than 40 per cent, and differs widely from 88 per cent, as stated in the work above mentioned.

With reference to the ready procurability of the natural magnetic oxide in various parts of India, we beg to submit such information as we have been able to obtain.

Inquiries at the Government Central Museum have shewn that magnetic iron ore is to be found at many places in the Vellore Taluq, &c.—*Vide* page 25 of the Catalogue of Articles contributed by Madras to the International Exhibition of Works of Industry and Art, held in London, 1862.

By reference to the Catalogue of the iron ores of Southern India, it will be found that the following are named as localities from which iron ores can be obtained, viz., in numerous villages in the Northern Division of Arcot; in some places in the Bellary District; in many places in the Canara District; in several localities in the Chingleput District; in several places in the Cuddapah District; in some places in Guntoor and Kurnool; from one place in Madura; from twelve different

places in Malabar; from some places in Masulipatam; from many places in Mysore, Nagpore, the Neilgherries, Rajahmundry, Salem, Tinnevelly; but whether it can be had in quantity in all these places is not stated.

In reply to some inquiries casually put to him, Dr. Aitken states that he has seen immense quantities of magnetic oxide at Coimbatore.

In the Memoirs of the Geological Survey of India, Volume IV. Part 2, valuable information is to be found in reference to the localities in which magnetic oxide of iron is to be met with, and in the Appendix to this Volume, the magnetic iron beds of Kunjamully near Salem, are admirably described. They are said to be very extensive and the supply of ore inexhaustible.

Unfortunately for the purpose considered by the authors of the work quoted, *i. e.*, the manufacture of iron, the absence of appropriate fuel in quantity interferes so greatly as almost to interdict it, or, if not, to reduce any profit obtainable thereby to a minimum. In like manner the cost of transport from one place to another will, it is apprehended, interdict the use of the magnetic oxide as material for filter beds, except in such places as those in which the oxide in question is found. Three and half Rupees per ton is the price paid by our Porto Novo Company for the carriage of the ore a distance of 20 or 25 miles.

NOTE.—As Doctor Wyndowe was not present when this paper was drawn up, it is necessary to state in explanation of the word "we" (which appears throughout the paper) that I felt myself fully justified in using it, from the knowledge that our convictions as to the mode of investigating the questions naturally arising out of the analytical results obtained, were identical, and I am gratified in being able to add that, after having carefully gone through them with Doctor Wyndowe, I found that he concurs fully in all that I have said, and that, accordingly, in using the plural expression, I did in fact but anticipate that complete agreement between us which is now ascertained.

J. MAYER.

Result of Analysis of Water by Dr. Mayer and Dr. Wyndowe.

Well No. I.

Sensible properties.	*By Dr. Mayer and Dr. Wyndowe.*
Appearances	To the unassisted sight, clear transparent.
Microscopical appearances, obtained from deposit after standing (with proper precautions.)	Gave clear evidence of the presence of animal life as well as vegetable growth.
Odour	Distinct, reminding one of water taken from a ship's tank, or water which has stood some days in a goglet.
Taste	There is an absence of that grateful and pleasent briskness that good water should impart to taste.
Chemical properties.	
Reaction to test paper	Perfectly neutral.

	Dr. Mayer.	*Dr. Wyndowe.*	*Mean.*
Solid ingredients in one Imperial gallon obtained by calculating from residue of evaporation of 2/10th gallon by Dr. Mayer, and of 1/10th by Dr. Wyndowe. *	grs. 36·15	grs. 33·7	grs. 34·925
Amount of organic matters present obtained by ignition of above residue re-carbonating and calculating from loss, on one Imperial gallon.	grs. 7·25	grs. 6·2	grs. 6·725
Difference between these two determinations being Salts, &c.	grs. 28·90	grs. 27·5	grs. 28·200
Hardness to soap test, having reference to standard water containing 16 grains carbonate of lime to the gallon, with which 22° of the graduated burette forms a permanent lather, and each degree may be assumed equivalent to 0·727 grs. of carbonate of lime, or 0·989 grs. of sulphate of lime.	14°	14°	14°
Of the above hardness, temporary, that is, removable by boiling, &c.	3°	3°	3°
Permanent	11°	11°	11°
Chlorides determined by the volumetrical method, and calculated as chloride of sodium in one gallon.	grs. 12·86	grs. 12·86	grs. 12·86

Bases in solutions by carbonic acid.

Iron	Traces.
Lime	Average quantity.
Magnesia	In quantity rather more than the average of waters.

* Note.—In all the other Analysis 2/10th gallons were taken for this determination.

In solution after boiling

Lime...	In rather large quantity.
Magnesia	Do. do.
Chlorides	Shewn above quantitatively.
Sulphates	Not in large quantity.
Nitrates	None detected.

These last results being qualitative merely, the remarks are as agreed between ourselves; the opinions expressed are formed upon the result of the application of known tests upon equal quantities of water, *viz.*, 1/10th gallon —each of us making a separate experiment.

Well No. II.

Sensible properties.	
Appearance	Clear transparent.
Microscopical appearance as in No. 1.	Gave evidence of the presence of animal life as well as vegetable growth.
Odour	None.
Taste	Not so fresh as good pure water should be; but in this respect it is better than No. 1.
Chemical properties.	
Reaction to test paper.	Decidedly acid, becoming alkaline after boiling some time.

	Dr. Mayer.	*Dr. Wyndowe.*	*Mean.*
Solid ingredients in one gallon Imperial determined as in No. 1.	grs. 31·60	grs. 31·9	grs. 31·75
Amount of organic impurity.. ...	grs. 6·90	grs. 7·4	grs. 7·15
Salts, &c.	grs. 24·70	grs. 24·5	grs. 24·6
Hardness to soap test, *vide* No. I. ...	13°	13°	13°
Of which temporary hardness ...	3·5°	3·5°	3·5°
Permanent do. ...	9·5°	9·5°	9·5°
Chlorides determined volumetrically as chloride of sodium in one gallon.	grs. 11·1	grs. 10·5	grs. 10·8

Bases in solution by carbonic acid.

Iron.	Traces.
Lime	Average quantity.
Magnesia	Rather above the average quantity.
In solution after boiling.	
Lime	Rather large amount.
Magnesia	Do.
Chlorides	Already determined quantitatively.
Sulphates	Present, but not in excess.
Nitrates	None.

Well No. III.

Sensible properties.	
Appearance	Perfectly clear and transparent.
Microscopical appearances... ...	Individual forms of animal organic life, besides the other appearances as described in Nos. I and II.
Odour	Free from odour.
Taste	Has a taste slightly saline.
Chemical properties.	
Reaction to test paper	Decidedly acid in the cold.

	Ly.	*Mayer.*	*Dr.*	*Wyndowe.*	*Mean.*
Solid ingredients in one gallon Imperial.	grs.	38·65	grs.	36·60	grs. 37·62
Amount of organic impurity ...	grs.	5·0	grs.	6·1	grs. 5·55
Salts	grs.	33·65	grs.	30·5	grs. 32·07
Hardness to soap test ...		13°		14·°	13·°5
Of which temporary hardness ...		3°		2·°5	2·°75
Do. permanent		10°		11·°5	10·°75
Chlorides determined volumetrically as chloride of sodium in one gallon.	25°=14·615 grs. *Mean* 25°=14·615 grs.			25°=14615 grs.	

Bases in solution by carbonic acid.

Iron	Traces.	Do.
Lime	Average.	Do.
Magnesia	Average.	Do.
In solution after boiling.		
Lime	Average.	Do.
Magnesia	Large.	Do.
Chlorides	Not determined here.	Not determined here.
Sulphates	Large.	Do.
Nitrates	Nil.	Nil.

Well No. IV.

		Dr. Mayer.	*Dr.*	*Wyndowe.*	*Mean.*
Sensible properties.					
Appearance	Clear and transparent.				
Microscopical appearances... ...	As described in Nos. I. and II.				
Odour	Free from odour.				
Taste	Slightly unpleasant.				
Chemical properties.					
Reaction to test paper.	Neutral.				
Solid ingredients in one gallon Imperial...	grs.	50·95	grs.	50·1	grs. 50·525
Amount of organic impurity ...	grs.	5·90	grs.	5·65	grs. 5·775
Salts	grs.	45·05	grs.	44·45	grs. 44·75
Hardness to soap test		18°		19°	18·50
Of which temporary hardness ...		7°		7°	7·00
Do. permanent		11°		12°	11·50
Chlorides determined volumetrically as chloride of sodium in one gallon	35°=19·461 grs. 35°=19·461 grs.			35°=19·461	grs.
Bases in solution by carbonic acid.					
Iron	More than a trace.			Traces.	
Lime	Large.			Large.	
Magnesia	Average.			Fair.	
In solution after boiling.					
Lime	Average.			Average.	
Magnesia	Very large.			Very large.	
Chlorides	Not determined.			Not determined.	
Sulphates	Very large.			Very large.	
Nitrates	Nil.			Nil.	

Result of Analysis of Water from Wells Nos. V & VI.

	No. V.	No. VI.
Sensible properties.		
Appearance	Clear	Clear.
Microscopical appearance ...	Much vegetable and a few animal organisms	Rotatoria plentiful, animal and vegetable life abundant.
Odour...	No difference in these respects from the other Wells.	
Taste...		
Chemical properties.		
Reaction to test paper ...	Slightly acid.	Do.
Solid ingredients in one gallon Imperial. ..	grs. 22·40 ...	grs. 33·15
Amount of organic impurity	grs. 3·55 ...	grs. 6·65
Salts	grs. 18·85 ...	grs. 26·50
Hardness to soap test. ...	8° ...	13°
Of which temporary hardness...	1°5 ...	2°
Do. permanent ...	6°5 ..	11°
Chlorides determined volumetrically as chloride of sodium in one gallon.	grs. 4·67 ...	grs. 9·35.
Bases in solution by carbonic acid		
Iron...	Traces	Traces.
Lime	In small quantity ...	In small quantity.
Magnesia	In very small do ...	In very small do.
In solution after boiling.		
Lime	Average quantity....	More than avera ge.
Magnesia	Small do. ...	Very small.
Chlorides	Determined ...	above.
Sulphates	In small quantity....	Average property.
Nitrates	None.	None.

No. V, though not good, better than other Wells analysed.
No. VI, decidedly bad.

Result of Analysis of Water from Well No. VII.

		Dr. Mayer.	*Dr. Wyndowe.*	*Mean.*
Sensible properties.				
Appearance	Perfectly clear.			
Microscopical appearances... ...	Animalculæ present, species not recognizable.			
Odour	Free from.			
Taste	Nothing perceptible.			
Chemical properties.				
Reaction to test paper	Faintly acid.			
Solid ingredients in one gallon Imperial.	grs.	29·5	grs. 30 85	grs. 30·11
Amount of organic impurity ...	grs.	7·85	grs. 7·65	grs. 7·75
Salt	grs.	21·65	grs. 23·20	grs. 22·42
Hardness to soap test ...		15°·5	18·°	
Of which temporary hardness ..		2°·5	3·°	27·6°
Do. permanent		13°	15·°	14°
Chlorides determined volumetrically as chloride of sodium in one gallon.	15·5 —9·0618 grs. 15·75°—6·270 grs.			16°—9·853 grs. chloride sodium.

Basis in solution by carbonic acid.		
Iron	Traces.	Traces.
Lime	Average.	Average.
Magnesia	Traces.	Traces.
In solution after boiling.		
Lime...	Average.	Average.
Magnesia.	Small.	Small.
Chlorides.	Not determined here.	Not determined here.
Sulphates	Large.	Large.
Nitrates.	None.	None.

Result of Analysis of Water from Well No. VIII.

Sensible properties.		
Appearance	Clear.	
Microscopical appearances... ...	Less amount of animal life present, but ascellatoriæ distinctly observed.	
Odour	None.	
Taste....	None.	
Chemical properties.		
Reaction to test paper	Neutral.	
	Dr. Mayer.	*Dr. Wyndowe. Mean.*
Solid ingredients in one gallon Imperial...	grs. 35·00	grs. 34·80 grs. 34·60
Amount of organic impurity ...	grs. 6·70	grs. 6·70 .....
Salts	grs. 28·30	grs. 28·10 grs. 28·20
Hardness to soap test	15°	17° 16°
Of which temporary hardness... ...	3°	3° 30°
Do. permanent	12°	14° 13°
Chlorides determined volumetrically as of chloride of sodium in one gallon.	15·5=9·0613grs.	16°=9·353grs. 15·75°=9·270 grs. of chloride of sodium.
Bases in solution by carbonic acid.		
Iron	Traces.	
Lime	Average.	
Magnesia	Small	
In solution after boiling.		
Lime...	Average.	
Magnesia	Small.	
Chlorides	Not determined here.	
Sulphates	Large.	
Nitrates...	None.	

Result of Analysis of Water from Wells No. IX & X.

		No. IX.	No. X.
Sensible properties.	Appearance ...	Not clear from numerous minute particles.	Clear, but impurity still present.
	Odour	Free from	Free from.
	Taste	Not remarkable ...	Brackish.

Microscopical Appearance.			
Chemical properties.			
Reaction to test paper.	Animal and vegetable, latter more.		Same as No. 9.
	Acid.		Acid.
Solids in 1 imperial gallon	grs. 28·20		grs. 70·10
Organic impurity ...	grs. 5·25		grs. 5·70
Inorganic do.... ...	grs. 22·95		grs. 64·40
Total hardness... ...	14·5°		26·5°
Temporary do	3°		9·5°
Permanent do			
Chlorides determined volumetrically in one gallon	11·5°		17·0°
Bases in solution by *carbonic acid.*	9·93820		26·9516°
Iron	Traces.		Traces.
Lime	Small (average)		Very large.
Magnesia... ...	About average.		Rather large.
Bases present after boiling.			
Lime	Small.		Not too large.
Magnesia	Small.		Little above average.
Chlorides	Determined above.		
Sulphates	Fair.		Much above average.
Nitrates	None.		None.

Captain Nelson's Report of the tracts of country on the Kistnah, marked "Unsurveyed and impenetrable" in the Great Trigonometrical Map, Sheet 76; with an Introduction by the Editor.

INTRODUCTION.

The following paper relates to a portion of the district of Kurnool which long remained unexplored by European travellers.

The writer, Captain Nelson, after 17 years hard service, was invalided in 1853 on account of an injury to the knee, and appointed to command the station of Ongole. His activity and energy found but little scope for development in this duty, and in 1854 he applied to Government for leave to explore "certain portions of country on the banks of the Kistnah river, marked on the Trigonometrical* map No. 76, as impenetrable." Leave was granted, Captain Nelson penetrated into this almost unknown land, and found that, though now barren and malarious, the country must once have been green with cultivation, and dotted with populous towns and villages. He was particularly struck with Peddacheroo and Siddapur, a tract of great natural beauty, where ruined forts and cities overlooked tanks of remarkable extent, which had once sufficed to supply thousands of acres with water, and thus aided in filling the exchequer of a powerful race of chieftains whose memory was still preserved by the neighbouring tribes.

On his return, Captain Nelson submitted the report to Government which is now published. He was then on the

NOTE.—It appears that this is a misnomer for the sheet No. 76, of the Indian Atlas, the details of which are not derived from Trigonometrical Surveys, although the Triangulation of Colonels Lambton and Earnest form its skeleton or framework.—ED.

point of retiring from the service and proceeding to England; but he found himself unwilling to quit India without making an effort to rescue the interesting country which he had explored from the desolation and pestilence which seemed to have claimed it for their own. He obtained permission to cultivate all lands which he could reclaim in Peddacheroo and Siddapur, rent-free, for 10 years, and with a grant of Rupees 3,000 from Government he addressed himself to his perilous task.

Half the little party who accompanied him from Nellore died of fever within twelve months, and the rest fled. Gradually, however, his kindliness and wisdom conciliated the Chenchuwars who wandered about the neighbourhood, and they began to give up their savage modes of life and aid him in his labours. Success was beginning to dawn upon his efforts, when, in 1859, he was obliged himself to succumb to the deadly climate. He was struck down by rheumatic fever; his lower limbs were paralyzed, and his shattered constitution compelled him to leave every thing and go to England in search of health.

His affairs did not prosper in his absence, and when he returned, married, in 1861, he found the sources of his income diminished, and labour harder to obtain than ever. In each successive year the feeble group that surrounded him was literally decimated by disease. No longer alone in the world, he had the interests of others to care for, and in March 1864 he found himself obliged to relinquish the great object of his life, and wrote as follows: "I have wasted 10 precious years and spent a great deal of money. I now have a family; and whatever quixotic notions I might once have entertained, I now confess to one sole motive, and this the acquisition of property for those I shall leave in the course of time; and as it is quite clear that neither honour nor

wealth is to be obtained here, I have applied to Government for permission to reside on the Neilgherries, to endeavour to retrieve my fortunes in planting Tea and Chinchona, which has been granted."

The story has a sad ending. Captain Nelson died within a few months after he had left Kurnool.

CAPTAIN NELSON'S REPORT.

I proceeded to the river Kistnah *via* Pothacamore Durshee, Chenaloor, and Vencatareddy Polliem, called Ragapolliem: carts would go no further; so packing my supplies on bullocks I proceeded by the Lumbadi track to Ragaman Pentah. It may here be stated that a Pentah is a cattle station.

Between Vencataraja Polliem and Ragaman Pentah you pass by a breach made by water through an artificial dam or bund of enormous strength, which must have been constructed to collect the great body of water which passes down the large Nullah that intersects the district. The bund, which is about 60 feet high and 80 paces in depth or width, stretches across the neck of a deep valley, the area of which is probably about 500 square acres.

The pent up water, as appears only natural to suppose on looking at the site, made a clean breach one day through the centre of the bund which crosses the Nullah, and the water resumed its course. What must have been the bed of this lake is now covered with jungle.

Unless the features of the country are much changed, it is impossible to understand why such a great work was ever attempted, as the country all around is rocky and hilly, and under no circumstances could produce crops.

If it were intended for the irrigation of the rich lands about Vencataraja Polliem, it seems singular that the site for a reservoir should have been chosen so far off as 5 miles,

when the same Nullah could have been dammed under far more favorable circumstances, though not capable of storing so large a supply of water, close to their doors.

About Ragaman Pentah the hills are high and precipitous, covered with long grass and dwarfish trees, intermixed with which are here and there found a good timber tree called Rupa, or Vaypa Maram.

This tree, which occurs more frequently in the north and west, as far as the Kistnah, is, I believe, well known in Madras. The Vaypa Maram at Madras, and to the southward, is the Margosa tree, called in Bengal the Neem. The bark is made into excellent rope by the Lumbadi people,--not so strong a rope as cotton, they tell me, but capable of wear and tear for a year. From the same fibre a good gunny is made. I have forwarded samples of both, with wood, leaves, and pods of the tree to the officer in charge of the Central Museum.

From Ragaman Pentah we proceeded to Nataca Pentah, about four hours journey: we had to ascend a high hill about a mile, or a mile and a half from Ragaman Pentah.

The country is exceedingly rugged—and one has to pick one's way among fragments of sand-stone, the whole surface of the country being covered with the same. The jungle is composed chiefly of dwarfish trees of no value.

When I passed over this tract, the grass had been burnt, the trees were leafless, and the whole scene as sterile and inhospitable as any in the extreme north of Europe during the Arctic winter, from the effects of an extreme temperature. From Nataca Pentah to Allotta is about four hours journey.

The country for the most part was similar in feature to that already described, only, if possible, more stony.

About two miles from Allotta, you descend by a winding ghaut about 800 feet. The road is composed of loose fragments of sand-stone, and, except to Lumbadi cattle, is almost impracticable.

From the ghaut you have a good view of the surrounding country, the little Fort of Allotta standing in the plain beneath you, about one mile from the river, which here forms an elbow, changing its course from easterly to north, north-east—much as it is sketched in the great maps.

The country on the other side of the river is nearly devoid of trees and slightly undulating: the high hills, sketched in the map on the left bank of the river after its course becomes northerly, do not exist. The river is turned to the north by a range of hills on the right bank of the river, running north and south. The appearance of the Kistnah here is very disappointing. As far as it can be traced by the eye, it appears a gigantic ravine or gully, with steep and almost precipitous walls of indurated mud, and flows about 1,000 or 1,500 feet below the level of the surrounding country. There was little water in the river at this time (March), and what there was lay in pools or formed rapids, giving the river much of the character of the famous salmon streams of the north of Europe.

The Fort of Allotta* is of stone, 80 paces square, with walls 12 feet high; it is admirably placed with a view to the defence of the river at that point: outside the Fort the ruins of a town of some size are in existence, the houses and streets of which were entirely composed of slabs of rock. There are the remains of four large bowries which have been used to irrigate the land by picottah; but it never could have been a producing country, and the Fort must have been built either as an out-post to dispute the passage of the river, or as the stronghold of some marauding clan.

* Vide Note 9

The river now-a-days is crossed three miles to the north-west of Allotta: there are two basket boats manned by Chenchowars in the employ of the Pulari contractor, who lives at Atmacore: the boatmen get monthly pay, and the profits of the ferry are paid to the contractor.

A large nullah or ravine empties itself into the river at this point, and the great deposit of alluvium, dried at this season and cracked into cubes by the intense heat of the sun, with yawning fissures from four to six feet in depth, testified to the power and violence of the stream during the monsoon. I observed jungle rubbish, *i. e.*, dead grass, roots of bamboo, &c., suspended in the forks of trees, 100 and 150 feet above the level of the bed of the river. High hillocks of white river sand are thrown up by the same cause, and give a sea-side appearance to the shore. The bed of the river and the boulders and rocks on the banks are of lime-stone.

From Allotta to Pentahbant Pentah, ascending the same ghaut, we proceeded as far as Yerra Pentah, and then rode west to Pentahbant Pentah, three hours journey from Allotta; the features of the country not differing from what has been before described. The surface of the country is covered with sand-stone and hornblende in fragments, from the size of a tea canister to that of a seaman's chest, over which you pick your way. Vaypa-maram and Woodapple are the trees which oftenest occurred. Pentahbant Pentah is situated in a maidan of red soil about 400 acres square, near the margin of a nullah running from west to east. From Pentahbant Pentah, we proceeded by the Lumbadi tract to Palotta, and from thence to Nakul Pentah.

The country between these three places is, comparatively speaking, flat—a rich red soil, free from stone, covered with jungle grass two feet in height, and the Vaypa tree plentiful

and of large size. Some years ago this land was tilled, but the spot being so remote from any market, and the intervening country so rugged, it was found a profitless speculation. From Nakul Pentah we proceeded to Yellagal Pentah, over a very rocky country; and from Yellagal Pentah to Arepentah, which I have marked in my map. From Arepentah to Shigarum pagoda, the country becomes wilder and more mountainous, and resembles a good deal the hilliest part of Coorg. Shigarum pagoda, which is built on the point of the highest hill within view, is reached by a stone road-way and stairs, about 15 paces broad, which winds round the hill.

The pagoda itself is an insignificant building and dilapidated; but from a platform on the roof a superb view of the surrounding country is obtained.

The dark gloomy looking walls of the Kistna mark the tortuous windings of its course, and at one favorable turn of the river you catch a glimpse of the stream, flowing like a great sewer deep down between its high banks. In the valley before us we saw glittering in the rising sun the golden balls which flank the top of the Holy Temple of Shreechalum or Purwuttum.*

The road to Purwuttum, which is of hewn stone, is a continuous descent and about three miles in length: nearly every stone or stair of the road is covered with written sentiments of devotion. There are several small dewals on the road side, besides the pagoda of Ullokasher.

Purwuttum must once have been a vast city; but nothing now remains of its former glory except the Temple. The ruins of stone bowries of great beauty, and lines of stone wall that every where can be seen standing out of the thorn jungle, still give an idea of a time that has long since passed away. Like all old ruined towns, Purwuttum is most unhealthy. A

* Vide Note 3.

deadly-fever appears to prevail there all the year round. The great festival at Purwuttum is held in March and April, perhaps the healthiest time of the year: still the amount of sickness and suffering among the pilgrims is very great.

The Temple of Purwuttum faces east and west: the east face is the principal entrance: a stone road commencing at the east tower leads in an easterly direction to the river, distant about 1¼ mile. It winds down a very steep hill. There are several small dewals on the way; and a little pagoda, every stone of which is elaborately carved, stands near the river. The Kistna here comes from the north north-west, and takes an abrupt turn again to the north and by west.

The banks on the opposite side of the river are precipitous and are not accessible. From Purwuttum another stone road proceeds westerly to the river, distant about a mile as the crow flies; but the descent to the river being too abrupt, the road slants down the heights running parallel to the stream for about two miles, making the distance from the Temple to the river three miles. Here there is a ferry, and a stone road, and stairs ascend the heights on the opposite side of the river, from whence there is a road to Hyderabad. A large nullah on either side of the stream empties itself into the Kistna. At this point, a deep deposit of alluvium and hillocks of sand are found at the mouth of all these nullahs, covered for the most part with the tall reed of which the native pen is made. Course of the river south-west to north-east, by compass.

Crossing the river, I marched due west into the tract of country called impenetrable, and halted in a large nullah about 5 miles distant. After mounting the heights on the banks of the river, the country is, comparatively speaking, flat; the soil is red, covered with jungle grass; the black-

wood tree is common but of no size, the average diameter being about 12 or 14 inches. Proceeding west, the jungle becomes much thicker, containing Bamboo, Blackwood, Rosewood, Vayapa-maram and Woodapple. Having penetrated about 15 miles due west from the ferry, I was forced to retrace my steps, after waiting some days for supplies and coolies, for which I had written in vain to the Tahsildar of Atmacore. We returned to Purwuttum, and from thence marched to Collum nullah. We proceeded by the stone road-way and steps, which lead from Shigarum pagoda for about ¾ of a mile, and then turned off to the south and proceeded for about 3 miles on a road partly paved and partly earth with slight ascents and descents, but on the whole rising, till we passed through an arch-way in ruins, which we found on the crest of an exceedingly steep hill. Stone stairs wind with many turnings down to the Collum nullah. Collum nullah is a deep gully, the bed of sheet rock, and, when I visited it, quite dry.

The banks, which are of indurated mud, are very steep, and the bed of the nullah is certainly not less than one thousand feet below the level of the country through which it winds its way. The banks of the nullah seen from above much resemble those of the Kistna. Half way down the heights there is a pagoda, and another one stands on an acre of level ground close to the beds of the nullah. Pilgrims make this a resting place. From Collum nullah to Peddacherro the road (stone stairs) rises from the nullah and runs to the south-east, ascending the hill-side on the left bank of the nullah till the high levels of the surrounding country are reached. Proceeding south-west by gentle ascents and descents, but on the whole descending, you pass through a jungle of bamboo and timber of weak growth, until you emerge on the broad plain of Peddacherro. Peddacherro is a place of great natural beauty, and you

cannot help asking yourself, why, in the place of the few Chenchowars' huts, there is not a rich and populous village. It is situated in the head of a large valley. A maidan of about 50 acres, dotted with fine banian and mangoe trees and a dry tank—about 60 acres, in extent—all beyond jungle, bamboo and timber. This is the first time in 12 years that the tank has become dry, although there is a breach in the bund.

On enquiring why this beautiful country was not cultivated, I was told that people were afraid of coming here to live, on account of fever. It has become feverish in the last 30 years. Formerly it was healthy: there was a town at Peddacherro, and there are the ruins of a stone fort. Notwithstanding the fever, the Lumbadies have many Pentahs in the neighbourhood. I observed, however, when their women and children came to the tank for the scanty supply of water which the little wells they had dug in the bed of the tank afforded, that a great many of them had the pot-belly of old fever subjects, and I had many applications for medicines to cure hopelessly indurated spleens, which showed in the wasted attenuated frames as big as foot-balls.

From Peddacherro I again penetrated the jungle, and marched north-north-east to a fortified hill, called Gazzelcondah; the road was not practicable for laden bullocks and was almost a continuous descent. We halted in a nullah full of wild mangoe trees. There was a Pentah in the neighbourhood. From thence I proceeded to the river, a further distance of 4 miles, the road continuing to descend to the river's edge. I saw no timber of any size. Course of the river from south-west to north-east.

The banks of the Kistna here form a much more gradual slope than I have before described. The country on the other side of the river appeared open and almost devoid of

timber. We returned to Peddacherro, and proceeded to Siddapore* through a dense bamboo jungle in which I observed some blackwood, rosewood and a few teak trees of small size. Timber was being felled as we passed through. The road through the jungle is level, broad and soft; indeed, there is not a stone to be seen. All this land appears very rich and ought to produce more profitable crops than bamboo and long jungle grass.

Five miles from Peddacherro, we halted on the margin of a nullah: so far you could drive a coach and four. Next morning the road became more broken and uneven. After proceeding about 3 miles, we passed through another archway in ruins, and soon came upon another stone road-way and stairs winding down a gorge in the hills to the pagoda of Nagalooty, which is seen over the tree tops in a ravine full of large mangoe trees at the bottom. Here you get a fine panoramic view of the low country stretching away towards Kurnool. Nagalooty pagoda is buried in an avenue of large mangoe trees. On the margin of a nullah there are two stone wells and three small dewals, besides the great Pagoda. a Priest (Pushari) lives here all the year round.

4. From Nagalooty to Siddapore you travel through a bamboo jungle—country flat—soil red. The Fort of Siddapore stands on an elevated piece of ground and is regularly built of hewn stone, with a ditch round it. I rode into the Fort over a breach in the wall: the breach is the effect of time and weather, not of service. The Fort and ditch and the remains of a town outside, Pagodas, Edgahs and other buildings are all grown over with thorn jungle. There is a stone godown here for storing grain. From the Fort walls, I saw the dry bed of the Siddapore tank of large size, but the bund delapidated and the bed very shallow. There is a little village of Chenchowars here.

* Vide Note 4.

From Siddapore I proceeded to Atmacore, distant 10 miles; the first four miles are thick bamboo and thorn jungle. From Atmacore I again made for the river; the latter half of the road was so rugged that it was impracticable for cattle of any description.

The country on either side of the river slopes down somewhat more gradually to the river, and the walls of indurated mud which, further to the east, look almost like artificial works, are no longer seen.

Being now satisfied that the object for which I came was accomplished, and that there was no timber (of sufficient size to make it valuable) in the "impenetrable tract," and that, moreover, if it existed, the nature of the country would be an almost insuperable bar to its removal, I returned to Ongole.

1. NOTE.—In the dry and hot seasons, when grass is scarce in the inhabited country, countless herds of cattle are sent from Doopaud and the country to the south and east of Doopaud to these Pentahs, which are always chosen as the best grass districts, and to the neighbourhood of an unfailing pool or spring in some nullah. Here the cattle remain until July, when fodder becomes abundant in the plains, and then they are driven back to the south, and are dispersed among their numerous owners until December or February, according to the season, when each herd is once more collected and driven off to a Pentah in charge of two herdsmen, who remain with them in the jungle, or hand them over to the charge of the Chenchowars. In the case of an entire herd belonging to one owner, when they are kept as *breeding stock*, they are only sent home for a month in the year to prevent their becoming perfectly wild—these are never milked.

These thinly inhabited districts, both on the right and left bank of the river, are also much frequented by the Lumbadies who, when not engaged in the carrying trade, and during the three hottest months, when they do no work, make them their Head Quarters,—moving from Pentah to Pentah in search of the best grass and water.

Their cattle, which are mostly bred in the neighbourhood of Amrabad (East Longitude 78°54') in and about 30 miles from the left bank of the river, are remarkably fine; stronger, hardier and more active than the famous breeds of Nellore or Mysore. They have a long horn, breed mostly a brown red, approaching the horse color, bay, and have generally bold faces: their price averages from 16 to 20 Rupees each. I am assured that a first class bullock will carry a load of 284 lbs., and I believe I have seen them carrying as much over this rugged country. An agent from Bellary bought eight of these beasts on the part of the Commissariat at Pentlabant Pentah, when I was there, measuring them by a standard before purchase. The Doopaud breed of cattle which was once famous appears to have entirely degenerated. No attention is paid to breeding and the same blood is continued from generation to generation. They are very small sized, leggy and small bodied, more like deer than cattle, and show plainly

enough in their uniform appearance and small bone, how the breed has become deteriorated.

With any attention to select breeding, these districts could produce admirable cattle, as the supply of grass all the year round is inexhaustible, and a hilly rocky country is favorable to the development of strong limbs and feet, activity and general hardihood.

Spotted deer, &c., are very numerous, and consequently the herds do not suffer severely from tigers. Altogether it is a first rate cattle country.

2. Page 130.

From this place, and as far as Nagalooty, the Poolery tax is raised by a contractor who pays 600 Rupees per annum for it.

Emam Sahib, the contractor, generally collects two thousand Rupees per annum, and if untiring energy in travelling from Pentah to Pentah at all seasons of the year and in the face of a deadly fever, ought to go for any thing, he certainly fairly earns his handsome profit. He appears popular among the Lumbadies and Chenchowars, which is much in his favor, but I heard many complaints from the latter of the rapacity of his peons, who, even in this season of scarcity, were laying an embargo upon the wild mangoes, the only food which these poor people had to subsist upon, and which of course had nothing to do with the Poolery contract. The Chenchowars might give trouble.

PURWUTTUM.

Note 3, Page 132.

In 1839-40, when Kurnool fell, the Commissioner was induced to get into his palanqueen and visit this extraordinary place.

I am told that he then gave the Temple to one Sunkaray Charry, a Temple Brahmin, living in the neighbourhood of Jungoovarpully, reserving, however, the endowments on the part of Government. The Temple expenses amount to two thousand Rupees per annum, the assets generally to between 7 and 10 thousand Rupees per annum. Sunkaray Charry, lets the place to a contractor, a Brahmin, who defrays the expenses of the Pagoda, servants' wages, &c., and pays a rent of 500 Rupees per annum to Sunkaray Charry. This contractor, a man of no religious sentiment, has brought the place down a great deal by his irreligious conduct, urging the Poojaries to dig in the most sacred spots for treasure, and establishing cordons of tax-gatherers, one within another, in the country round the Temple and on all the roads by which the pilgrims arrive.

The feast of Purwuttum lasts for two months; *i. e.*, from the new moon in February until the new moon in April. All pilgrims, except Byragies, religious medicants, &c., pay about sixty Rupees per head per mensem for the privilege of residing within the temple enclosure, and visiting daily the holiest part of the temple in private prayer. Four servants belonging to the contractor, viz., a Brahmin, a Byraghee and two Teloogoo Poojaries, remain in close attendance during the day near the images before whom offerings are laid. The said offerings, which generally consist of eyes and limbs in solid gold, offered either in gratitude for a supposed cure, or as an inducement to perform one, are, on the retirement of the devotee, seized and placed in a treasure chest which is kept on the spot.

When the temple is closed at 9 P. M., the four abovementioned servants are carefully searched, and the treasure chest is carried to the Cutcherry, just outside the temple. Next morning the seals are broken and the contents of the chest valued, &c. Each pilgrim desirous of entering the temple for

private prayer is provided with a ticket at the Cutcherry and has an arm stamped, for which he pays one Rupee eight Annas. Very poor people who cannot afford the personal interview pay eight Annas for the privilege of looking at the outside walls, a sight well worth the money, for the walls of the Temple enclosure, 300 paces by 250, and about 20 feet in height are built of stones, every one of which is carved with a tableau in *Alto Relievo* representing the combat of men and animals. The two temples within the enclosure are entirely covered with copper gilt.

SIDDAPOOR.

Note 4, Page 137.

Riding along the bund of the Siddapoor tank, I observed that it does not now occupy more than a fifth of the space it once did. A gigantic bund stretches away to the south-east, which I am told was breached by the overflowing water of the tank about 50 years ago. My informant, who holds the office of Curnum at the villages of Siddapoor and Peddacherroo, and whose family appear to have held the same post for many generations past, states that it is on record that the bund cost 40,000 Rupees, and that the revenue derived from the tank alone was enormous. He gave me some interesting details of the history of Siddapoor or Tonsnager. This was the place from which were derived the revenues, that supported in wealth the 350 dancing girls, who once formed the yearly procession that marches round the walls of the Holy Temple of Purwuttum, and this place supported also the same number of carpenters and silversmiths who were attached to the Temple. In 1848, Billakalla Gooroo Kistapah, my informant's uncle and Curnum of Siddapoor, conceived the idea of restoring the place to its former importance. He communicated with the Commissioner of Kurnool, who gave him every encouragement, and told him that he should have what land he liked at the nominal rent of 8 Annas a cawny, if he could establish a village and cultivation at Siddapoor. Accordingly, Gooroo Kistapah raised a sum of 700 Rupees and travelled from village to village in the districts of Kurnool and Bellary in search of volunteers, who would join him in his attempt to reclaim these lands. A party of 80 persons were collected, and in March 1848 they squatted on the site of the old Town of Siddapoor; some jungle was cut down, and in July, 20 acres of paddy were planted. A fine old stone bowree was cleared of rubbish, cleaned out, and the water declared excellent. This bowree was resorted to because the squatters thought that the tank water coming from the surrounding hills was so saturated with decomposing vegetation that it would probably induce the deadly fever of which they had all heard so much. The health of the squatters was excellent for about 10 months from the date of their arrival, when fever broke out, and thirty persons were burned or buried in a very short space of time. The rest were panic-struck, and every one who had strength fled.

Poor Gooroo Kistapah was among the first victims, and his son on his death became Curnum of Siddapoor and Peddacherroo, which post he filled until about three months ago, when he also died of fever, and the present Curnum, his cousin, was appointed. There can be no doubt that this unhealthy jungle is, and has been, for many years past slowly extending. Trees grow when men sleep, and although the intense heat of March, April and May arrest vegetation, the heavy rains in June, July and August produce a yearly increase of jungle which man makes no attempt to restrict. In short, the people of this district are and have been for years retiring before the jungle and its concomitant fever; and the jungle and fever will continue to advance, until a vigorous stand is made against them, the jungle cut down and the land cultivated.

Enumeration of the snowy peaks hitherto measured in the Himalaya. By Robert de Schlagintweit, Professor at the University of Giessen.

The valuable memoir "The Trigonometrical Survey of India," by Major J. T. Walker, contained in the Journal of the Asiatic Society of Bengal, 1862, No. I., pp. 32-48, enables me, in connexion with the data published by me in the second volume of our "Results of a scientific mission to India and High Asia," to give here an enumeration of those snowy peaks, which have hitherto been measured in the lofty mountain-chain of the Himalaya.

In order to render this enumeration useful in a scientific point of view, as well as for practical purposes, I have added to each peak, besides its latitude, longitude, and height, also a name. The necessity of finding proper names for the peaks is not only of importance for trigonometical operations in general, but also for every geographical detail. Many of the difficulties, alluded to by Major Walker in para. 58 of his memoir, "which the compiler meets with in the identification of peaks, whose positions have been determined by different persons, after long intervals, or from different points of view under the disadvantages of altered aspects," would greatly be diminished—though they will never entirely disappear,—if every peak should have its definite name.

Although many a peak of striking aspect is distinguished by a name given to it by the natives, which repeated inquiries prove to be no arbitrary one, yet such a designation is wanting for a considerable number of peaks, especially when they are situated in the higher, uninhabited regions. As it may not be generally known, I may mention here, that also in the Alps many peaks had not been designated by names before the time when a livelier sense of the

necessity of geographical precision became general. It may be remembered, that Saussure, in his first scientific exploration of the Alps, found Mont Blanc without a name well defining the peak, its individuality being merged along with the surrounding region under the general appellation of "Monts Maudits."

Whenever in the Himalaya designations for a peak were wanting, we endeavoured to supply the deficiency by those of any well defined object, such as passes, glaciers, valleys, rivers, springs, etc. in their immediate neighbourhood; for in the Himalaya such objects are sufficiently distinguished by popular and characteristic names, with which we had every opportunity during our travels of getting a correct and intimate acquaintance.

Every peak measured by the Great Trigonometrical Survey, whether its name be known or not, is marked with a number or an initial. With reference to the various characteristics adopted in such cases by the Great Trigonometrical Survey, I hope not to commit an error, when I state it here as my conviction, that, though Major Walker does not clearly express himself about this point, the Roman numbers, viz. I, II, III, etc. are signs, which the G. T. Survey wishes to be considered as definite ones, whilst all other characteristics, as *E. G. A*, a, L, B, γ. etc., are provisional signs, which the G. T. Survey will replace at a later period by definite Roman numerals.

With reference to the accuracy with which the peaks contained in this enumeration are measured, we have to distinguish three degrees.

I. The peaks marked with Roman numerals, as I, II, III, etc. are measured with the first degree of accuracy: even a later re-measurement will not alter to any appreciable amount the results obtained. See Major Walker's memoir, paras. 80 and 81.

II. The latitude and longitude of peaks measured with the second degree of accuracy is correct within 10 to 15 seconds, and the height within 70 to 90 feet.

III. The latitude of the peaks measured with the third degree of accuracy may be wrong within 2 to 3 minutes, the longitude within 3 to 6 minutes, and the height within 100 to 200 feet. None of the peaks of this category have hitherto been measured by the G. T. Survey.

Besides, the geographical co-ordinates of all the peaks hitherto measured in the Himalaya, depend upon the correctness of the following data:

1. On the latitude of the G. T. Station of Kalsanpur, for which the value of 24° 7′ 11″·26 is adopted.

2. On the longitude of the Madras Observatory, for which I have adopted the value 80° 13′ 55″·5 East of Greenwich, in conformity with the Admiralty and Royal Astronomical Society. The old value for the Madras Observatory, as adopted by the G. T. Survey is 80° 17′ 21.″

3. On the mean sea-level as observed in Kydd's dockyard at Calcutta.

The peaks contained in the following enumeration are arrayed according to geographical provinces, and within them from East to West. Among the 216 peaks contained in the enumeration, 17 exceed the height of 25,000 feet, 40 the height of 23,000 feet, and 120 the height of 20,000 feet. One of the 216 peaks actually reaches the height of 29,002 feet (Gaurisankar, or Mount Everest), and another the height of 28,156 feet (Ranchinjinga West). The relative number of the other peaks exceeding the height of 20,000 feet, are:

Relative Numbers.	From Feet	To Feet.	Relative Numbers.	From Feet	To Feet.
2... ...	58,000	27,000	12... ...	24,000	23,000
5... ...	27,000	26,000	27... ...	23,000	22,000
8... ...	26,000	25,000	20... ...	22,000	21,000
11... ...	25,000	24,000	33... ...	21,000	20,000

THE PEAKS HITHERTO MEASURED IN TH... ... ... 21,17[illegible]
... ... 28 4[illegible]

No. Curr.	Name of the Peak (1) and sign of the G. T. Survey.	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height Eng. Feet	No. Curr.	Name of the Peak and sign of the G. T. Survey	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height. Eng. Feet.
	A. Eastern Himalaya.								
	I. *Bhután.*								
	The peaks 5, 7, 9 and 10 are measured with the first degree, peak 8 with the second, and the other peaks with the first degree of accuracy.								
1.	Dal-La East	27 52·7	92 38·6	21,435	6.	Chóra	27 42·2	89 14·5	22,720
2.	Dal-La West or Giant ...	27 50	92 34	22,495	7.	Gipmóchi II.	27 16·5	88 53·2	14,518
3.	Théme-Ri.	27 48·7	92 28·5	20,480	8.	Forked Dónkia... ...	27 52	88 51	20,870
4.	Oámla...	27 36	92 7	22,430	9.	Paulǎnri or Dóukia III	27 57·0	88 49·7	23,186
5.	Chamalhári I	27 49·7	89 15·3	23,944	10.	Chóla, or Chumúnko IV ...	27 27·5	88 46·2	17,325
	II. *Sikkim.*								
	The peaks 2, 4, 5 and 6 are measured with the third degree, the peaks 3, 7 and 8 with the second, and the other peaks with the first degree of accuracy.								
1.	Guareám V.	27 34·2	88 45·2	17,572	8.	Pandím D 2.	27 42	88 18	22,581
2.	Tómochámo...	27 56	88 43	21,000	9.	Pandím VII.	27 34·6	88 12·2	22,017
3.	Kinchinghán	27 56	88 40	22,750	10.	Mársingh VI.	27 30·7	88 16·1	19,146
4.	Changokháng	27 53	88 38	20,600	11.	Kanchinjínga East VIII.	27 41·5	88 8·4	27,815

(1.) Remarks for the transcription of the names: vowels and diphthongs as in Italian and German: ă = u in "but," ă = an in the French "gant." Consonants sound as in English. The sign, marks the syllable to be accentuated Morshiadi.

No. Curr.	Name of the Peaks and sign of the G. T. Survey.	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height. Eng. Feet	No. Curr.	Name of the Peaks and sign of the G. T. Survey	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height. Eng. Feet
5.	Chomiomó	28 1	88 31	22,700	12.	Kanchinjínga West IX ...	27 42·2	88 8·0	28,156
6.	Tăkcham	27 44	88 30	19,473	13.	Kábru X	27 36·5	88 5·8	24,015
7.	Pandim *D 3*	27 44	88 28	19,244	14.	Jánnu XI	27 40·9	88 1·8	25,304

B. Central Himalaya.

Nepál.

The peaks 1, 40, 41 and 42 are measured with the third, all the other peaks with the first degree of accuracy.

1.	Yángma	27 55	87 52	26,000	22.	Barathór West XXXV ...	28 32·2	84 4·1	24,718
2	Sihsur XIII...	27 53·4	87 4·5	27,799	23.	Morshiádi XXXVI ...	28 35·1	83 58·5	24,780
3.	Chamláng East XIV... ...	27 46·5	86 58·0	24,020	24.	Morshiádi XXXVII ...	28 29·7	83 ·0	22,964
4.	Chamláng West XVI ...	27 45·3	86 48·5	22,215	25.	Morshiádi XXXVIII ...	28 29·9	83 55·9	22,986
5.	Gaurisánkar, or Mount Ever-	27 59·3	86 54·7	29,002	26.	Morshiádi (2) XXIXX ...	28 35·7	83 48·4	20,522
6.	Sankósi XVII ... [est XV	27 45·3	86 33·5	22,826	27.	Morshiádi XL	28 31·1	83 47·5	23,641
7	Sankósi XVIII	27 52·9	86 28·5	21,987	28.	Morshiádi XLI...	28 39·3	83 42·9	22,471
8	Sankósi XIX	27 58·3	86 25·1	23,570	29.	Dhavalagíri, or Dholagiri	28 41·8	83 28·7	26,826
9	Sankósi XX	27 57·9	86 18·3	23,447	30.	Naráyani XLIII... [XLII	28 45·8	83 22·4	25,456
10	Sankósi XXI	27 57·5	86 5·7	19,560	31.	Naráyani XLIV	28 45·2	83 21·8	25,299
11	Jijíbia East XXII	28 7·7	85 51·3	21,853	32	Naráyáni XLV	28 44·0	83 20·9	24,912

(2.) Major Walker gives as the height of this peak in his memoir 26,52[illegible] 20,522 evidently a mis-print for 20,522.

12.	Jibjbia Central XXIV ...	28 10·4	85 45·9	22,891	33.	Naráyani XLVI	28 44·1	83 17·9	25,095
13.	Jibjbia North XXIII ...	28 21·1	85 46·0	26,305	34.	Naráyani XLVII	28 40·5	83 15·7	23,565
14.	Daibúng XXV	28 15·4	85 30·2	23,762	35.	Naráyani XLVIII	28 43·9	83 11·7	24,181
15.	A'ku North XXVI ...	28 23·5	85 6·8	24,313	36	Naráyani XLIX	28 44·9	83 7·9	23,799
16.	A'kuSouth XXVII	28 20·7	85 4·0	23,313	37.	Machipúcha, or Naráyani L	28 44·6	83 6·1	21,727
17.	Yássa South XXVIII ...	28 26·1	84 37·4	25,818	38.	Naráyani LI	28 46·0	83 5·0	21,472
18.	Yássa Central XXIX ...	28 30·2	84 33·1	25,729	39.	Chaubíssi LII	28 49·7	82 36·1	19,415
19.	Yássa North XXX	28 33·0	84 32·7	26,680	40	A'pi LIII...	30 0	80 57	22,799
20.	Barathór East XXXIII	28 29·4	84 10·5	22,947	41.	Kunlás East	30 13	80 54	21,699
21.	Barathór Central XXXIV...	28 32·1	84 6·4	26,069	42.	Kunlás West	30 13	80 53	22,513

C. Western Himálaya.

I. *Kámaon.*

The peaks 1, 2 and 3 are measured with the third degree, the others with the first degree of accuracy.

1.	Chaudáns East...	30 6	80 27	19,569	8.	Nánda Dévi West LVIII...	30 22·5	79 57·4	25,661
2.	Chaudáns West	30 7	80 24	19,171	9.	Nánda Dévi Central LIX	30 22·6	79 57·3	25,587
3.	Pách Chúli South	30 10	80 18	20,479	10.	Trissúl East LX	30 16·2	79 51·4	22,342
4.	Pách Chúli Central LIV	30 12·9	80 24·7	22,673	11.	Trissúl West LXII ...	30 18·7	79 45·7	23,382
5.	Pách Chúli North LV ..	30 15·2	80 21·7	21,471	12.	Unknown LXI	30 30·9	79 51·1	23,092
6.	Nánda Khát LVI... [LVII	30 16·9	80 3·2	22,538	13.	Nandákna North LXIII	30 22·2	79 42·3	19,916
7.	Nánda Dévi East, or Látu	30 22·0	79 58·9	24,417	14	Nandákna South LXIV ...	30 21·0	79 42·2	20,773

No. Curr.	Name of the Peak and sign of the G. T. Survey.	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height Eng. Feet.	No. Curr.	Name of the Peak and sign of the G. T. Survey.	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height Eng. Feet.
	II. *Gárpwál.*								
	The peaks 2 and 4 are measured with the third degree, the peaks 1, 3, 5, 6, 7, 8, 11, 15, 16, 22, 25, 35, 37 and 38 with the first, and all the other peaks with the second degree of accuracy.								
1.	Unknown LXVI.	30 41·1	79 41·5	22,093	25.	Bhūs, or Srikánta LXXVI..	30 57·4	78 47·4	20,149
2.	I'bi Gánun East	30 56	79 36	24,200	26	Néla East	31 11·2	78 45·1	19,655
3.	I'bi Gánun Central LXVII.	30 55·2	79 34·8	25,373	27.	Néla West	31 11·9	78 40 2	19,086
4.	I'bi Gánun West	30 59	79 33	24,000	28.	Chétkul β	31 20·3	78 41·5	19,338
5.	Nalikánta LXVIII	30 43·9	79 23·5	21,661	29.	Chétkul *D*...	31 20·2	78 39·7	19,313
6.	Bádrinath East LXIX ...	30 44·3	79 15·9	23,210	30.	Chétkul *x*, or *O*	31 21·3	78 36·1	21,517
7.	Bádrinath Central LXX ...	30 43·4	79 14·5	22,511	31.	Chétkul *P*. or *D*.	31 20 1	78 35·3	21,159
8.	Bádrinath West LXXI...	30 46·7	79 13·6	22,347	32.	Chétkul ∠	31 19·6	78 34·4	21,211
9.	Rúdru (I, or γ)	30 58·6	79 4·8	21,384	33.	Damdár East	31 8·9	78 35·5	19,577
10.	Sárga Rúer (β')	20 59·7	79 4·8	22,906	34.	Damdár West	31 8·8	78 34·9	19,628
11.	Kídarnath, or Mahapanth	30 47·9	79 3·2	22,790	35.	Bandarpūch LXXVII ...	31 0·2	78 32·3	20,754
12.	Shíppur East ... LXXII	31 0·8	79 3·4	22,076	36.	Changsákha *D*″	31 13·2	78 31·0	20,431
13.	Shíppur West	31 2·5	78 59 6	20,933	37.	Jamnóki LXXVIII	31 0·4	78 80·7	20,038
14.	Bhagiráthi (∠ or 2) ...	30 56·5	78 59·1	21,390	38.	Sargoróin LXXIX... ...	31 6·1	78 29·1	20,405
15.	Tharlaságar South LXXIII	31 51·6	78 58·8	22,582	39.	Báspa κ'	31 14·1	78 31·1	20,609
16.	Tharlaságar North LXXIV.	30 51·7	78 58·8	22,628	40.	Báspa ζ	31 15·5	78 25·2	19,193
17	Nélong (R')	31 6·6	78 54·2	19,694	41	Báspa *R*	31 14·4	78 23 8	19,285
18.	Srikánta No. 3	30 53·9	78 55 1	20,844	42.	Báspa δ...	31 16·3	78 22·3	19,334
19	Srikánta *h*	30 55·1	78 49·9	21,911	43	Báspa γ	31 17·2	78 21·4	18,754
20.	Srikánta *j*	30 43·8	78 48·4	16,934	44.	Dandángsi *T*...	31 26·9	78 19·2	19,639
21.	Srikánta Central	30 56·1	78 48·1	20,105	45	Rári	31 19 8	78 18·3	19,044
22	Jáuli LXXV	30 51·3	78 50·5	21,672	46	Barbáti South *Q*	31 20 0	78 18 2	18,863
23	Jhála East...	31 7·9	78 49·6	19,962	47	Barabáti North *K*	31 21 0	78 18·2	18,648
24.	Jhála West	31 7·9	78 45·8	18,659	48.	Gorás *B*	31 19 9	78 10·8	16,509
	III. *Kánáur.*								
	The peaks are all measured with the third degree of accuracy.								
1.	Rúkor East I	31 38 5	78 40 2	19,946	14.	Málgan *A*...	31 38·1	78 8·0	19,494
2.	Rúkor West *W*	31 38·9	78 38·4	20,645	15.	Buránda West *F*... ...	31 23 9	78 6·9	16,890
3	Rothíngi *F*	31 31·9	78 38·2	19,205	16.	Dógri μ	31 27·1	78 5 6	16,342
4	Urcha *Q*	31 40·1	78 36·7	20,641	17.	Pábar *A*	31 24·6	78 5·4	16,843
5.	Lámbar 5...	31 32·6	78 39·1	20,380	18	Shátul *M*...	31 24 6	78 1·7	17,269
6.	Mórang *P* or 3	31 34·9	78 13·6	20,513	12	Kársva 4	31 25·4	77 54·8	17.201
7.	Kiukúchi 1 or *K*	31 27·2	78 28·1	20,824	20.	Rúnepu 5	31 26 3	77 53·7	16,903
8.	Chárang North *l*	31 25·9	78 27·2	20,254	21.	Tári, or Bhabéh 2	31 42·8	77 44·0	18,626
9.	Chárang South *n*	31 25·4	78 26·3	19,800	22.	Tári, or Bhabéh 3	31 41·4	77 53·5	18,445
10.	Ráldang South *S*	31 29.6	78 21·6	21,250	23	Tári, or Bhabéh β	31 43·7	77 50 3	17,244
11.	Ráldang North *R*... ..	31 31·2	78 20·9	19,866	24.	Tári, or Bhabéh δ	31 41·0	77 56·5	17,947
12.	Castle Rock *X*	31 27·5	78 17·4	18,048	25.	Tári, or Bhabéh ϵ	31 4 3	78 2·0	17,558
13.	Castle Rock *D*	31 27·9	78 17·3	18,012	26	Tári, or Bhabéh × ...	31 42·4	77 45·4	17,471
	IV. *Kúlu.*								
	The peaks are all measured with the second degree of accuracy.								
1.	Rátang *S* II	32 1·5	77 46 4	21,365	5.	Rátha β	32 20·6	77 1·6	19,462
2.	Párbáti I	31 51·5	77 42 0	20,515	6.	Goraldtnu X, ...	32 6·9	76 55.6	15,108
3.	Sháncha *c*	31 43·7	77 30·8	15,605	7	Tongáur β'	32 12·9	76 54.6	17,028
4.	Deotiba	32 12·9	77 23·0	20,417	8.	Thámsar	32 12·6	76 44·7	16,662

No. Curr.	Name of the Peak and sign of the G. T. Survey.	Geographical Co-ordinates. Lat. North ° ′	Long. East. ° ′	Height Eng. Feet.	No. Curr.	Name of the Peak and sign of the G. T. Survey.	Geographical Co-ordinates. Lat. North ° ′	Long. East ° ′	Height Eng. Feet.
	D. North western Himalaya.								
	I. *Lahól.*								
	The peaks are all measured with the second degree of accuracy.								
1.	**Kánzam, or Kúlzum** μ ...	32 21·3	77 42·4	20,581	10.	Shigri I.[3]	32 42·7	77 15·6	18,424
2.	**Súrcha East K[IV]** ...	32 32·7	77 40·4	19,981	11	Gáphan...	32 28·7	77 13·3	19,212
3.	**Súrcha West K[III]**	32 35·5	77 37·4	20,073	12.	Kárdong *P*	32 33·1	77 8·8	18,942
4.	**Shígri L[III]**	32 22·4	77 33·2	19,949	13.	Sissu *M*...	32 26·0	77 2·4	20,355
5	**Shígri L[II]**	32 21·1	77 32·5	20,566	14.	Ghúsa...	32 30·5	76 51·5	19,833
6.	**Shígri L[V]**	32 22·4	77 28·7	19,839	15.	Northern Chándra Bhága...	33 2·5	76 44·2	18,130
7.	**Shígri L**	32 26·9	77 27·9	20,442	16	Northern Chándra Bhága I.	33 4·4	76 34·0	18,645
8.	**Shígri L[VI]**	32 32·8	77 23·9	21,415	17	Northern Chándra Bhága α	33 5·7	76 34·0	20,151
9.	**Shígri L[VII]**	32 38·4	77 22·7	20,561	18.	Northern Chándra Bhága α	32 49·2	76 32·3	20,658
	II. *Chámba.*								
	The peaks are all measured with the second degree of accuracy.								
1.	**Gáuri** θ'	32 10·9	76 48·9	16,017	3.	**Chéro West**	32 33·7	76 36·2	19,208
2.	**Chéro East P'**	32 34·6	76 41·9	20,044	4.	**Túral** α	32 15 0	76 28·2	16,315

	III. *Kishtvár.*								
	The peaks are all measured with the second degree of accuracy.								
1.	Chimrát	32 46·4	76 47·2	20,257	7.	Southern Chándra Bhága *West End*	32 49·4	76 25·7	18,639
2.	Gurdhár South	32 55·1	76 41·9	21,142	8.	Southern Chándra Bhága *Double Top*	32 40·9	76 31·2	19,668
3.	Gurdhár North X	32 57·6	76 37·2	17,919	9.	Southern Chándra Bhága *Black Cone*	32 49·2	76 21·6	17,145
4.	Southern Chándra Bhága *N*	32 55·2	76 20·2	17,243	10	Paupdár	32 56·5	76 19·2	16,836
5.	Southern Chándra Bhága *D.*	32 58·4	76 19·5	17,426	11.	Véheli 2	33 19·3	76 17·0	19,906
6.	Southern Chándra Bhága *E.*	32 59·4	76 15·1	16,042	12	Kishtvár i	33 11·0	76 2·2	16,662
	IV. *Rajáuri.*								
	The peaks are all measured with the second degree of accuracy.								
1.	Bárma Sákul	33 28·9	74 49·3	15,483	5.	Rátan Pir c^2	33 31·0	74 41·4	15,127
2	Rátan Pir b^1	33 28·6	74 50·0	15,140	6.	Rátan Pir d	33 32·7	74 38·8	15,114
3.	Rátan Pir b^3	33 29·3	74 48·6	15,593	7.	Tátta Kútti South	33 44·9	74 27·1	15,524
5.	Rátan Pir c^1	33 31·5	74 41·4	15,095	8.	Tátta Kútti North y ...	33 54·4	74 24·9	15,133
	V. *Kashmír.*								
	The peaks are all measured with the second degree of accuracy.								
1.	Machahói *f*..	34 13·7	75 34·3	17,904	7.	Báltal, or Gvashbrári.. ...	34 9·9	75 18·8	17,839
2.	Purmandal Ke Sir 12 ...	34 3·6	75 30·4	17,052	8.	Haramúk	34 24·1	74 53·6	16,903
3.	Pir Panjál α	33 48·9	75 26·5	14,581	9.	Kaj Nag 1...	34 13·8	74 0·8	14,438
4	Pir Panjál β^5	33 26·1	75 28·1	14,546	10.	Sathóla	34 20·7	73 57·0	14,039
5.	Pir Panjál β^6	33 32·0	75 28·8	14,187	11	Málekpur 2	34 21·3	73 55·9	14,238
6.	Ambarnáth *e*...	34 13·6	75 28·7	17,321	12.	Ismáel de Dóri North ...	24 29·8	73 54·3	12.643

This Article having been communicated to Col. Walker, Superintendent of the Grand Trigonometrical Survey by the Honorary Secretary, elicited the following reply.

DEHRA DOON, 19*th November* 1865.

MY DEAR SIR,

I am obliged to you for forwarding for my perusal Robert de Schlagintweit's paper, enumerating the snow peaks hitherto measured in the Himalayas. Opinions will probably differ, as to the utility of the nomenclature therein adopted, or indeed of any attempt to give names to mountains, which the inhabitants of the surrounding regions have not yet attempted to name. To some few of the most prominent peaks, it may be convenient to give names ; but as the process of selecting a suitable appellative is necessarily arbitrary, there will be great differences of opinion, as to the propriety of the selection. Thus, the highest known mountain in the Himalayas was named Mount Everest by the late Surveyor General, Sir Andrew Waugh, in honor of his predecessor. It is the only mountain to which our officers have ventured to give a name, for, as a rule, we accept what we find, and give nothing that is either doubtful, imaginary, or fanciful. Yet, in the one instance in which we have departed from our rule, we have not been universally followed. No less an authority than Sir John Herschel, in the last edition of his Physical Geography, refers to our Mount Everest by the name of Deo Danra.

Herr Schlagintweit has mistaken the object of the Roman numerals which are employed in the paper I communicated to the Journal of the Asiatic Society. It is not intended that they shall never give place to other symbols. When the regions in which the corresponding peaks stand shall have been topographically surveyed, the total number of peaks laid down will be tenfold greater than it is at present,

and this must necessitate a fresh arrangement of symbols, the present being merely an enumeration of the peaks already known, in order of sequence, from East to West : I find that a similar arrangement has been adopted by the Russian surveyors in their published synopsis of the co-ordinates of the stations of the Russian survey: even where the places are well known, it is found convenient to refer to them by numerals, arranged in order from North to South, as well as by their names; but, of course, when additional positions are determined, the existing numerical arrangement must be altered. We have adopted Roman numerals with no other object than to prevent confusion with the Italian numerals that are employed in giving the elements of latitude, longitude and height, which are usually written on our charts by the side of the symbolic name.

Certain erroneous inferences might be drawn from Herr Schlagintweit's paper, which I am sure no one will be more obliged to me than that gentleman himself for here pointing out

First. That the snowy peaks enumerated by himself are all that have been hitherto measured in the Himalayas. They comprise all of which the positions have hitherto been *published*, as far as I know to the contrary ; but they do not comprise a fifth part of the number already measured by the officers of this survey.

Secondly. That none of the peaks to which he assigns the 3rd degree of accuracy have been measured by the G. T. Survey. Of these, there is an important group in the district of Kănáur. Herr Schlagintweit's figures are all but identical with the values given in the published "Chart of the first section of the North West series ; 1847-1854." It is evident that they were derived from that source only, and that the few differences which exist are merely due to errors in copying the original. Besides which, the source from which

these data have been obtained is duly acknowledged in Vol. II of the de Schlagintweit's "India and High Asia," to be the G. T. Survey.

Third. That the height of 26,522 which is assigned to peak XXXIX in the Journal of the Asiatic Society, is a mis-print for 2,052. On referring to the original records, I find that there has not been any mis-print. The height of this peak has been determined with as great accuracy as any other peak fixed by the G. T. Survey; it has been observed from no less than eight independent stations, and the individual results are singularly accordant, falling within an extreme range of 38 feet.

Fourth. That the valuable memoir in the Journal of the Asiatic Society was written by myself. It was written by my able Assistant Mr. Hennessy, and was merely communicated by myself to the Society.

I may add that recent operations of the G. T. Survey, in Assam confirm the accuracy of the latitudes and longitudes assigned by Herr Schlagintweit to his three first peaks in Bhutan, but they increase the heights as follows. Dal-La East by 987 feet, Dal-La West by 571 feet, and Theme-Ri by 798 feet.

Believe me, dear Sir,

Your's very truly,

J. T. WALKER, *Lt. Col. R. E.*,

Supt. G. T. Survey of India.

On the question of the propriety of the name "Deo Danga" for Mount Everest, I am informed by Colonel Ramsay, the Resident in Nepaul, that "Danga, or as the word is usually pronounced, Danra, is the usual Nepalese term for a mountain ridge, in contradistinction to the word "Lek" (pronounced Lake) which is used to designate a mountain top or peak."

J. T. W.

DAILY

AND

HALF MONTHLY RESULTS

OF

METEOROLOGICAL OBSERVATIONS

MADE AT THE

MADRAS OBSERVATORY.

IN THE YEAR 1863.

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

January. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers. Shade.		Sun.	Grass.	Deduced.		Wind.		Rain.	Clouds.	Weather.
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
1	30·023	69·7	66·7	77·4	63·0	95·7	57·4	65·1	86	71	NE	—	3	Fine.
2	30·013	71·8	67·1	78·3	63·9	98·3	61·5	64·5	79	111	NE	—	16	Light flying clouds.
3	30·015	73·6	67·0	79·3	70·8	98·3	67·0	63·4	72	162	NE by N	—	20	Passing clouds.
4	30·029	74·3	71·1	80·3	67·5	101·6	66·2	69·6	86	155	NNE	—	47	Frequently overcast.
5	29·983	74·9	71·7	80·5	71·5	97·5	69·6	70·2	86	179	NE	—	43	Frequently overcast. Shower
6	29·999	74·2	68·5	79·2	69·7	95·3	66·7	65·6	75	150	ENE	—	34	Passing clouds. [at 3 P. M.
7	30·012	73·7	67·8	79·4	65·9	97·0	62·1	64·6	74	139	NE by N	—	12	Chiefly fine.
8	30·017	74·2	69·4	79·4	67·8	97·3	64·6	67·0	79	190	NNE	—	36	Flying clouds.
9	30·021	75·4	69·0	79·7	72·4	97·6	70·0	65·8	73	237	NNE	—	38	Flying clouds.
10	30·061	74·4	69·3	79·7	69·6	97·8	67·9	66·7	78	183	NNE	—	31	Flying clouds.
11	30·074	73·9	67·7	79·5	68·4	95·7	64·4	64·4	73	174	NNE	—	22	Chiefly fine.
12	30·057	73·3	67·3	78·7	65·9	97·1	62·2	64·1	74	137	NE by N	—	15	Light passing clouds.
13	30·015	70·8	65·8	77·9	64·7	96·8	62·6	63·0	77	113	NNE	—	15	Light passing clouds.
14	30·010	72·5	66·9	77·7	63·6	97·3	59·4	63·8	76	100	NE	—	20	Passing clouds.
15	30·039	72·1	66·6	79·3	66·8	98·5	63·4	63·5	76	95	NE	—	20	Nearly clear.
Mean.....	30·024	73·2	68·1	79·1	67·4	97·5	64·3	65·4	78	146	NE by N	0·00	25	
Average..	30·004	74·6	68·9	80·0	69·1	96·8	63·5	66·0	76	155	NE	0·64	42	
Difference..	+0·020	—1·4	—0·8	—0·9	—1·7	+0·7	+0·8	—0·6	+2	—9	1 Point N	—0·64	—17	

154

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

January. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers. Shade.		Sun.	Grass.	Deduced.		Wind.		Rain.	Clouds.	Weather.
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity	Direction.			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
16	30·031	73·2	67·7	78·9	65·3	98·1	61·2	64·7	76	118	N E	—	11	Fine.
17	30·036	74·0	68·5	79·8	67·6	99·0	64·1	65·7	76	118	N E	—	15	Nearly fine.
18	30·054	72·5	67·8	80·0	65·9	99·1	61·6	65·3	79	86	NE by E	—	12	Fine.
19	30·066	72·7	68·5	79·8	66·7	99·2	63·0	66·3	81	91	NE by E	—	10	Fine.
20	30·026	71·8	67·9	79·2	66·0	99·3	—	65·9	82	88	E by N	—	11	Fine.
21	30·022	73·1	68·7	80·2	65·2	99·3	61·1	66·5	80	78	E	—	11	Nearly fine.
22	30·061	74·7	68·9	79·7	66·8	97·4	62·5	65·9	75	113	E N E	—	8	Light passing clouds.
23	30·011	75·1	69·5	79·8	68·8	97·3	65·0	66·7	76	169	NE by E	—	26	Passing clouds.
24	29·939	74·8	69·5	79·4	67·6	97·6	63·9	66·8	77	162	N E	—	5	Fine.
25	29·987	76·0	70·1	80·2	68·8	99·7	64·1	67·2	75	167	N E	—	39	Frequently clouded.
26	29·997	75·8	72·1	80·5	72·1	96·4	70·5	70·4	84	222	N N E	—	91	Overcast. [7 A. M.
27	29·998	73·1	71·2	75·6	72·5	—	72·3	70·3	91	197	N N E	1·46	100	Overcast. Frequent rain after
28	29·973	74·0	71·0	78·4	70·6	91·8	70·5	69·6	87	208	N E	0·49	100	Overcast. Rain from 1 to 5PM.
29	29·969	75·7	71·1	79·4	72·5	97·2	71·3	68·9	81	164	NE by N	—	95	Nearly overcast.
30	29·970	75·5	71·0	79·7	69·7	99·1	67·2	68·9	81	173	NE by N	—	54	Flying clouds.
31	29·988	75·9	71·9	80·8	70·9	102·1	68·7	70·0	83	149	N E	—	57	Frequently overcast.
Mean	30·008	74·2	69·7	79·5	68·6	98·2	65·8	67·4	81	144	N E	1·95	40	
Average..	29·991	74·5	68·6	80·6	68·2	97·8	60·6	66·5	75	128	NE by E	0·37	31	
Difference..	+0·017	—0·3	+1·1	—1·1	+0·4	+0·4	+5·2	+1·9	+6	+16	1 Point N	+1·58	+9	

155

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

February. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
1	29·997	76·3	72·8	81·3	73·4	99·2	70·5	71·2	85	182	N E	—	80	Chiefly overcast.
2	29·995	76·1	71·2	80·5	72·6	98·8	70·5	68·8	79	148	N E	—	40	Flying clouds.
3	29·950	74·2	70·1	79·4	69·0	97·9	66·2	68·1	83	109	N E	—	21	Chiefly fine.
4	29·920	73·5	70·4	80·4	67·7	99·9	62·7	68·9	87	65	E N E	—	12	Fine. Heavy dew.
5	29·914	73·9	71·1	81·0	66·7	101·1	62·3	69·8	88	64	E N E	—	18	Light hazy clouds.
6	29·938	72·9	69·7	81·6	66·8	101·2	62·6	68·2	85	84	E N E	—	2	Fine but misty.
7	29·966	74·3	71·1	80·3	67·4	100·6	63·6	69·6	86	98	N E by E	—	35	Frequent clouds.
8	29·924	74·3	71·3	82·2	68·6	102·7	65·4	69·9	87	96	N E	—	47	Hazy and cloudy.
9	29·894	75·7	72·4	82·3	68·5	102·8	63·6	70·9	86	92	N E	—	34	Hazy and cloudy.
10	29·883	76·0	72·4	82·3	69·5	101·8	64·6	70·8	85	67	E by S	—	49	Light clouds.
11	29·906	77·0	72·9	81·7	69·4	99.6	63·2	71·1	83	110	S E	—	19	Hazy.
12	29·922	78·6	74·8	83·4	72·4	101·8	67·6	73·2	84	99	E by S	—	44	Flying clouds.
13	29·925	78·4	73·5	82·8	74·4	101·0	69·4	71·4	79	139	E	—	36	Flying clouds.
14	29·899	76·6	73·4	83·4	72·3	98·0	65·9	72·0	86	122	S E	—	11	Fine.
Mean.....	29·932	75·6	71·9	81·6	69·9	100·5	65·6	70·2	85	105	E by N	0·00	32	
Average..	29·982	75·6	69·8	81·8	69·0	99 9	64·9	66·9	75	135	E	0 27	28	
Difference	—0·050	0·0	+2·1	—0·2	+0·9	+0·6	+0·7	+3·3	+10	—30	1 Point N	—0·27	+4	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

February. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humi. dity.	Velocity	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
15	29·904	77·7	73·6	83·2	71·4	97·7	67·1	71·8	83	133	S E by S	—	10	Fine.
16	29·873	76·8	72·9	85·0	71·7	100·0	68·0	71·1	83	120	E by E	—	37	Flying clouds.
17	29·889	76·9	72·5	83·7	70·4	101·2	66·3	70·5	81	100	S S E	—	20	Hazy day. Fine night.
18	29·917	77·6	72·1	83·2	70·3	103·1	65·4	69·6	77	89	E S E	—	21	Chiefly fine.
19	29·954	77·4	71·1	81·7	69·9	101 2	64·6	68·1	74	161	N E	—	43	Frequently clouded.
20	29·982	79·8	73·2	83·4	76·5	101·8	70·9	70·2	74	219	NE by N	—	87	Overcast.
21	29·962	79·4	74·3	84·0	76·3	103·8	73·2	72·1	79	191	N E	—	89	Chiefly overcast.
22	29·975	78·2	71·8	82·2	74·5	100·1	70·0	68·8	74	170	NE by N	—	48	Light hazy clouds.
23	29·986	77·7	72·9	82·5	72·5	102·4	68·2	70·7	80	148	N E	—	60	Passing clouds.
24	30·024	74·9	68·7	80·5	66·7	99 9	59·9	65·5	73	131	N E	—	12	Fine.
25	29·994	73·5	66·9	80·2	65·3	99·6	58·3	63·2	72	124	N E	—	6	Do.
26	29·983	72·7	67·4	80·4	65·0	100·7	58·0	64·5	77	80	E N E	—	11	Hazy.
27	29·960	73·4	69·4	80·7	65·3	100 8	58·2	67·4	82	83	E N E	—	5	Fine.
28	29·941	74·7	70·6	81·2	65·1	101·7	57·3	68·7	83	92	E N E	—	10	Hazy.
Mean..	29·955	76·5	71·2	82·3	70·1	101·0	64·7	68·7	78	132	E by N	0·00	33	
Average..	29·968	76·9	70·8	83 8	69·7	100·1	64·5	67·9	75	130	E S E	0·05	23	
Difference..	—0·003	—0·4	+0·4	—1·5	+0·4	+0·9	+0·2	+0·8	+3	+2	3 Points N	—0·05	+10	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

March. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
1	29·919	75·0	71·1	84 9	68·2	108·5	61 2	69·2	83	82	S E	—	32	Cloudy morning : fine day.
2	29·865	76·2	71·7	84·8	68·3	103·6	61·8	69·6	81	103	S E	—	0	Fine.
3	29·812	78·3	74·0	86.1	68·4	101·7	61·4	72·2	82	127	S S E	—	11	Light haze.
4	29·833	79·7	74·5	86·0	71·7	103·7	66·1	73·7	80	138	S S E	—	15	Fine day : hazy night.
5	29·893	79·0	71·9	84 9	71·3	102·6	65·0	68·4	70	111	S E	—	11	Fine.
6	29 901	77·7	70 6	84·4	69·3	103·7	64·0	67·2	71	88	E by S	—	8	Fine.
7	29·875	78·3	70·2	85·5	68·7	104·5	62·7	66·3	68	91	E by S	—	0	Fine.
8	29·922	77·4	69·9	83 2	69·4	102·5	63·6	66 1	69	98	E	—	15	Fine day : flying clouds at night.
9	29·951	78·7	72·5	84·8	71 1	103·7	67·3	69·7	74	107	E	—	15	Light clouds.
10	29·913	80·2	74·8	86·2	72·3	105·4	68·2	72·5	78	102	E	—	25	Flying clouds.
11	29 868	80·3	75·7	86·3	74·2	106 0	70·5	73·8	81	101	E S E	—	37	Occasional clouds.
12	29·827	81·9	76·0	88·5	75·5	105·5	71·8	73·6	76	110	S S E	—	33	Fine with passing clouds.
13	29 812	82·7	76 0	87·8	75·9	102·7	72·3	73·2	74	130	S E by S	—	9	Fine.
14	29·833	82 2	76 7	88·8	75·6	104·2	72·3	74 5	78	137	S S E	—	12	Light hazy clouds.
15	29·899	82·4	76·2	88·1	76·1	105·4	71·9	73·7	76	91	S E	—	30	Frequently clouded.
Mean....	29·876	79·3	73·5	86·0	71·7	1 4·2	66 7	70·9	76	108	S E by E	0·00	17	
Average.	29·880	78·9	72·7	85·5	71·7	1020	66·4	69·9	75	138	S E	0·05	23	
Difference	—0·044	+0·4	+0·8	+0·5	0	+2·2	+0·3	+1·0	+1	—30	1 Point E	—0·05	—6	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

March. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
16	29·948	78·9	75·4	84·8	75·3	102·3	73·2	73·9	85	52	E S E	0·65	57	Chiefly overcast. Rain at 4½ and 8 to 9 A. M.
17	29·870	81·5	75·3	86·3	75 5	105·3	71·6	72·7	75	75	S E	—	20	Light clouds.
18	29·878	81·3	74·8	87·1	75·3	103·7	71·9	72 0	74	83	S E	—	10	Fine.
19	29·930	81·3	74·8	86·1	75·3	104·4	71·2	72·0	74	71	S E	—	41	Flying clouds.
20	29·930	81·2	76·1	87 3	74·7	107·5	71·6	74·0	80	79	S S E	0·02	33	Frequently clouded.
21	29·945	81·1	75·4	85·5	76·7	106·8	72·7	73 0	77	65	S E	—	76	Chiefly overcast.
23	29·935	80·3	75·9	86·2	76·5	109·8	74·0	71·1	74	127	N E by E	—	87	Chiefly overcast.
23	29·938	81·5	75 4	87·3	75·3	106·6	72·1	72·9	76	54	E	—	31	Fine with light haze.
24	29·945	81·0	75·2	87·5	74·6	106·4	70·5	72·8	77	59	S E	—	11	Fine.
25	29·924	81·4	75·4	88·2	73·6	104·4	69·0	72·9	76	68	S E by S	—	9	Light haze.
26	29·912	80·6	73 9	87·9	72.7	106·7	68 3	70·9	73	66	S S E	—	3	Fine.
27	29·873	80·0	74 7	87·6	72·8	105·5	66·8	72·5	79	58	S E	—	4	Fine.
28	29·865	81·2	74·5	88·4	72·5	106·5	67 0	71·6	74	88	S S E	—	6	Light clouds at night.
29	29·875	82·3	76·8	89·1	73·9	104·8	68·5	74·6	78	116	S S E	—	7	Fine.
30	29·868	82·3	76·6	88·4	74·5	103·2	70·4	72·8	74	116	S by E	—	9	Light haze.
31	29·868	81·4	75·8	88·5	74·2	104·3	68·2	73.5	78	115	S	—	19	Flying clouds.
Mean.....	29·907	81·1	75·2	87·3	74·6	105·5	70·4	72·7	77	81	S E	0·67	26	
Average.	29·886	80·9	74·9	87·5	74 2	102·8	69·0	72·4	76	144	S S E	0·32	28	
Difference	+0·021	+0·2	+0 3	—0·2	+0·4	+2·7	+1·4	+0·3	+1	—63	2 Points E	+0·35	—2	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

April. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction.			
	Inches.	°	°	°	°	°	°	°	Cents.	Miles.	Points.	Inches.	Cents.	
1	29·860	82·5	75·9	89·2	74·1	107·5	69·8	73·2	74	121	S	—	12	Light haze.
2	29·813	83·4	76·9	92·4	75·7	107·4	71·6	74·3	75	165	S	—	9	Fine day : hazy night.
3	29·746	83 8	77·5	91·7	75.7	104·6	71·6	75·0	76	189	S	—	15	Hazy.
4	29·710	84·7	78·3	91·3	77·9	104·6	71·8	75·9	76	205	S S W	—	24	Cloudy for several hours.
5	29·751	84 6	78·4	91·9	78·7	104·3	74 3	76·1	76	205	S	—	25	Light haze.
6	29·752	85·9	78·4	93·4	78·9	104·5	75·0	75·5	72	217	S by W	—	25	Fine : cloudy about sunset.
7	29·737	85·7	79·6	96·9	79·1	112·7	75·9	77·4	77	208	S S W	—	20	Hazy.
8	29·757	86·1	79 8	94·6	79·6	107·3	76·5	77·5	76	221	S	—	4	Fine.
9	29·833	85·1	79·1	92·1	79·7	102·5	77·4	76·9	77	189	S	—	14	Fine.
10	29·862	84·7	78·0	91·7	78·1	104·6	74·1	75 4	75	131	S S E	—	10	Fine.
11	29·829	84 1	77·8	90·9	75 7	103·8	71·9	75·4	76	124	S S E	—	5	Fine.
12	29·794	84·9	77·7	91·0	76·3	105·2	72·2	74.9	74	145	S E by S	—	13	Fine with passing clouds.
13	29·768	85·5	78·2	92·4	77·5	105·6	74·1	75·4	73	160	S E	—	11	Fine.
14	29·789	85·9	79·1	92·6	78·3	105·4	74·3	76·5	75	148	S E by S	—	10	Fine with flying clouds.
15	29·816	85·5	78·8	92·3	78·7	108·6	75 0	76·3	75	63	E S E	—	17	Passing clouds.
Mean ..	29·788	84·8	78·2	92·3	77·6	105·9	73 7	75·7	75	166	S by E	0·00	14	
Average.	29·843	83·1	77·0	90·0	77·4	105·9	71·8	74·6	76	173	S by E	0·16	26	
Difference	—0·055	+1·7	+·21	+2·3	+0·2	0·0	+1·9	+1·1	—1	—7	Same as	—0·16	—12	

160

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

April. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
16	29·810	84·7	78·1	91·5	80·5	109·6	77·0	75·6	75	100	E S E	—	30	Frequently clouded. Lightning at
17	29·805	85.5	78 1	91·3	79·1	107·5	76·7	75·3	72	83	S E	—	17	Occasionally cloudy. night.
18	29·788	85·7	78·9	92.5	77·7	110·6	74·5	76·3	75	53	E S E	—	34	Heavy passing clouds.
19	29·774	85·8	78·7	91·3	80·3	107·9	76·6	76·0	74	79	S by E	—	49	Heavy clouds. A few rain drops.
20	29·792	8·33	77·4	90·1	78·7	106·6	77·0	75·1	77	71	S by E	0·20	80	Cloudy. Rain at 6¾ A. M.
21	29·814	77·3	75·5	82·5	75·5	83·2	74·1	74·7	92	68	E S E	1 71	100	Steady rain after 6 A. M.
22	29·830	78·1	76·4	83·1	74·7	—	73·2	75·7	92	82	S S E	0·60	100	Overcast and rainy.
23	29·640	80·7	77·5	86·9	75·3	102·4	73·9	76·3	87	90	S S E	0·41	68	Overcast and showery.
24	29·823	78·2	75·9	87·0	74·9	101·8	73·6	74·9	89	119	S S E	2·10	68	Chiefly overcast. A thunder storm from West between 7 & 8 P. M.
25	29·779	79·7	76·8	90·6	73·7	108·3	72·2	75·7	88	98	S S W	0·03	53	Cloudy with light showers.
26	29·780	84·4	77·8	91·1	76·3	111·8	74·8	75·2	75	104	S S E	—	24	Light clouds.
27	29·764	8·56	80·7	94·0	79·0	113·2	76·3	79·0	81	108	S by E	—	15	Chiefly fine.
28	29·777	84.8	79·2	96·8	79·6	111·3	77·4	77·1	78	123	S	—	26	Fine with passing clouds.
29	29·753	86·6	80·4	96·8	77·9	112·1	76·6	78·2	76	141	S by W	—	20	Flying clouds before day break.
30	29·745	87·8	80·3	98·9	80·9	116·3	78·6	77·6	72	164	S by W	—	34	Flying clouds before day break.
Mean ...	29·792	83·2	78·1	91·0	77·6	107·3	75·5	76·2	80	99	S E by S	5·05	48	
Average.	29 806	84·0	77·6	91·0	78·4	107·8	75	75·1	75	174	S by E	05	34	
Difference	—0·014	—0·8	+0·5	0·0	—0·8	—0·5	—0·3	+1·1	+5	—75	2 Points E	+4·40	+14	

161

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

May. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
1	29·748	88·5	80·3	98·5	81·6	125·3	78·1	77·3	70	151	S by W	—	12	Light haze.
2	29·750	87·0	81·4	98·1	81·3	115·3	78·2	79·5	79	173	S	—	0	Fine.
3	29·742	86·9	80·3	96·7	80·7	115·3	77·0	77·9	75	160	S	—	0	Fine.
4	29·753	86·8	79·4	95·4	79·5	105·3	75·3	76·6	73	231	S	—	0	Fine.
5	29·725	87·3	79·9	93·6	79·5	105·3	76·6	77·2	73	219	S by E	—	5	Fine.
6	29·730	86·5	80·2	94·5	79·7	105·7	76·1	78·0	76	245	S by E	—	0	Fine.
7	29·758	86·6	80·4	94·5	80·3	107·1	77·7	78·2	76	228	S by E	—	3	Fine.
8	29·696	88·2	80·4	96·2	81·3	115·3	78·8	77·6	72	211	S	—	14	Hazy.
9	29·696	88·2	79·0	98·2	80·5	109·6	75·9	75·5	67	183	S	—	15	Fine day : cloudy night.
10	29·703	88·2	80·2	94·7	81·9	110·3	78·4	77·3	71	194	S by E	—	17	Fine day : cloudy night.
11	29·696	87·3	80·4	92·7	81·4	109·2	78·6	77·9	74	174	SS E	—	38	Cloudy and hazy.
12	29·690	87·4	82·1	92·3	82·2	105·2	79·3	80·3	80	124	S E	—	39	Cloudy and hazy.
13	29·694	86·2	79·3	94·4	80·7	112·2	77·8	76·7	74	79	E S E	—	76	Chiefly overcast.
14	29·705	86·3	79·3	92·2	79·7	108·2	76·4	76·7	74	74	E by S	—	97	Overcast.
15	29·710	85·3	79·9	92·9	81·6	112·2	78·5	78·0	79	81	E N E	—	71	Passing clouds. Rain drops after sunset.
Mean.....	29·721	87·1	80·2	95·0	80·8	110·8	77·5	77·7	74	168	S S E	0·00	26	
Average..	29·756	85·3	78·1	93·0	79·8	109·8	77·4	75·4	73	201	S	1·32	39	
Difference	—0·035	+ 1·8	+ 2·1	+ 2·0	+ 1·0	+ 1·0	+ 0·1	+ 2·3	+ 1	—33	2Points E	— 1·32	—13	

162

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

May. Second Half	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents.	Miles.	Points.	Inches.	Cents	
16	29·712	86·1	80·1	92·2	81·3	111·1	78·9	78·0	77	76	S E by E	0·12	51	Rain before sunrise Partly [fine.
17	29·679	87·5	79·4	93·4	80·3	107·4	76·8	76·4	71	141	S E	—	26	Light hazy clouds.
18	29·652	87·8	81·0	94·4	81·0	106·1	77·9	78·6	75	178	S S E	—	41	Hazy and cloudy.
19	29·681	87·3	78·8	95·5	81·5	112·8	78·6	75·6	69	169	S	—	37	Frequently cloudy.
20	29·690	87·3	78·0	98·4	80·9	113·4	77·6	74·4	66	192	S S W	—	43	Hazy clouds.
21	29·709	88·4	78·2	99·5	81·7	115·2	78·6	74·2	64	267	S S W	—	27	Light hazy clouds.
22	29·739	86·7	78·1	95·2	80·0	113·3	76·8	74·7	68	191	S	—	66	Cloudy.
23	29·738	87·5	76·9	99·3	80·5	115·1	77·5	72·6	62	173	S W	—	48	Passing clouds.
24	29·752	88·1	77·0	97·1	81·2	116·0	77·7	72·5	61	155	S W	—	32	Light clouds.
25	29·775	88·4	78·7	96·0	79·9	114·3	75·7	75·0	66	153	S	—	20	Light clouds.
26	29·773	86·3	76·6	98·7	80·4	115·4	75·6	72·6	65	144	S S W	—	34	Passing clouds.
27	29·736	88·4	77·3	101·4	79·7	116·1	76·1	72·8	61	168	S W by S	—	31	Passing clouds.
28	29·707	89·5	78·1	100·6	80·6	116·6	77·7	73·6	61	173	S by W	—	23	Chiefly fine.
29	29·691	89·5	79·1	100·9	81·6	112·9	79·3	75·2	64	189	S	—	35	Fine with occasional clouds.
30	29·664	91·4	77·1	99·8	82·4	117·9	80·3	71·2	53	118	S	—	47	Hazy clouds.
31	29·681	89·5	77·2	101·4	84·7	118·1	81·2	72·1	58	131	S W	—	70	Chiefly overcast.
Mean.....	29·708	88·1	78·2	97·7	81·1	113·9	77·9	74·3	65	169	S	0.12	39	
Average..	29·707	86·2	77·5	95·1	80·4	110·6	78·2	74·1	68	218	S W	1·60	47	
Difference	+ 0·001	+ 1·9	+ 0·7	+ 2·6	+ 0·7	+ 3·3	— 0·3	+ 0·2	—3	—49	2Points S	— 1·48	—8	

163

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

June. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers. Shade.		Sun.	Grass.	Deduced.		Wind.		Rain.	Clouds.	Weather.
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
1	29·631	89·1	78·8	102·0	81·4	116·0	78·1	74·9	64	171	S W	—	32	
2	29·654	88·7	78·5	95·5	81·2	111·9	76·7	74·5	64	190	S by W	—	15	Light clouds.
3	29·630	88·2	78·8	98·0	80·3	110·9	76·7	75·2	67	206	S	—	18	Light clouds.
4	29·662	91·1	77·6	101·3	82·4	112·1	77·4	72·1	55	176	S W by S	—	25	Hazy.
5	29·695	90·0	77·3	103·0	82·2	112·9	77·7	72·1	57	221	S S W	—	52	Passing clouds.
6	29·711	88·1	77·2	98·2	84·4	105·3	80·3	72·8	61	181	S S W	—	80	Fine morning ; cloudy after-
7	29·723	87·9	76·0	96·4	81·8	103·1	78 6	70·9	58	199	S W by S	—	94	Chiefly overcast. noon.
8	29·742	84·6	76·5	95·3	78·8	106·1	74·5	73·2	70	137	S S W	0·12	93	Overcast.
9	29·759	85·9	77·5	96·4	79·4	107·9	76·1	74·2	69	139	S S W	—	62	Overcast. Rain before 2½ A.M.
10	29·756	87·7	78·2	98·2	80·2	113·1	75·9	74·5	66	156	S by W	—	15	Dull day ; clear night.
11	29·728	88·1	78·3	100·9	79·5	102·2	75·9	74·5	65	154	S S W	—	43	A few passing clouds.
12	29·718	85·1	78·6	94·3	77·9	103·0	75·0	76·1	75	146	W S W	0·15	95	Cloudy.
13	29·734	86·2	76·0	97·4	80·6	110·7	77·7	71·7	63	136	S S W	0·12	85	Chiefly overcast. Rain from 2½ to 6 A.M.
14	29·710	87·1	76·1	97·2	79·4	113·9	75·0	71·5	61	160	W S W	0·07	72	Chiefly overcast. Rain at 4½ & 7½ P.M.
15	29·677	84·6	75·5	92·4	78·6	99·0	76·3	71·6	67	152	S W	—	100	Heavy clouds. Shower about 5 P.M.
Mean....	29·702	87·5	77·4	97·8	80·5	108·5	76·8	73·3	64	168	S S W	0·46	59	Overcast.
Average..	29·692	86·6	76·7	95·8	80·7	109·8	78·2	72·7	64	230	S W	0·92	60	
Difference	+ 0·010	+ 0·9	+ 0·7	+ 2·0	— 0·2	— 1·3	— 1·4	—0·6	0	62	2 Points S	— 0·46	—1	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

June. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers. Shade.		Sun.	Grass.	Deduced.		Wind.		Rain.	Clouds.	Weather.
		Dry.	Wet.	Max	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
16	29·729	80·3	73·9	85·9	77·4	89·0	74·1	71·1	74	114	W S W	0·12	100	Rain at 8 A. M. Overcast.
17	29·694	85·3	75·6	95·0	76·6	104·0	73·8	71·5	65	162	S W	—	97	Chiefly overcast.
18	29·680	88·6	74·3	96·1	79·4	105 9	76·3	67·8	52	189	S W	—	88	Frequently overcast.
19	29·678	89·9	73·6	96·1	82·2	103·5	78·6	65·9	46	230	W S W	—	90	Chiefly overcast.
20	29·667	88·9	74·2	94·1	83·2	99·7	77·9	67·4	51	237	S W by W	—	95	Overcast.
21	29·652	90·0	73·6	97·2	81·2	105·0	77·0	65·8	46	209	S W by S	—	82	Chiefly overcast.
22	29·678	89·1	75·6	99·4	82·2	111·0	75·4	69·7	54	215	S W	—	80	Cloudy. Lightning.
23	29·714	87·8	75·9	100·2	81 9	112·0	77·5	70·8	58	184	S W	—	65	Cloudy.
24	29·736	85·1	76·4	98·2	78·8	109·8	79·4	72·8	68	215	S W	0·30	73	Chiefly overcast. Thdr. storm at 8½ P.M.
25	29·699	87·1	75·7	100·0	77·6	109·7	75·2	70·8	60	181	S S W	0·18	70	Chiefly overcast. Thdr. storm at 8 P.M.
26	29·679	88·2	73·8	94·7	79·4	105·1	76·8	67·1	51	212	W S W	—	74	Cloudy. Lunar halo.
27	29·646	88·1	74·1	97·3	81·5	107·9	78·6	67·7	52	206	S W by W	—	87	Overcast. Light showers.
28	29·656	86·4	76 9	98·2	81·2	107·9	77·0	73·0	65	193	S S W	—	78	Chiefly cloudy. Showery.
29	29·680	86·3	76·9	99·5	80·4	111·9	76·8	73·1	66	196	S S W	0·01	60	Frequently clouded.
30	29·692	87·5	76·9	100·1	81·7	114·6	78·4	72·5	62	206	S W by S	—	55	Flying clouds.
Mean	29·685	87·2	75·2	96·8	80·3	106·5	76·8	69·8	58	197	S W	0·61	80	
Average..	29·704	85·0	76·1	93·7	79·4	109·5	77·9	72·4	67	235	S W	1·29	70	
Difference	— 0·019	+ 2·2	— 0.9	+ 3·1	+ 0·9	— 3·0	— 1·1	— 2·6	—9	— 38	Same as	—0·68	+10	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

July. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced		Wind.		Rain.	Clouds.	Weather.
				Shade.		Sun.	Grass.	Dew Point.	Humidity.	Velocity.	Direction.			
		Dry.	Wet.	Max.	Min.	Max.	Min.							
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
1	29·696	85·8	76·3	100·1	81·8	111·0	78·6	72·3	65	217	S WbyW	0·10	60	Hazy clouds. Rain at 8½ P.M.
2	29·670	87·9	76·3	100.1	79·4	112·0	75·6	71·4	59	193	S W	0·07	67	Cloudy. Rain between 4 and 6 P. M.
3	29·666	90·9	75·3	99·1	80·9	110·0	76·6	68·3	49	180	S WbyW	—	61	Cloudy.
4	29·695	84·8	76·8	99·3	82·4	108·1	78·6	73·6	70	201	S W	0·34	65	Cloudy. Rain at 4 and 6½ P.M.
5	29·719	85·2	75·5	98·8	80·4	109·9	77·6	71·3	65	177	S S W	0·03	70	Passing showers after 4 P.M.
6	29·687	84·3	75·5	97·9	79·6	111·9	75·6	71·8	68	142	S S W	0·14	84	Rain after 10 P. M.
7	29·659	81·5	75·5	90·5	76·9	102·1	75 3	73·0	76	136	S W	0·34	100	Overcast. Rain at 2½ A. M. and 9 P. M.
8	29·636	80·9	76·4	91·9	75·7	102·9	73·6	74·6	82	101	S WbyW	0·04	90	Overcast. Shower at 4 P. M.
9	29·671	79·8	76 3	93·1	76·5	104·9	75 6	74·9	85	137	S S W	2·25	80	Overcast. Steady rain after 4 P. M.
10	29·719	82·3	76·9	91·1	75·6	104·9	74·8	74·7	79	150	S	0·11	88	Chiefly overcast. Shower at 9½ P. M.
11	29·732	83·5	77·9	91·3	76·6	107·9	73·7	75·7	78	131	S S W	0·36	47	Thunder storm at 11½ P.M.
12	29·757	82·5	76·4	91·9	75·3	112·5	74·2	73·9	77	120	S WbyW	0·13	53	Chiefly fine. Shower at 11½ P M.
13	29·768	84·7	77·0	92·2	78·5	111·8	74.6	73·9	71	125	S	—	47	Flying clouds: fine night.
14	29 791	82·8	78·3	92·4	78·4	109·9	73·6	76·6	82	105	S	—	65	Flying clouds.
15	29·784	78·9	75·5	82·3	73·2	—	70·5	74·1	85	132	W S W	2·39	100	Thunder storm about 2 A. M. & rain until sunrise. Overcast.
Mean...	29·710	83·7	76·4	94·1	78·1	108·6	75·2	73·4	72	150	S W	6·30	71	
Average..	29·708	84·3	76·0	92·6	78·8	107·0	76·8	72·6	69	215	S W	1·93	74	
Difference	+ 0·002	— 0·6	+ 0·4	+ 1·5	— 0·7	+ 1·6	— 1·6	+ 0·8	+3	—65	1 Point S	+ 4·37	—3	

July 9th.—A sharp thunder storm from the North West about 6½ P. M.

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

July. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.	Dew Point.	Humidity.	Velocity.	Direction			
		Dry.	Wet.	Max.	Min.	Max.	Min.							
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
16	29·772	84·0	76·8	91·0	77·1	105·8	74·6	73·9	73	136	S S W	—	55	Dull and hazy.
17	29·760	84·1	75·1	93·1	77·1	100·9	74·0	71·2	66	144	S WbyW	—	75	Dull and hazy.
18	29·713	85·3	75·4	94·5	77·1	102·8	70·7	71·1	64	162	W S W	—	54	Hazy.
19	29·655	85·4	76·8	95·3	77·2	109·9	73·7	73.3	68	155	S W	—	52	Passing clouds. Fine night.
20	29·669	85·3	76·4	92·9	77·5	107·7	70·1	72·8	67	159	SW S	—	19	Chiefly fine.
21	29·655	86·9	77·0	95·0	81·4	112·0	77·1	73·0	64	163	S W	—	41	Passing clouds. Wind very variable.
22	29·661	83·5	76·6	89·7	77·6	97·9	74·8	73·8	73	138	W	0·13	94	Frequent showers before 9 A. M.
23	29·665	78·5	75·2	83·1	75·6	—	73·9	73·9	86	156	S WbyS	0·54	95	Heavy rain before 2 A. M. Showery
24	29·654	82·7	75·3	89·1	76·4	98·7	73 8	72·2	72	141	S WbyW	0·02	100	Overcast. [and dull.
25	29·633	84·8	74·8	90·9	78 2	100·8	75·2	70·4	63	186	W by S	—	93	Overcast.
26	29·657	84·0	75·1	90·8	79·4	98·8	75·8	71·3	67	130	W S W	—	100	Overcast.
27	29·668	84·5	74·9	91·9	78·6	98·6	73·6	70·7	64	162	W by S	0·06	84	Cloudy.
28	29·689	85·1	75·6	94·3	78·2	104·6	73·3	71·6	65	173	S W	—	72	Cloudy.
29	29·732	85·9	76·0	94·3	78·4	102·8	73·7	71·8	64	134	S S W	—	73	Passing clouds.
30	29·721	85·6	77·5	96·0	78·9	99·8	74·0	74·3	70	141	S by W	0·02	70	Chiefly overcast. Thunder shower be-
31	29·738	87·2	76·2	96·0	78·6	106·9	74·9	71·6	61	167	S W by S	—	64	Passing clouds. [fore midnight
Mean...	29·690	84·5	75·9	92·4	78·0	103·2	74·0	72·3	68	153	S W	0·77	71	
Average..	29·721	83·9	75·6	91·9	78·4	105·9	76·2	72·1	69	207	SW by W	1·98	77	
Difference	—0·031	+0·6	+0·3	+0·5	—0·4	—2·7	—2·2	+0·2	—1	—54	1 Point S	—1·21	—6	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

August. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers. Shade.		Sun.	Grass.	Deduced. Dew Point.	Humidity.	Wind. Velocity	Direction	Rain.	Clouds	Weather.
		Dry.	Wet.	Max.	Min.	Max.	Min.							
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
1	29·773	86·1	76·8	94·5	78·6	108·9	72·9	73 0	66	168	S S W	0·01	49	Flying clouds. Shower at 11 P. M.
2	29·788	83·9	75·8	96·4	77·4	108·9	73·6	72·4	70	151	S W by S	—	59	Cloudy. Thunder and lightning.
3	29·748	84·6	76 7	95·2	76·6	106·4	72·8	73 5	70	174	S W	—	70	Cloudy.
4	29·741	81·9	74·6	92·0	77·5	109·9	71·9	71·5	72	122	S S W	0·08	82	Nearly overcast. Rain at 2½ P M.
5	29·760	78·0	74·1	92·5	76·0	109 1	73·0	72·4	83	130	S S W	0·74	83	Nearly overcast. Frequent rain.
6	29·737	82·2	76·4	91·2	75·6	108·9	72·8	74·1	78	135	S W	0 05	87	Nearly overcast. Shower at 5½ P. M.
7	29·727	83·2	78·2	92·5	76·9	105 1	73 4	76·3	80	150	SW byW	0·48	68	Chiefly overcast. Rain at 5, 6 & 10½ P.M.
8	29·750	82·4	75·9	89·2	76·4	101·9	73·1	73 2	74	149	W S W	—	94	Overcast.
9	29·749	81·4	74·2	92·1	77·3	103·7	73·7	71·1	72	165	SWbyW	0·23	100	Overcast. Rain from 8 to 9 P. M.
10	29·727	82 2	75·6	91·5	76·5	103·1	72·9	72·8	74	136	W S W	0 08	84	Chiefly overcast. Rain at 10 P. M.
11	29·687	80·8	74·4	84·5	76·3	—	71·7	71 6	75	115	W by S	0·04	100	Overcast. Shower at 10 P. M.
12	29·643	85·1	74·3	93·6	76·4	104·9	72·0	69·5	61	181	W S W	—	67	Heavy passing clouds.
13	29·680	84·9	74·5	93·3	77·4	103·7	73·3	69·9	62	191	SW byW	0 01	78	Cloudy. Shower at 6¾ P. M.
14	29 694	86·4	74 8	94·1	77·2	104·7	72·7	69·7	59	168	W S W	—	74	Chiefly overcast.
15	29 694	85 1	74 2	95·9	78·8	107·9	72·7	69·3	60	167	S W	0·03	66	Cloudy. Showers at 5½ and 10 P. M.
Mean....	29·727	83·2	75·4	92·6	77·0	106·2	72·8	72·1	70	153	S W	1·75	77	
Average..	29·749	83·5	76 0	91·6	78·1	105·8	74·2	72·9	71	162	S W by S	2·08	72	
Difference	−0·022	−0·3	−0·6	+1·0	−1·1	+0·4	−1·4	−0·8	−1	−29	1 Point W	−0·33	+5	

168

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

August. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers. Shade.		Sun.	Grass	Deduced. Dew Point	Humidity.	Wind. Velocity.	Direction	Rain.	Clouds	Weather.
		Dry.	Wet	Max.	Min.	Max.	Min.							
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
16	29·692	85·2	75·2	96·1	79·0	108·1	74·7	70·9	64	168	S W	0·09	72	Flying clouds. Showery. evening.
17	29·710	83·3	75·9	93·1	77·8	104·0	74·6	72 9	72	170	S S W	0·41	74	Cloudy. Rain at 5½ A.M. & between 8½ & 11
18	29·740	83·5	76·3	94·9	76·0	105·9	72·5	73·4	73	164	S S W	0·29	63	Passing clouds. Rain at 5½ P.M. [P.M.
19	29·771	83·8	77·6	90·9	76·3	109 8	72·7	75·2	76	135	S	—	45	Partly fine. Cloudy night.
20	29·797	83·6	77·6	92·4	76·6	109·1	73·4	75·3	77	141	S W	0·26	57	Rain before sunrise and at 5¾ P M.
21	29·789	83·2	77·3	91·8	79·2	107·7	73·9	75·0	77	136	S by W	0·01	59	Light showers.
22	29·773	84·5	77·9	93·3	78·2	108·1	74·5	75·3	75	146	S W by S	0·09	39	Chiefly fine. Shower at 11½ P. M.
23	29·791	84·6	77·2	92·3	77·4	112·7	73·4	74·3	72	136	S	—	44	Chiefly fine.
24	29·803	85·2	77·0	91·2	77·6	109·1	72 5	73·7	69	125	S S E	—	28	Chiefly fine.
25	29·805	84·9	78·1	92·3	79·4	113·6	74·7	75·5	75	118	S S E	—	50	Light clouds. [10½ P. M.
26	29·788	83·3	76·2	93·1	78·4	115·6	73·7	73·1	71	113	S S W	0·16	50	Fine morning; cloudy night. Rain at
27	29·786	82 2	77·9	91·2	75·6	103·1	73·8	76·3	83	132	S S W	0·08	50	Shower at 1 A. M. Fine day.
28	29·758	84·7	78·0	92·1	78·6	112·1	75·4	75 4	75	138	S S E	—	35	Passing clouds. Fine night.
29	29·729	85·2	78·5	92·1	78·7	110·1	75·4	76 0	75	134	S S E	—	22	Chiefly fine.
30	29·726	82·6	76·3	94·1	76·6	112·9	72·7	73·7	76	129	N	—	65	Hazy clouds.
31	29·719	84·3	76 8	92·8	77·9	110·7	75·9	73·8	71	124	S S E	—	50	Light clouds.
Mean....	29·761	84·0	77·1	92·7	77·7	109·5	74·0	74·4	74	138	S by W	1·39	50	
Average..	29·753	82·8	75·8	90·3	77·7	105·8	74·4	72·9	73	175	S W	1·78	71	
Difference	+0·008	+1·2	+1·3	+2·4	0·0	+3·7	−0·4	+1.5	+1	−37	3 Points S	−0·39	−21	

169

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

September. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents.	Miles.	Points.	Inches.	Cents.	
1	29·695	83·5	77·1	91·6	78·2	112·0	73·7	74·6	75	117	SW	—	67	Cloudy.
2	29·687	85·1	77·1	89·4	78·2	96·7	76·1	73·9	70	146	S W	0·05	85	Nearly overcast. Shower at 10¾ P. M
3	29·727	77·6	73·8	83·2	74·3	—	72·4	72·1	84	170	W S W	0·75	100	Rain from 1½ to 9 A. M. Thun. & lghtg.
4	29·712	80·6	76·3	86·2	76·2	92·0	74·4	74·6	83	73	SWbyW	0·01	96	Overcast. Fall before sunrise. & lghtg.
5	29·691	79·5	75·3	83·4	76·0	87·2	73·3	73·6	82	78	W S W	0·27	100	Rain at 2½ & 6¼ A. M. Overcast.
6	29·709	78·9	75·1	83·4	76·1	88·0	74·6	73·5	84	111	S W	0·19	100	Overcast. Rain from 6 to 10 P. M.
7	29·712	79·5	74·0	86·6	75·2	96·0	72·4	71·6	77	114	S WbyW	—	100	Overcast.
8	29·745	82·4	75·8	90·5	75·9	103·0	72·4	73·0	74	128	SWbyW	0·02	90	Nearly overcast.
9	29·731	84·4	76·4	91·3	75·6	102·9	71·6	73·1	70	119	S W	—	76	Chiefly overcast.
10	29·720	84·9	75·4	91·9	77·8	101·7	72·4	71·3	65	135	W S W	0·02	93	Chiefly overcast.
11	29·738	84·3	76·0	91·4	76·6	100·0	73·7	72·6	69	133	S WbyW	0·10	91	Rain about 1 A. M. Overcast.
12	29·810	83·5	75·8	91·7	77·4	102·0	73·7	72·6	71	160	S S W	0·02	82	Chiefly overcast.
13	29·839	82·0	76·8	91·7	77·4	106·0	73·8	74·7	79	155	S S W	—	65	Cloudy.
14	29·832	81·0	77·2	88·4	74·3	95·7	71·8	75·7	85	168	S S W	0·34	75	Rain from 2 to 4 A. M. Dull day. Fine evening.
15	29·788	84·1	75·6	92·6	76·2	105·0	73·6	72·0	68	157	S W	0·06	34	Fineday-Cloudy night-Shower at 11 P. M
Mean. ...	29·742	82·1	75·8	88·9	76·4	99·2	73·3	73·3	76	131	S W	1·83	84	
Average..	29·763	82·9	75·7	90·5	77·8	102·8	74·5	72·7	72	168	S W by S	2·03	68	
Difference	—0·021	—0·8	+0·1	—1·6	—1·4	—3·6	—1·2	+0·6	+4	—37	1 Point W	—0·25	+16	

170

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

September. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
16	29·759	85·1	76·6	93·3	75·6	104·7	72·7	73·1	68	151	SW byW	—	37	Fine with flying clouds.
17	29·755	81·3	75·7	85·8	72·9	93·0	71·4	73·4	78	111	W by S	0·88	93	Rain till 9¼ A. M. Overcast.
18	29·769	80·0	75·0	87·1	76·4	99·5	73·5	72·9	80	131	S W byW	009	92	Shower at 1¼ A. M. Chiefly overcast
19	29·754	85·3	76·0	91·6	76·8	102·1	72·8	72·1	66	145	W by S	—	55	Passing clouds.
20	29·709	86·0	74·9	93·5	78·5	106·0	72·9	70·0	60	175	S W byW	—	43	Fine with passing clouds.
21	29·705	84·0	73·5	90·2	77·7	102·0	73·5	68·7	61	171	W S W	0·03	89	Chiefly overcast.
22	29·710	82·9	72·3	87·2	76·5	96·0	72·8	67·2	61	196	W	—	100	Overcast.
23	29·716	85·3	74·4	92·4	79·3	101·0	74·4	69·6	60	147	W	—	74	Cloudy.
24	29·747	87·7	74·9	95·6	78·4	110·3	71·7	69·2	56	150	W by N	—	64	Passing clouds.
25	29·732	88·3	73·7	97·4	80·7	112·1	75·5	66·8	50	144	W by S	—	54	Passing clouds.
26	29·747	86·1	76·3	96·4	78·5	116·3	73·7	72·2	65	165	S S W	—	47	Light clouds.
27	29·766	86·4	77·2	94·8	77·7	117·2	74·3	73·5	66	150	S	—	20	Chiefly fine.
28	29·751	86·0	77·0	95·3	78·9	117·0	74·9	73·4	67	121	S by W	—	34	Flying clouds.
29	29·762	85·7	76·2	95·4	79·3	116·1	75·3	72·2	65	145	S	—	55	Partly fine. Thunder & lightning at 10 P. M.
30	29·749	85·7	78·4	93·4	77·7	104·1	73·8	75·6	73	139	S	0·21	88	Rain after midnight. Day nearly overcast.
Mean ...	29·742	85·1	75·5	92·6	77·7	106·5	73·5	71·4	65	149	SWbyW	1·21	63	
Average..	29·796	82·2	76·1	89·1	77·1	106·6	74·1	73·6	76	136	S S W	2·20	62	
Difference	—0·054	+2·9	—0·6	+3·5	+0·6	—0·1	—0·6	—2·2	—11	+13	3 Points W	—0·99	+1	

171

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

October. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds.	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction.			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
1	29·723	85·7	73·3	96·5	77·6	112·1	73·9	75·5	73	155	by W	—	62	Cloudy.
2	29·725	85·9	77·2	95·8	79.0	111·3	74·6	75·7	68	160	Variable	—	91	Overcast and stormy. [illegible]
3	29·752	83·3	75·2	93·1	75.8	104·3	71·9	71·7	70	157	S W	0·99	93	Thunder storm from 11¾ P. M. to 1¾ A. M. Overcast.
4	29·758	84·3	75·8	94·0	77·8	114·3	73·5	72·2	68	154	S SW	—	65	Chiefly overcast.
5	29·734	85·3	75·2	93·7	77·6	105·9	72·9	70·9	63	140	S W	—	70	Cloudy.
6	29·735	84·5	77·1	95·3	77·4	112·1	73·2	74·2	72	145	by E	—	44	Cloudy. Clear night.
7	29·779	84·4	76·5	95·0	77·4	110·2	73·6	73·3	70	132	S	—	22	Light clouds.
8	29·813	85·9	76·8	92·8	78·4	114·2	73·1	73·1	67	107	S E by S	—	10	Fine.
9	29·836	84·0	77·7	92·8	78·8	111·4	74·1	75·3	76	108	S S E	—	19	Light haze.
10	29·820	84·8	77·5	91·5	77·6	107·7	73·4	74·6	72	123	S E	—	23	Light clouds.
11	29·841	84·5	77·0	90·2	77·9	107·5	74·7	74·0	71	103	S E	—	22	Chiefly fine.
12	29·866	83·7	76·3	89·7	77·1	109·0	72·9	73·3	72	96	E by S	—	43	Passing clouds.
13	29·855	83·3	76·6	91·3	78·9	115·2	75·4	73·9	74	108	N N E	—	70	Heavy clouds.
14	29·868	75·9	73·8	78·4	75·6	81·4	72·6	72·9	91	115	N W	3·22	90	Overcast. Rain from [illegible] A. M. to [illegible] P. M.
15	29·846	77·0	75·6	83·4	74·9	107·2	73·9	75·0	94	84	N N W	1·10	91	Overcast. Rain at 7 A. M. and at 5 P. M.
Mean	29·797	83·5	76·4	91·6	77·5	108·3	73·6	73·5	73	126	S by E	5·31	54	
Average...	29·822	80·8	76·0	86·5	75·9	107·7	73·5	74·1	81	122	S by E	5·08	58	
Difference	−0·025	+2·7	+0·4	+5·1	+1·6	+0·6	+0·1	−0·6	−8	+4	Same.	+0·23	−4	

October 2nd and 3rd. A thunder storm from 11¾ P. M. to 1¾ A. M. with vivid and almost incessant lightning. The wind remarkably unsteady all the time, vering through more than a complete revolution each way—retrograde and direct.

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

October. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds.	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction.			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
16	29·853	81·1	77·1	84·9	75·9	107.2	74·2	75·5	48	106	N	0·23	77	Rain at 6½ A. M. & 10½ P. M.
17	29·798	77·6	75·2	82·5	75·7	99·7	74·2	74·2	89	99	N by W	1·33	56	Rain, chiefly before 4 A. M.
18	29·767	80·7	76·6	85·7	74·6	107·2	71·6	75·0	84	137	N by E	—	54	Passing clouds.
19	29·682	79·6	76·0	82·7	76·7	86·2	72·8	74·5	85	349	N E	0·87	95	Stormy. Rain at 5 A. M. and 8½ P. M.
20	29·797	76·4	74·8	83·8	74·9	100·2	72·6	74·1	93	185	S E by S	2·57	95	Rain; heaviest at 6 A. M.
21	29·888	76·2	75·2	82·6	74·3	94·2	72·4	74·8	96	115	S S E	3·81	99	Overcast. Heavy steady rain.
22	29·885	77·2	75·2	81·5	73·4	95·2	72·6	74·4	91	52	Variable	0·07	100	Overcast. Shower at 10¼ A. M.
23	29·872	76·7	73·9	82·0	71·7	98·2	71.6	72·7	88	111	N	1·41	85	
24	29·837	78·4	74·3	83·3	73·2	95·3	71·4	72·5	83	125	N N W	0·02	75	Chiefly overcast. Rain from 4½ to 11½ A. M.
25	29·827	75·4	73·9	76·4	73·1	77·3	71·3	733	93	98	S W	1·45	100	Chiefly overcast. Overcast; raining till 1½ P. M.
26	29·794	79·2	75·4	85·4	73·9	99·3	73·2	73·8	84	61	S W by W	—	75	Passing clouds.
27	29·769	80·0	75·3	86·3	75·2	111·5	72·3	73·3	81	96	S E	—	8	Fine.
28	29·849	80·8	77·0	87·3	76·6	111·3	73·2	75·5	85	86	E	—	10	Fine.
29	29·886	81·0	75·0	86·3	76·9	105·8	73·4	72·5	76	107	N by E	—	27	Passing clouds.
30	29·889	79·6	75·3	85·2	75·1	108·5	70.4	73·5	82	74	N	—	23	Light clouds.
31	29·854	80·3	75·1	84·8	74·6	106·2	69·4	72·9	79	83	N N E	—	27	Nearly fine.
Mean.....	29·838	78·7	75·3	83·8	74·7	100·2	72·3	73·9	86	118	N E by E	11·78	63	
Average..	29·873	79.0	74·5	84·2	74·3	100·7	71·8	72·6	82	129	N E	7.87	58	
Difference	−0·045	−0·3	+0·8	−0·4	+0·4	−0·5	+0·5	+1·3	+4	−11·1	Point E	+·91	+5	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

November. First Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry	Wet.	Max.	Min	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents.	
1	29·853	80·4	75·7	85·3	75·9	104·9	71·9	73·7	81	140	N N E	—	36	Flying clouds.
2	29·878	79·2	70·6	83·6	75·0	100·2	71·3	66·3	66	171	N N E	—	20	Fine.
3	29·902	76·9	69·3	83·4	69·8	102·3	64·6	65·4	69	148	N N E	—	17	Light haze.
4	29·891	75·5	68·0	82·9	69·7	102·1	60·3	64·0	69	114	N	—	14	Fine.
5	29·848	77·0	68·3	83·5	67·7	101·3	66·6	63·6	65	100	N	—	5	Fine.
6	29·849	78·8	71·6	83·9	72·6	105·3	65·5	68·2	71	124	N N E	—	49	Overcast till sunrise.
7	29·886	78·6	71·7	83·8	71·5	102·4	64·6	68·4	72	126	N N E	—	13	Fine.
8	29·908	78·6	70·8	83·5	71·7	103·5	65·1	67·0	69	136	N N E	—	14	Fine.
9	29·912	78·3	71·1	83·5	72·9	102·4	66·6	67·6	71	115	N E by N	—	49	Fine after sunrise.
10	29·935	77·8	71·2	82·8	71·1	104·6	64·7	63·0	73	120	N E by N	—	14	Fine.
11	29·942	76·9	71·1	83·0	70·5	104·9	63·9	68·3	76	106	N N E	—	14	Fine.
12	29·919	76·1	70·8	83·7	71·8	103·8	65·6	68·3	78	91	N N E	—	15	Fine.
13	29·900	76·8	71·4	84·8	69·5	105·4	63·4	68·9	77	77	N N E	—	0	Fine.
14	29·892	79·6	73·5	86·5	72·9	110·4	67·3	70·8	76	73	N	—	4	Fine.
15	29·919	79·8	74·5	84·7	74·1	107·8	68·2	72·2	79	100	E	—	31	Fine after sunrise.
Mean. ...	29·896	78·0	71·3	83·9	71·8	104·1	65·9	68·1	73	116	N N E	0·00	20	
Average.	29·914	77·6	72·1	82·3	73·1	102·1	69·5	69·6	77	140	N N E	6·28	60	
Difference	−0·018	+0·4	−0·8	+1·6	−1·3	+2·0	−3·6	−1·5	−4	−24	Same.	−6·28	−40	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

November. Second Half.	Mean Pressure reduced to 32°	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction			
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points.	Inches.	Cents	
16	29·939	77·3	75·1	83·5	73·9	106·0	65·8	74·2	90	80	NE	0·55	62	Cloudy and showery.
17	29·934	79·1	75·5	83·0	74·9	100·7	70·5	74·0	85	123	NNE	0·32	93	Nearly overcast. Rain after 5 P.M.
18	29·956	79·4	76·1	82·1	74·1	95·1	72·2	74·8	86	170	N by W	0·26	97	Overcast with light showers.
19	29·983	77·3	73·8	82·9	76·5	99·6	74·2	72·3	85	183	NE by E	0·42	80	Overcast. Rain at 4½ and 7 P.M.
20	29·969	79·7	74·3	83·5	75·5	103·4	71·6	72·0	78	162	NE	0·01	60	Cloudy with light showers.
21	29·978	79·4	72·7	83·5	76·5	103·3	72·5	69·6	73	192	NE	0·02	49	Passing clouds.
22	29·999	77·4	69·7	82·2	71·7	101·6	65·9	65·8	69	138	NNE	—	35	Passing clouds.
23	30·003	75·9	73·4	82·4	70·3	103·6	63·7	72·3	89	98	N	0·09	63	Cloudy. Rain at 7¼ A.M.
24	30·005	77·5	72·9	82·9	72·5	105·0	68·7	70·8	81	115	NNE	0·01	50	Flying clouds.
25	29·993	78·3	72·2	83·0	73·2	103·6	70·7	69·4	75	140	N E by N	0·01	40	Flying clouds.
26	29·972	78·0	72·0	82·2	72·4	101·9	65·4	69·2	75	130	NNE	—	45	Fine with flying clouds.
27	29·958	76·8	70·6	82·1	71·3	101·5	65·4	67·6	74	131	NNE	—	36	Fine with flying clouds.
28	29·975	77·8	71·1	82·5	70·5	103·4	64·7	67·9	73	148	NNE	—	27	Flying clouds.
29	29·975	77·6	70·7	82·5	70·9	99·6	65·1	67·3	72	188	N by E	—	28	Flying clouds.
30	29·952	77·7	70·3	81·6	73·9	100·4	70·5	66·7	70	243	NNE	0·34	82	Rain at 1½ A.M. Chiefly overcast.
Mean.	29·973	77·9	72·7	82·7	73·2	101·9	68·5	70·3	78	149	NNE	2·03	56	
Average..	29·950	76·2	71·1	81·1	71·7	97·5	68·8	68·7	78	176	NNE	5·52	55	
Difference	+0·023	+1·7	+1·6	+1·6	+1·5	+4·4	−0·3	+1·6	0	−27	Same.	−3·49	+1	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

December First Half.	Mean Pressure reduced to 32 °.	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind.		Rain.	Clouds	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity.	Velocity.	Direction	Rain.	Clouds	Weather.
	Inches.	°	°	°	°	°	°	°	Cents	Miles.	Points	Inches.	Cents.	
1	29·897	73·7	72·0	76·4	71·7	77·8	69·3	71·2	92	228	N	2·38	100	Overcast. Rain after sunrise.
2	29·955	75·0	73·3	77·0	72·0	77·0	71·1	72·5	92	182	N E	1·92	100	Overcast. Rain, heaviest about noon
3	29·883	75·4	73·8	79·6	73·5	92·5	71·7	73·1	93	113	N E	1·55	100	Overcast. Rain, chiefly before sunrise
4	29·982	72·6	71·4	74·0	71·9	74·0	71·5	70·9	94	104	N	5·48	100	Heavy rain nearly all day.
5	29·998	73·5	71·5	76·4	71·6	76·4	70·9	70·6	91	103	N N W	1·98	100	Rainy and overcast.
6	29·964	76·3	71·6	79·6	73·0	99·8	72·5	69·4	80	154	N E	0·03	90	Chiefly overcast and showery.
7	29·968	75·5	70·8	79·6	70·0	100·8	65·7	68·5	80	102	N E	—	20	Fine.
8	30·001	73·9	70·8	78·9	68·9	99·2	64·5	69·3	87	98	N E	—	17	Light clouds.
9	30·024	74·4	67·0	79·0	67·0	99·4	61·0	62·9	69	105	N E	—	40	Cloudy at intervals.
10	30·022	74·3	67·5	79·0	69·5	100·6	63·8	63·8	71	115	N	—	31	Light flying clouds.
11	30·012	75·3	68·7	79·6	69·0	101·5	64·2	65·3	72	115	N N E	—	43	Flying clouds.
12	30·032	75·1	69·4	79·6	68·3	98·5	62·6	66·5	76	144	N E by N	—	40	Flying clouds.
13	30·037	74·4	69·0	79·6	70·0	99·3	65·6	66·3	76	151	N N E	—	20	Light clouds.
14	30·027	74·3	68·2	79·6	66·7	98·7	61·6	65·0	74	141	N E by N	—	30	Flying clouds.
15	30·015	74·8	68·5	79·8	67·6	99·3	59·8	65·2	73	160	N E by N	—	30	Flying clouds.
Mean. ..	29·994	74·6	70·2	78·5	70·0	93·0	66·4	68·1	82	134	N N E	13·34	54	
Average.	29·957	75·3	70·3	80·1	70·8	97·4	66·9	67·9	79	164	N N E	3·98	55	
Difference.	0·037	—0·7	—0·1	—1·6	—0·8	—4·4	—0·5	+0·2	+3	—30	Same.	+9·36	—1	

Daily Results of Meteorological Observations made at the Madras Observatory in the year 1863.

December Second Half.	Mean Pressure reduced to 32 °	Corrected Mean Temperature.		Self-Registering Thermometers.				Deduced.		Wind		Rain.	Clouds.	Weather.
				Shade.		Sun.	Grass.							
		Dry.	Wet.	Max.	Min.	Max.	Min.	Dew Point.	Humidity	Velocity.	Direction.	Rain.	Clouds.	Weather.
	Inches.	°	°	°	°	°	°	°	Cent.	Miles.	Points.	Inches.	Cents.	
16	30·009	74·8	68·4	79·9	68·8	100·7	62·6	65·0	73	124	N E by N	—	19	Chiefly fine.
17	29·986	72·6	67·1	78·6	67·5	99·6	58·4	64·1	76	116	N N E	—	20	Fine with flying clouds.
18	30·031	73·5	67·9	79·4	65·2	100·5	57·4	64·9	76	120	N E by N	—	24	Fine with flying clouds.
19	30·035	74·4	67·8	79·5	70·4	98·5	62·6	64·2	72	150	N N E	—	19	Fine with flying clouds.
20	30·039	75·0	68·7	79·3	69·8	99·6	65·1	65·4	73	173	N N E	—	25	Fine with flying clouds.
21	30·055	74·7	67·2	78·9	67·8	99·0	60·3	63·1	68	144	N E by N	—	34	Fine with flying clouds.
22	30·038	74·0	68·4	79·4	68·0	98·7	60·3	65·5	76	119	N N E	—	40	Fine with flying clouds.
23	30·035	73·2	68·2	79·6	68·2	102·5	61·6	65·6	78	86	N N E	—	35	Chiefly fine.
24	30·036	73·4	69·3	79·6	65·6	101·3	57·6	67·3	82	109	N N E	—	36	Chiefly fine.
25	30·009	76·2	67·7	79·7	71·5	97·7	67·3	63·0	65	184	N N E	0·02	25	Chiefly fine.
26	29·989	76·0	69·0	80·2	71·2	98·5	64·6	65·4	71	192	N E by N	—	29	Chiefly fine.
27	29·991	75·2	69·2	80·1	68·8	98·3	63·6	66·2	74	167	N N E	—	60	Cloudy.
28	30·007	76·0	71·0	79·9	74·9	97·6	70·8	68·6	79	199	N N E	0·02	100	Overcast.
29	29·999	74·7	69·7	80·5	70·8	100·5	68·6	67·3	78	159	N N E	—	76	Cloudy.
30	29·988	72·5	67·6	78·9	67·8	99·0	61·2	65·0	78	131	N N E	—	22	Fine with passing clouds.
31	29·979	71·9	67·0	78·6	65·8	99·8	58·6	64·4	78	105	N N E	—	21	Flying clouds.
Mean ...	30·014	74·3	68·4	79·5	68·9	99·5	62·5	65·3	75	143	N N E	0·04	37	
Average	29·996	74·5	68·8	79·5	69·5	101·3	64·4	65·9	76	183	N N E	3 3	50	
Difference.	+0·018	—0·2	—0·4	0·0	—0·6	—1·8	—1·9	—0·6	—1	—40	Same.	—2·29	—13	

Results of Meteorological Observations made at the Madras Observatory in the year 1863.

The year 1863 presented no extraordinary meteorological features throughout its entire course.

The mean annual atmospheric pressure was 29,835,—0·009 less than the average of twenty years.—Its extreme range was 0·589 inch; viz. from 30·137, the reduced reading on both January 11th and 19th, to 29·548 on June 1st.

The highest temperature registered in full sunshine was 125·3, on May 1st.—In the shade, the lowest was 63·0, on January 1st and the highest 103·0 on June 5th.—The mean daily range was 13·3.—The annual means of temperature, evaporation and dew point, were, 81·2; 74·5; and 71·6, respectively; each half a degree above the usual numbers.—The humidity was the precise average value of past years, viz. 74 per cent.

The rainfall, amounting to 54·61 inches, was distributed over 99 days, and was 3·86 inches above the twenty year average, or 108 per cent thereof.

The greatest quantity received on any one day was 5·48 inches, on December 4th. More than one inch of rain was measured on seventeen days during the year 1863.

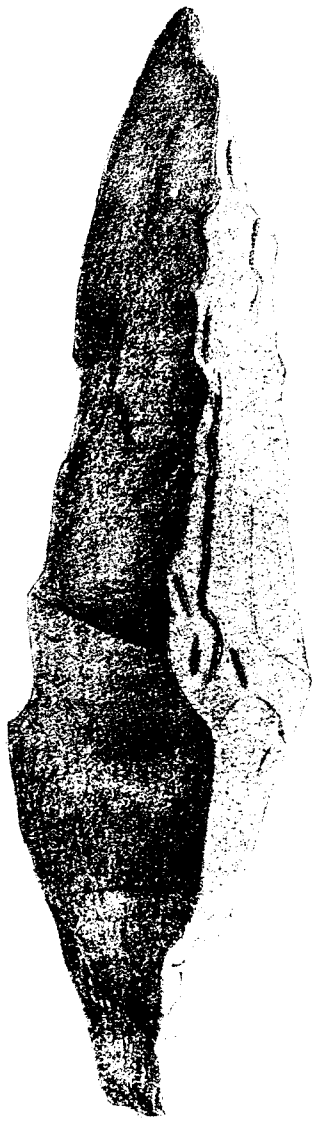
The mean daily velocity of the wind was 132 miles, and its mean direction S. E. by S.—Its quantity and duration from each of the thirty two nautical Points was as follows.—

From.	Miles.	Quarter Days.	From.	Miles.	Quarter Days.	From.	Miles.	Quarter Days.	From.	Miles.	Quarter Days.
North	568	18	East	576	26	South	3224	84	West	649	18
N by E	1223	38	E by S	555	24	S by W	2150	52	W by N	375	10
N N E	3578	100	E S E	725	26	S S W	1984	52	W N W	316	10
N E by N	4750	128	S E by E	690	28	S W by S	2529	70	N W by W	99	2
North East	2590	78	South East	1880	67	South West	3694	94	North West	264	9
N E by E	1911	54	S E by S	2281	76	S W by W	3031	78	N W by N	39	2
E N E	419	22	S S E	2572	66	W S W	3276	84	N N W	318	10
E by N	1226	41	S by E	1808	46	W by S	1169	31	N by W	397	16
North East Quarter.	16270	479	South East Quarter.	11087	359	South West Quarter.	21057	545	North West Quarter.	2457	77

N. R. POGSON,
Government Astronomer.

184.

185



188.

189

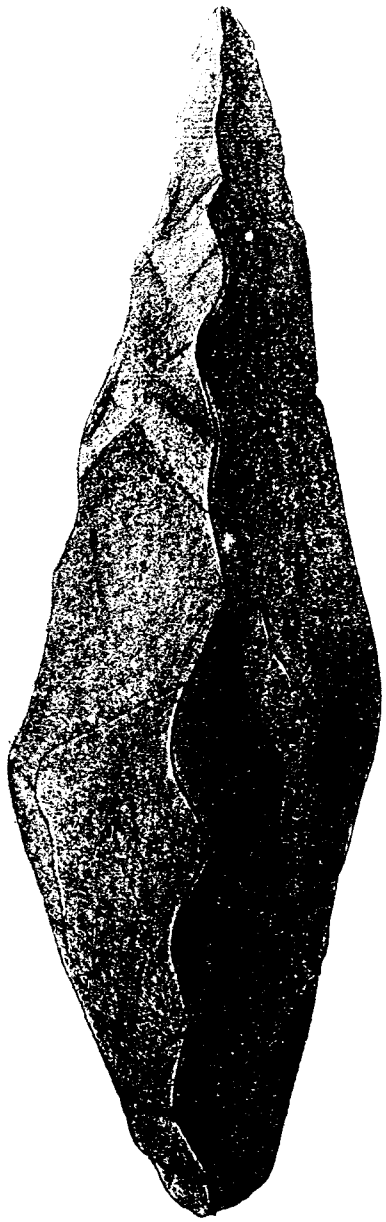
192

PLATE I

A Barrow Lithogr. Madras 1865.

193

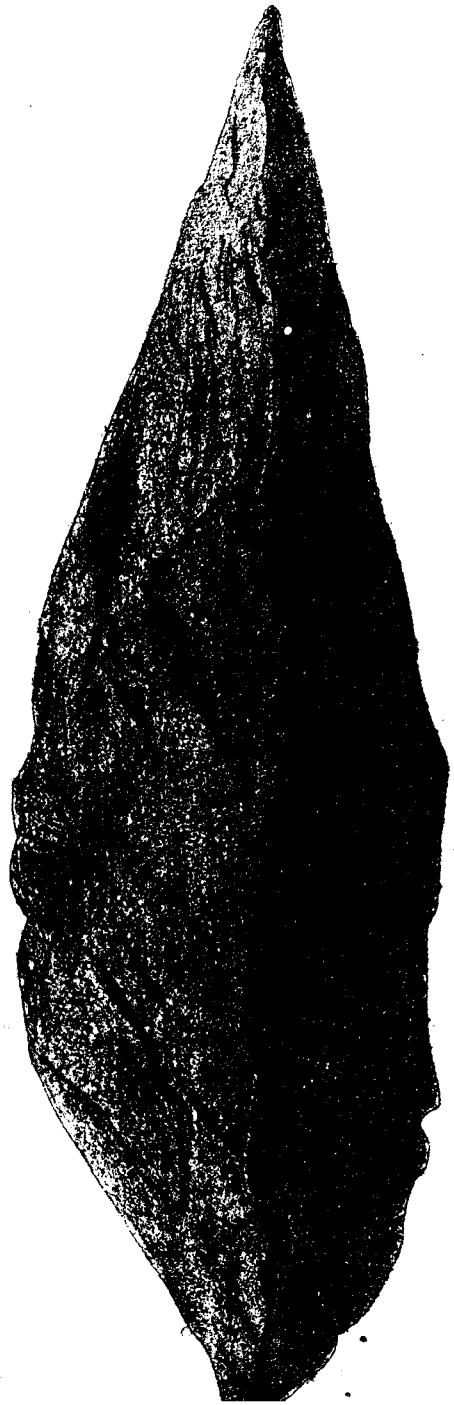
PLATE IV



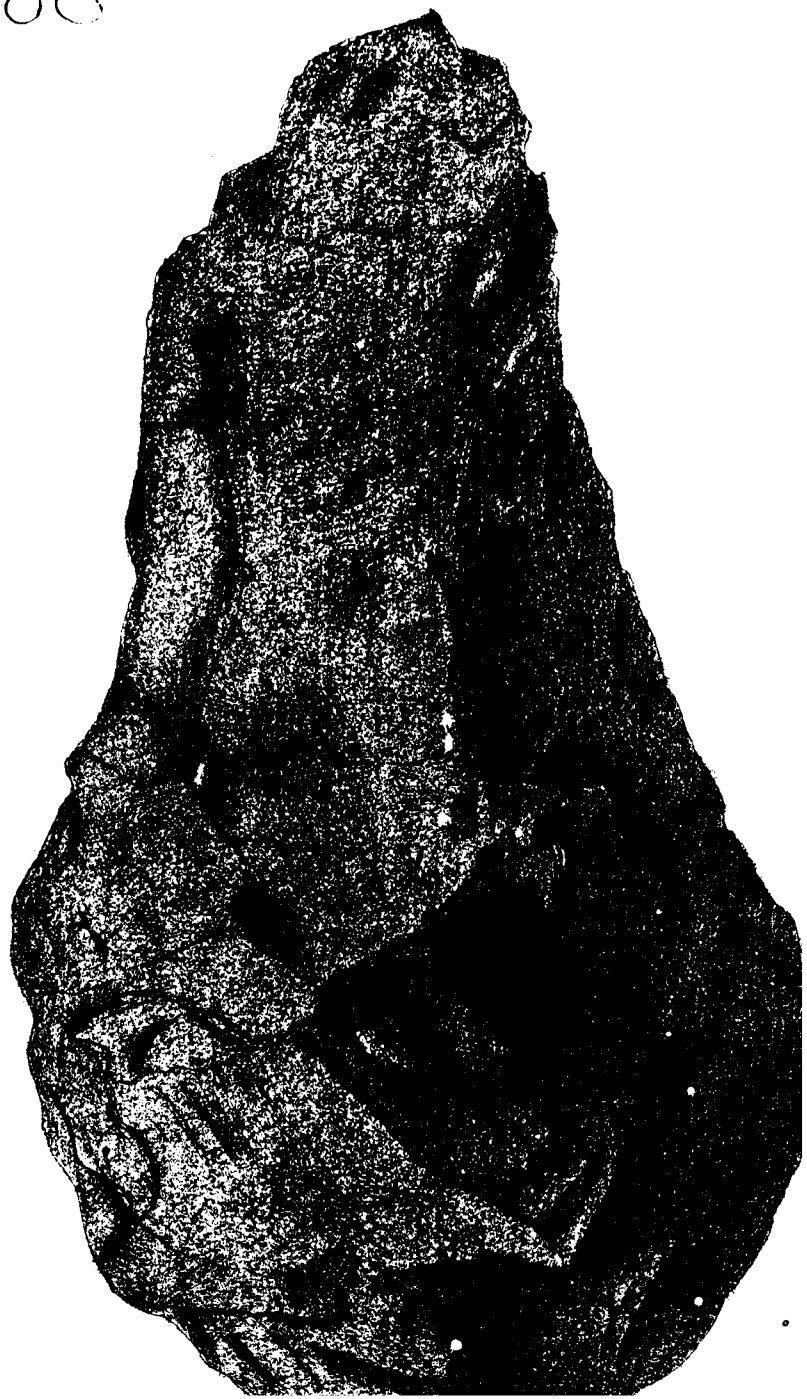
A Barrow Lithogr. Madras 1865.

196

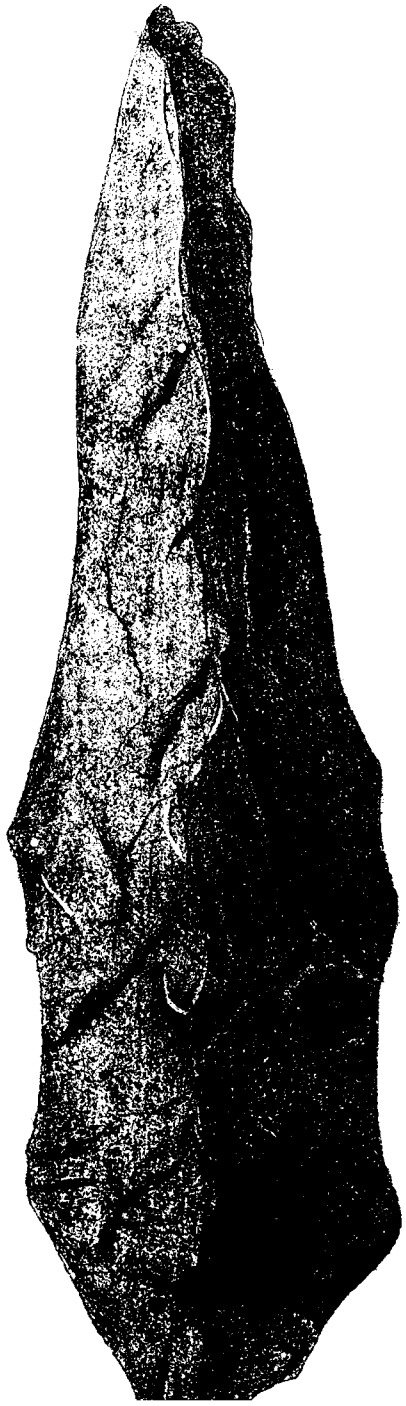
197



200



201



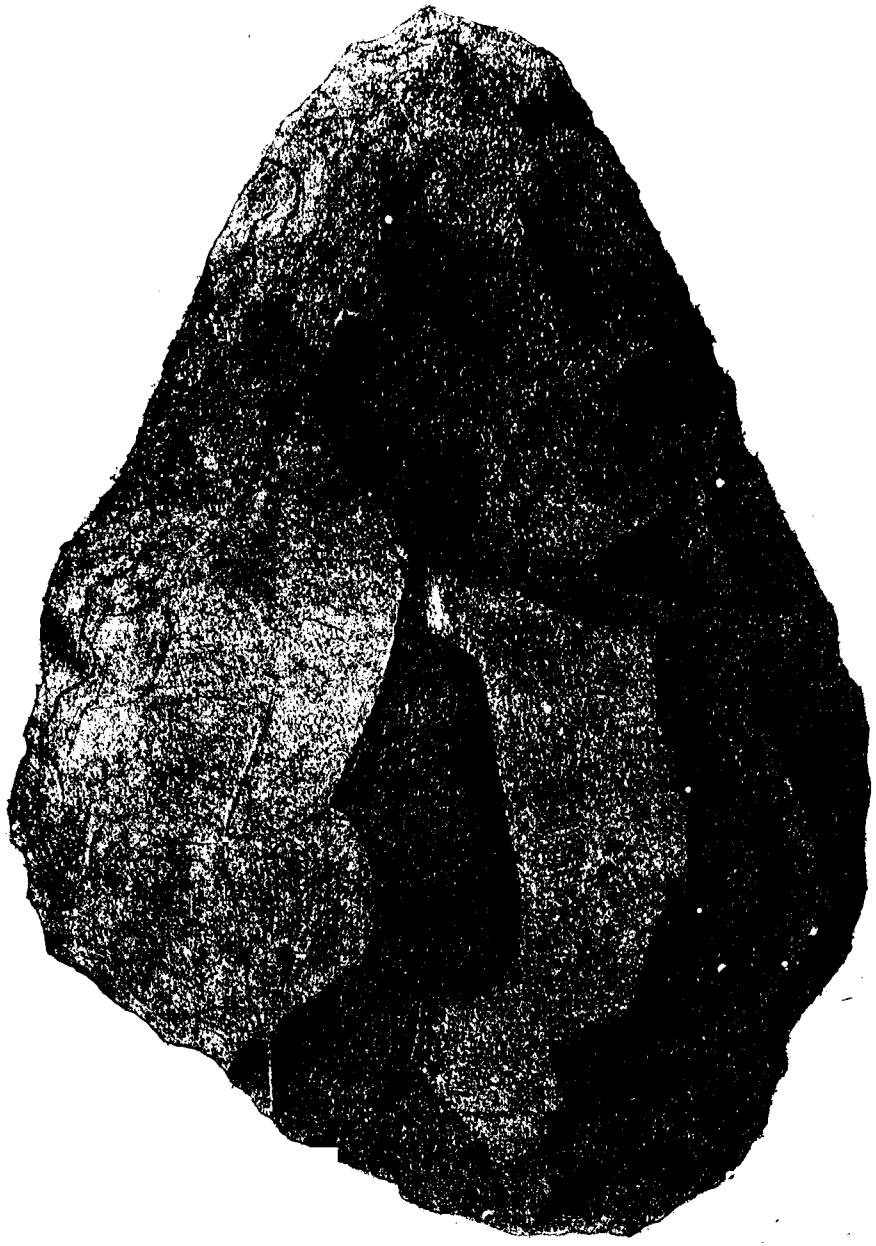
2204

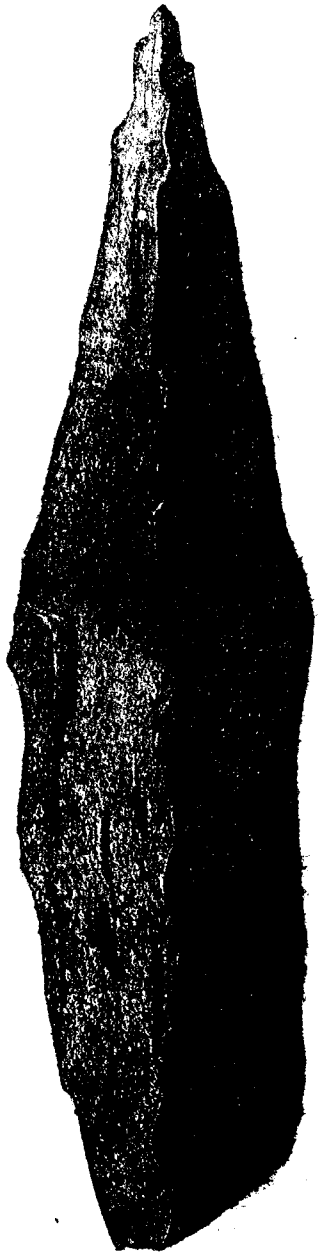
205

208

209

PLATE VIII &c





Govt. Lith. of Madras 1854

212

PLATE IX a.

213

A. Barron, Lithog[r] Madras 1865.

A. Barron, Lithog[r] Madras 1865.

A. Barren, Lithog. Madras, 1865.

2·20

2·21

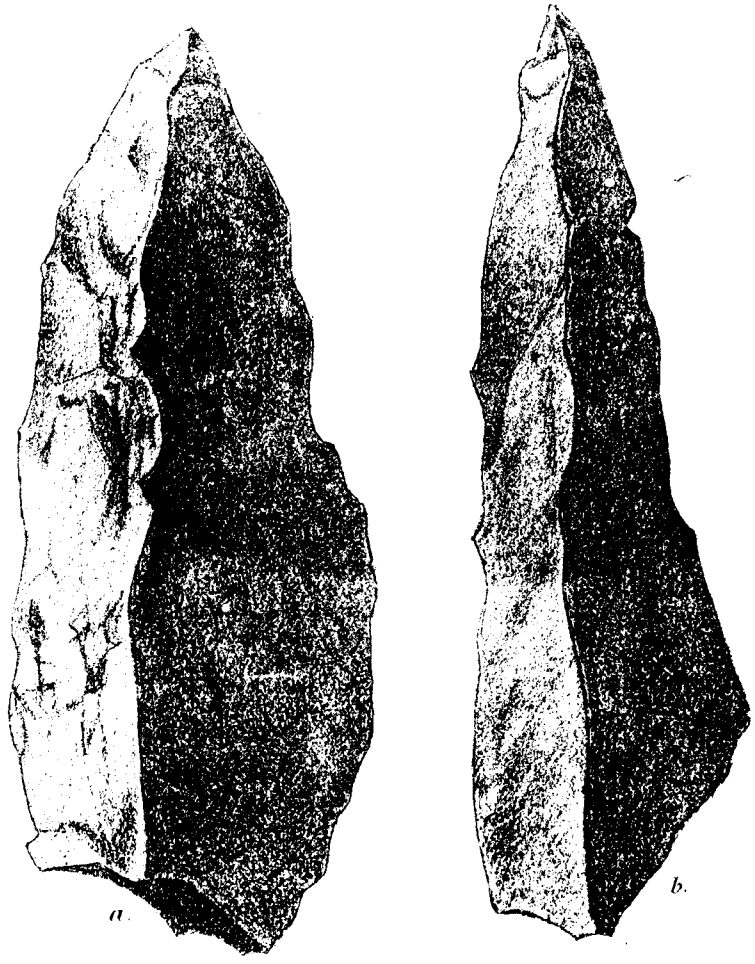
PLATE XIa.

2·2·41

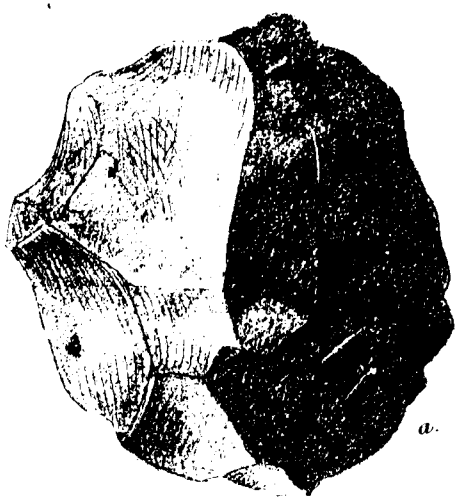
925

PLATE XII a

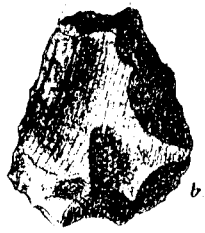
en Lithog. Madras


a.
b.

230



a.



b

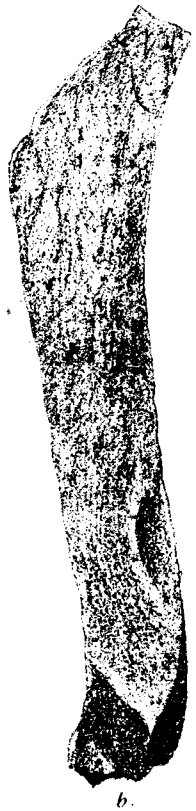
c.

A Barren, Lithogr. Madras 1865.

PLATE XV.

231

a.



b.

A Barren, Lithogr. Madras 1865.

232