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Anatomy of Ailurus, Porcula, and Stylocerus, in continuation, with sundry miscellaneous emendatory Notes. By B. H. Hodgson, *Esq.*

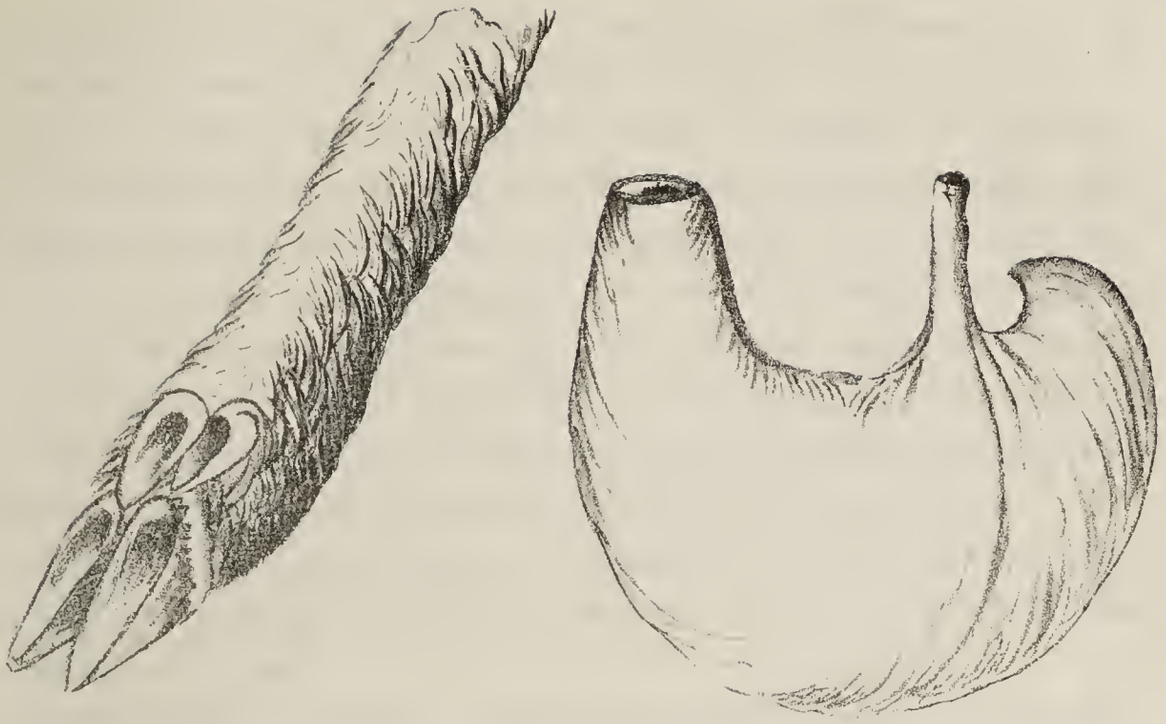
In presenting to the Asiatic Society of Bengal my paper on the structure and habits of Ailurus, I noticed the circumstances which had tended to render my account of the anatomy less full and satisfactory than I could have wished, and I promised to take the first fresh opportunity to rectify and complete that account. I now proceed to redeem my pledge so far as my materials and the very frail state of my health have allowed me so to do. Last month I obtained a couple of young Wáhs alive. They were taken from the nest, a perforation in the bole of a lofty decayed tree, and were about half grown, male and female, alike in every respect of size and colours. They must have been born in April or May, and were certainly six months old when I got them. Yet they had not quitted the retreat in which they were born, nor had their mother ceased to tend them; whence we may safely infer that the period of infantine helplessness is much protracted in these most singular animals. So long as they lived they were fed with milk, or milk and rice. But they died in about 15 days under the terrible process of cutting the molar teeth. Each was from 12 to 13 inches long between the snout and anus. Testes of male in the groin, that is void of scrotum. Penis small, sheathed, directed forwards and downwards, and upon the whole assimilated to the same organ in Felis and Viverra, rather than in Canis or Paradoxurus,* though void of all semblance of

* Paradoxurus differs greatly from the Felines and Viverrines in the canine character of this organ, which is large and plainly directed, in its sheath, along the abdo-

preputial sac or gland, and lastly, furnished with a small simple bone. Teats of female 8. Her vulva simple, that is, without trace of preputial gland. Anus of both with a large nude margin, but no appearance whatever of special anal glands, and no other semblance of pores than two very shallow simple reduplications of the skin, having a central lateral position (one on each side), probable only subservient to the lubrication of the parts. Peroneum of both sexes hairy and void of all trace of glands.

Ailurus ochraceus. Soft anatomy.—Male 12½ inches long from snout to anus. The male's thoracic and abdominal viscera are as follows :— The lungs have 4 main and 6 total divisions, and are disposed bilaterally on each side the æsophagus. The liver has 3 main divisions, that is, the laterals and the central. Of these the laterals are bifid, and the central, trifid, and there is no lobulus, so that the total divisions are 7. The lateral lobes are the larger and are very unequally divided. The gall-bladder is half imbedded in one of the clefts of the central lobe, and is of an elliptic shape, pouring its thin yellowish bile into the intestine about two inches below the stomach by one long clear duct. The pancreas is a very fragile, colourless, glandular, linguiform organ lying parallel to the biliary duct and close in contact with it. I could not satisfactorily trace the pancreatic ducts; but there seemed to me to be one, very short, put off from the lower or posteal end of the organ, and entering the intestine close to the entrance of the biliary duct, perhaps ½ inch above it. Spleen 3 inches long by two, dark-coloured as a gizzard, tongue-shaped, and lying along the greater arch of the stomach with merely membranous attachments thereto. Heart 1⅛ inch long by $\frac{13}{16}$ of greatest diameter, muscular and firm. Stomach pyriform, inclining to hemispherical and decidedly of the solvent type, though its outer coat shows some faint signs of muscularity upon the surface of its equable, thickish and membranous walls. Inner coat of uniform surface, void of folds or bands. Orifaces nearly but not quite terminal. Greater arch of the stomach 7½ inches; lesser, 2 inches. Towards the pyloric orifice is a sort of subsidiary stomach, extremely glandular and resembling in character but not in position the succenturiate ventriculus of

men. The special secretory glands are preputial and form a parallelogramic nude subvalvular field, in the centre of which lies the large membrum. In the female the lips of the vulva are the seat of the glands.



Foot, Stomach, and Head of the Pigmy Hog.

Porcula Salvania.

T. Block, Asiatic Lith. Press, Calcutta

birds and of some few mammals. It has longitudinal bands along the inner surface and is very thick-coated. Intestines about $4\frac{3}{4}$ lengths of the animal, that is, somewhat shorter than in maturity; 4. $10\frac{1}{2}$ long, of large equable diameter, void of cœcum, and exhibiting on their inner surface nor valves, nor folds, nor other retardatory processes, not even, I think, a valvula coli to distinguish the small from the great intestine. And, in fact, no such distinction has place, the intestinal canal being of equal breadth throughout and similar aspect internally,* save the last 6 inches, which are wider, thicker-coated and furnished internally with longitudinal bands, not unlike the post ventricle above noticed.

Kidneys 1 inch long, elliptic and lobulated, there being 3-4 distinct divisions of the body of the organ under the strong and uniform cortical substance or cover.

Soft anatomy. (*Female.*) The liver has 7 divisions in all; the right and left lobes about equal and bifid, but very unequally so; the central lobe, smaller and trifid.

The elliptic gall-bladder is freely suspended between the larger 2 lobules of the central lobe and discharges the bile into the intestine by a large clear duct about 2 inches long, and which enters the intestine about that distance from the stomach. The lungs have 4 chief divisions, but 6 in all, the 2 latter being very subordinate. The spleen is dark-coloured, tongue-shaped, and lies along the stomach longitudinally and centrally on its outer arch. The pancreas, in form, structure, and position as noted in the male, seems to discharge the pancreatic juice into the intestine just below where the bile enters it. The intestines are 4. $9\frac{1}{2}$, of one equable diameter of half an inch, and void of cœcum or valves internally. The stomach is a large, membranous and simple sack, showing something of muscularity without, but no folds or bands of any sort within. I could not satisfactorily determine the form of the uterus in this young subject.

Hard anatomy. (*Male.*) Cervical vertebræ 7, dorsal and ribs 15, lumbar 5, sacral 3, caudal 18.† Total 48. Carpal bones 7, metacar-

* This remark refers to salient retardatory, and not to minute secretory, processes (villi) characterising the inner surfaces of various intestines.

† I have some doubt as to the number of sacral and caudal vertebræ, because the former are not clearly distinguished from the proximate vertebræ by any of the usual signs of anchylosis, depression, &c. The circumstances which have determined

pal 5, digital 3, for each digit, fore and aft, save the innermost, which has but 2. Tarsal 7, exclusive of the os calcis. Metatarsal 5. Digits 5, before and behind, with very free action on each other, and the so called thumb not much removed from the front, and of course not at all opposeable, being articulated in the same plane with the rest of the digits.

The alæ of the atlas and falciform process of the axis are small, and so also are the spinous and transverse processes of the vertebræ generally. The pelvis is short, broad and obliquely deflected from the plane of the spinal column. It is feeble too, owing chiefly however to the very imperfect anchylosis or osseous blending of the vertebræ of the sacrum. The bones of the pelvis in front (ossa pubis) are united merely by cartilage and form a short bridge of which the keystone is wanting. The ribs, of which 8 only, I think, are true and 7 false, are much curved or bulged; and this, with the large flat muscles laid over them, gives an ursine breadth to the chest, despite the narrowness of the sternum. The sternum is long, and consists of 7 bony cylindric pieces very distinctly articulated and having a very small ensiform cartilage. Admirable a climber as is the Ailurus, it has no clavicle, nor even pseudo-clavicle or os-clavìculare; and as I have noticed the same thing in other eminently scansorial subplantigrades, I am rather surprised at the unqualified terms in which recent and eminent anatomists* express themselves on the subject.

The scapula is a stout broad triangular bone, but somewhat rounded along the superior elongate margin. Its glenoid cavity is rounded but inclines to an ovoid rather than a strictly special form. It is deep enough to afford secure lodgment to the condyle of the humerus, but not so deep as to interfere with free motion of the fore limb. The keel

me in regard to the joints constituting the sacrum are, distinct enclosure between the pelvic bones (ilia) and the openings for the passage of the nerves. In regard to the coccygeal vertebræ an envious rat, which ate off 3 or 4 of the vertebræ before I had completed my examination, but not before I had roughly counted all the joints of the spinal column, is the cause of my doubt.

* Lawrence and Coulson apud Blumenbach. Manual, Eng. Edit. of 1827, p. 49. Carpenter is more guarded. An. Physiol. p. 469. And Bell, The Hand, p. 46. It is possible I may have overlooked a very small os claviculare. And it is difficult to decide whether what I have assumed to be the metacarpal bone of the thumb be not rather the first phalanx.

of the scapula is strongly developed, and at its anteal extremity terminates in a cylindric process which advances as far forwards as the foremost part of the scapula, and appears designed to prevent dislocation of the shoulder in climbing when there is a violent outward pressure on the shoulder-joint. The acromion and coracoid are very slightly developed. The humerus is a single, stout, cylindric bone, as long as the radius and furnished with very large articulating surfaces at each end, especially the lower, towards which the strong ridge for the attachment of the supinators is conspicuous. The radius and ulna are quite separate, nearly equal in size and strength, cylindrico-depressed, with very ample and perfect articulating surfaces. The olecranon is small, like the os-calcis. The carpal bones are beautifully jointed so as to allow the freest motion to the wrists; and the digits play with the greatest freedom on one another. The talons or claws, fore and aft, are very highly curved, and much compressed. They have deep bases which are suddenly contracted forwards where they are grooved underneath. Their points are very sharp, and they can be turned over the penultimate phalanges as completely as in Felis, but they are only partially sheathed. The femur is as long as the tibia, a single, stout, cylindric bone, very similar in size and form to the humerus, and like it, distinguished by its enlargement at the distad end suited to afford room for the finest jointure. At its proximate or upper end is a very distinct neck, oblique to the shaft, as in the human subject, only thicker and shorter perhaps; and the ball and socket-joint whereby it is united to the pelvis is not so deep as in man, so that the leg has much freer motion, very similar indeed to that of the arm, wherein however the glenoid is not so round or so deep. The tibia and fibula are completely separate; the former stout; the latter, feeble, but both entering into the composition of the ankle-joint and both cylindric in form. The tarsus is as finely articulated as the carpus and the posteal digits have as free play as the anteal, both being quite alike in size and shape. The above details of the skeleton of Ailurus exhibit more conformity with the Plantigrade than with the Digitigrade model, except in regard to the talons, which are thoroughly feline or musteline. The separation of the ossa pubis* appears to be a

* It is possibly only an effect of non-age. The interval of the bones is very narrow. So short is the pubic bridge that it appears to run as much transversely as longitudinally.

remarkable character of Ailurus associating it, quoad hoc, with the Marsupials. Blumenbach (Man: pp. 46 and 53) and after him all others have noticed the length of the humerus and femur as a special character of the Plantigrades, and particularly of Ursus, their type. Quoad locomotive organs, Ailurus is very decidedly framed on the plantigrade model. Nor will it fail to be remarked how decidedly the small feeble processes of the cervical vertebræ in Ailurus sunder it from the Carnivora par excellence. Yet Ailurus has *their* talons and even *their* nutritive viscera, whilst its masticatory organs are of a diametrically opposite character. Such is the ænigma we are contemplating, which, however, may be thus far explained that if width of gut be allowed to be equivalent to* length, the extreme breadth of the intestines of Ailurus will bring them into harmonious correspondence with its triturant dentition. And we may always rest assured that there are no real anomalies in nature, how surprising soever, and at first not wholly intelligible to us that rich variety of means by which the same end is accomplished without violation of a given model of organization. But the state of my health warns me not to prolong these comparative remarks, which will be better made by others. I proceed therefore to my next subject, the Pigmy Hog of the Saul forest, an apparent second species of which form I have recently discovered in the Sus-Papuensis† of New Zealand. Since my account of that most rare and interesting animal, the Pigmy Hog, was submitted to the Society, I have been so fortunate as to obtain another and complete specimen of an old male. He was sent to me alive from the Saul forest, but died on his way up, and though the entrails thus became considerably corrupted before the examination took place, there was no destruction of parts, nor any thing to impede a just appreciation of the structure of the soft as well as hard anatomy. To enable me the better to appreciate the structure and affinities of the Pigmy Hog, I procured and dissected at the same time a sample of the ordinary domestic hog of this place, which is native to the Tarai though imported largely into the mountains, to satisfy the appetites of the lazy and carnivorous mountaineers.

Porcula Salvania. Soft Anatomy. A fine mature male. Length

* Blum. Man. p. 112. In the mature Ailurus the width of the intestines is one inch.

† Voyage de la Coquille, as quoted in the Penny Magazine, voce Sus.

from snout to vent 26 inches. Colour a clear amber brown. Pelage ample, ordinary. No mane. A strongly marked mystaceal tuft. Testes and penis as in Sus, but only 6 mammæ, which are clearly developed in the male, and are much more remote from each other than in Sus, the type of which has 12 teats. Liver 2 lobes, each sub-divided into 2, and no lobulus? 4 divisions in all. Gall-bladder half embedded in the great cleft, $1\frac{3}{4}$ inch long by $\frac{7}{8}$ wide. Biliary duct 3 inches, discharging the secretion into the nutritive canal close to the pyloric orifice of the stomach, so that the bile seems rather to pass into the stomach itself than into the intestine. Lungs 7 divisions in all, and more nearly equal in size (as are the lobes of the liver) than in Sus, but otherwise similar. Heart $2\frac{3}{8}$ inches by 2 of maximum width. Spleen very long and narrow like a Manis' tongue, $6\frac{1}{2}$ inches by $\frac{3}{4}$ inch. Position and general character as in Sus, but the organ is very decidedly longer and narrower in Porcula than in Sus. Pancreas too much decayed for examination. Stomach $10\frac{1}{2}$ inches along the greater arch, 3 inches along the lesser, in shape like the segment of a circle or crescent, longer and narrower than in Sus, and having a fundus in every respect of length and width much less considerable than in Sus. The orifices are more remote than in Sus; and the fundus, which contracts teatwise and is curved like a ram's horn towards the æsophageal canal, almost touches the cardiac orifice, partly by reason of this incurvation and partly because of the nearly terminal position of the upper orifice. Otherwise the stomach has the usual characters of Sus; but it is perhaps thicker in the coats. Great intestine 9 feet long and $1\frac{3}{4}$ inch wide, singly and slightly banded and sacced, whereas the same intestine in Sus is doubly and strongly banded and sacced. Cœum $4\frac{3}{4}$ inches by 2 inches, conoid, not sacculated at all. In Sus the cœcum is banded and sacculated like the colon, and is also much more capacious than the plain cœcum of Porcula. Lesser intestines $14\frac{1}{2}$ feet long and $\frac{3}{4}$ inch wide.

To summarize the differences in the chylopoietic viscera of Sus and of Porcula, we may note that in Porcula the stomach is narrower, has the orifices more terminal, and altogether is of a much less retardatory character in regard to the passage of the food; that the great intestines and cœcum of Porcula uphold the same character of diminished retardation, the cœcum being less in size and void of sacculæ, whilst the colon is only singly and slightly sacculated, not doubly and strongly as in

Sus; that the intestines are shorter* in Porcula and more equally divided into great and small gut, thus yet further continuing the character of diminished retardation of the passage of the food; that the lobes of the lungs and liver of Porcula show less disparity of relative size and that its liver has apparently one lobule less than in Sus; that the spleen is much longer and narrower in Porcula; and lastly, that this Lilliputian member of the Suidæ or Hog kind has invariably six remote, instead of twelve proximate, teats.

Pigmy hog. Osteology. The cervical vertebræ are 5, the dorsal and ribs 14, the lumbar 6, the sacral 5, the caudal 10. Total 40. All these bones bear in general a resemblance to those of Sus, both as to number and character, the only material difference being the extraordinary diminution of the caudal vertebræ, which are 10 in Porcula, 20 in Sus. The sculls of the two with the same general characters, have two important disparities, to wit, that the length of the facial portion of the cranium is greatly contracted in Porcula, which likewise wants the characteristic and normal nasal bone of Sus. It should further be remarked of the scull of Porcula that in consequence of the diminished length of the face the molar teeth are carried much more backwards than in Sus. The extremities of the two types have characters too similar to make it worth while to enumerate the bones of the legs and feet in Porcula, which however differs from Sus, and approaches the Peccaries by the unusually diminished size of the inner back digit.

It will be seen above that I have assigned 5 cervical vertebræ to Porcula, and by implication, to Sus also. Both in fact are so characterised beyond all possibility of doubt, and I call attention to the facts with reference to the unqualified language of the most eminent Anatomists and Physiologists† to a contrary effect. Thus Doctor Carpen-

* As compared with the tame, but perhaps not as compared with the wild, hog. Porcula has 10 lengths for the intestines, great and small; and so also has the wild Boar, though the tame Pig has 13 and 14 lengths. (Blumenbach's Manual, page 114.) Some other differences may be resolved in the same way: but other and material ones, not.

† Blumenbach, Cuvier, Laurence, Coulson, Carpenter. (Manual, p. 42. Animal Physiology, p. 461.)

Cuvier makes one exception to the otherwise universal 7 cervical vertebræ among the Mammalia. His exception is the 3-toed sloth. (Leçons d'Anatomie comparee, 1. 154.)

ter in his very recent work of 1844, "It is remarkable that the number of the cervical vertebræ should be the same in *all Mammals*, the long necked Giraffe and the seemingly neckless whale having each 7 vertebræ, like all the rest."

I cannot lay my hands upon any osteological formula for Sus, and I am aware that the tame breeds of the Pig manifest a strange variability in regard to some parts of their osseous frame-work. But I believe such deviations do not belong to the vertebræ of the neck in Sus, and upon the whole I think that the citations and quotation I have given will fully justify my having called special notice to the 5 vertebræ in the neck of Porcula, a perfectly and exclusively wild type.

I now proceed to the Stilthorns or Muntjacs.

Stylocerus Ratwa. Soft anatomy and cuticular organs. Young male, procured in April, died in October. Two-thirds grown yet not the least sign of horns. Small knobs as in the female in lieu of horns. Eye-pits large. Mufle large. Facial creases conspicuous, and their glands developed. Feet-pits in the hind extremities only, but there conspicuous. Inguinal pits none. No calcic gland nor tuft. Canines distinct but not yet exserted from the lips. Mamma 4. Liver with one grand lobe very partially divided, and a second small lobe. Gall-bladder none. Lungs with a primary dichotomous division. Right lobe quadripartite; left, tripartite and a lobulus. Spleen round, flat, attached to outer side of paunch. Pancreas tongue-shaped, narrow, pale; its ducts vague and doubtful. 4 stomachs a l'ordinaire. Great gut 10. 10. 0. First foot, or that next the cœcum, as wide nearly as it, or 2 inches. Cœcum 13 inches by $2\frac{3}{4}$, void of sacculation and banding. Small gut 41. 0. 0. very narrow, the average width being half an inch.

Osteology (from a mature specimen). The vertebræ of the spinal column are as follows: Cervical 7. Dorsal 13. Lumbar 7. Sacral 5. Caudal 13—14. Total 45-6. The sternum consists of 7 bones, which are broad and flat, except the first and last, and these are narrow and cylindric. Ribs 13, whereof 8 are true and 5 false. The ribs are compressed, or very little bulged laterally, and the chest exhibits the perfection of the "thorax carinatus" type, whence one is rather surprised at the breadth and flatness of the sternal plates; the very reverse moreover (to add to the riddle) being equally true of the broad-chested climbing Wáh! Ensiform cartilage of the sternum large and

spatulate. Reverting to the spinal column we note that the vertical and lateral processes of the cervical vertebræ are very inconspicuous, while the spinous processes of the dorsals are of perfectly uniform and very inconsiderable height. These are interesting points, having such harmonious and direct reference to the short neck and light head and horns of the Mantjacs. The processes of the lumbar vertebræ, on the other hand, are well developed; the spinous chiefly in depth (fore and aft), and the transverse in length. The spines of the lumbar and dorsal vertebræ are about equal in height. The vertebræ of the neck and back, possess extreme mobility. The sacrals are anchylosed, and have but small vertical or lateral processes. The ilia of the pelvis are united to the first, and first only, of the sacral vertebræ. The pelvis has the usual characters of elongation parallel to the spine in all its parts, even the symphysis pubis or pubic bridge being perfectly longitudinal and not less than $1\frac{3}{4}$ inch in extent. The bones of the extremities have the ordinary number and character with one signal exception, to wit, that the humerus and femur* are nearly as long as the radius and tibia, the length of the metacarpus and metatarus being I think proportionally diminished. To those who are conversant with Anatomy this elongation of the 1st joint of the legs will seem strange, and the more so when I add that the whole bones of the forelimb of the Ratwa are so far from any approach to perpendicularity or rigidity† that they are signally remarkable, even among Cervines, for the opposite characters. The fact is that the Ratwa has no powers of sustained speed or extensive leap: but it is unmatched for the facility with which it passes unscathed and delayed under that low, tangled and rigid undergrowth of the forest which forms its constant abode. I have seen the Ratwa often chased to death in an hour by a couple of the rude bowmen of these hills, aided by 3 or 4 chiens de rue. And on the other hand, I have, whilst stalking the Ratwa, myself been constantly foiled and amazed by the rapidity with which the creatures would glide out of sight and reach amid dense thickets of bamboo by a succession of

* Length of humerus $4\frac{5}{8}$ inches, of radius $4\frac{9}{16}$ inches, of femur $5\frac{3}{4}$ inches, of tibia $6\frac{1}{16}$ inches.

† See Bell's fine remarks on the rationale of the structure of the limbs in fleet quadrupeds, and especially of their fore extremities. (*Treatise on the Hand*, p. 54, et alibi.)

rapid bendings of the spine and limbs that enable them to wend on their way without kneeling or a moment's pause, where there were scarcely six inches of free perpendicular passage room. It is no, their speed, a quality of which they have little, but this weasel-like flexibility of the spine and limbs that enables the Ratwas, amid the peculiar copse-wood they inhabit, to foil their great enemy the wild dog or Cyon primævus. The Mantjacs of the genus Stylocerus or Stilthorn, though strictly Cervine animals, are no doubt the most aberrant of their family; and the singular habits I have just remarked on may serve, in part at least, as a key to the apparent anomalies, but real adaptations, of the Cervine model of structure as seen in them. Who, for instance, that has observed the Ratwa, whether at rest or in motion, has failed to remark the invariable and extreme low carriage of the neck and head? Now this I apprehend is as clearly referable to the length of humerus, which protrudes and depresses those parts, as it is perfectly suitable to the exigencies of the animal's position and its consequent comfort and safety.

I solicit the particular attention of those who have perused my Essay of the Ruminants of India (Journal, No. 180) to the following emendata et addenda. Character of the Cervidæ,—add Gall bladder wanting. Genus Rucervus, for type C. Elaphoides vel Duvaucelli, read Types C. Elaphoides et Duvaucelli. Captain Hutton assures me I may safely recur to my old notion that these two species are not identical, for that he possesses live samples of both. I conjecture that Mr. Gray's C. Smithii is but a synonyme of Duvaucelli verus. Genus Procervus; I have procured another specimen of this very rare animal, but alack! the horns were cast. It was a male and mature, and had no interdigital pits. Nor had the original specimen, nor my description of it, though the corrector of the press was pleased to make me say otherwise in print.*

Genus Rusa, for Feet-pits in all 4 feet, read Feet-pits none? Two recent specimens of the Jarai show no foot pores, and Captain Hutton assures me that his samples are similarly characterised. Wherefore I must presume mistake in my Nipalese memoranda, a portion only of

* See Vol. XVII., page 690, line 2. The expression there is "*Feet-pits none.*" —Eds.

which, of very various dates and unequal value, was saved on my hurried departure for Europe.

Genus Axis. Read canines in males only or in both sexes. And below as follows: Their breeding time is spring, their rutting season, autumn. They gestate about 6 months. Horns cast in January, and, in confinement at least, not perfect till June-July. With September, when the horns are in full perfection the males begin to rut.

Character of Moschidæ,—add Gall-bladder constant; and in the native names, for Múskhi haran, read Múskh simply. Character of the Cavicorniæ minores, add Gall-bladder constant. Character of the Antilopidæ for canines constant, read canines rare. Genus Antelope, add canines none. So also Genus Gazella. Genus Tragops. The name, I hear, is pre-occupied. Wherefore I substitute Tragomma. Colonel Sykes (Zool. Journal) says of this type, "Eye-pits very small." But there are certainly none in my samples nor in those of Procapra, though there be slight depressions in the sculls of both. Such embryotic organs however cannot be admitted as characters of genera, how interesting soever they be as indications of those links by which genera are connected.

Genera 13, 14, 15, 16. Add to the generic character of each, Canines none. Native name of Nemorhœdus, for Saraw read Saráon, vulgo Sarrow. Genus Kemas, for Calcic tufts? read, No calcic gland or tuft.

Genus Hemitragus,—add Horns in both sexes.

Genus Capra,—add no eye-pits.

Note. I have just ascertained by careful experiment that goats gestate 5 *lunar* months. Genus Ovis, the assertion that the wild type or Ammonoides gestates 6 months rests necessarily on native information. I feel confident that the gestation is identical with that of domestic sheep. Carvicorniæ majores, character of the group, dele "laterally;" and for mufle large, read mufle variable. Character of Bovinæ, for large angle, read acute angle, and for mufle very large, read mufle large and constant. Genus Bos. Type Bos domesticus, add this note. Domestic types are bad, but I have none other to refer to, Bos being a form proper to temperate climes and authors having rather lumped together than discriminated the various wild types of Bos and its allies. I believe however that Bos Scoticus, the Chillingham breed, and the Wizend of Germany, are genuine

wild types of Bos, as above defined, and if so, they should be at onee and exelusively substituted and eited. Bubalus is the tropieal, Bos the temperate, and Bison the Aretic, type. We cannot therefore look for a true wild Bos in India where it is represented by the very distinct but allied forms Bibos et Gavæus. The range of these latter beyond India is unknown; but judging by Cuvier's expressions I should say that some of his fossil and extant animals belong to one or the other. Genus Bibos. Character. After Cranium massive, add, nor compressed nor depressed. Genus Bison. Add as a note. Blumenbach says the Auroehs has a suborbital sinus. This, if correet, must refer to the seull some slight depression on which may indicate an embryotie eharaeter of analogy with other genera. But, as already observed, no ostcological indication of that sort ean be admitted as a generic character, for there is no developed and apparent organ. The Bison has some singular analogies with the eervidæ and this may be one of them. The Yak, a genuine Bison, has no trace of real suborbital sinus. I have now two female Yaks which came to me in December enecinte. They calved in April and July; and I am assured that the domestie Yak drops its ealf at all seasons save dead winter. One of my young ones is very vigorous and sprightly, and its mother also: the other, dead.

Genus Bubalus: for Types Bubalus buffelus et B. Arna, read, Type Bubalus Arna, and add to the note, after "true Buffaloes," of which the Arna is the unquestionable, best and sufficient type. The tame animal is therefore needlessly as falsely eited.

It having been asserted in the Journal, No. 177, that that noblest of all the Indian Cervines, C. Affinis, is, in fact, not an Indian species at all, but an American, of which my sample was purehased for the Court of Nepal by its Vakeel at Calcutta, I beg to state, first, that this idle story, originating with the vanity of the Upádhyas, was, with all the other circumstances of the case, thoroughly sifted by me and the Durbar before I published the speeies, and, next, that having referred the point a fresh to the present Resident Major Thoresby upon the appearance of the eited No. of the Journal; that gentleman wrote me as follows: "The story trumped up in the Journal, is baseless. The Deer in question was shot in the Mórang, so far as appears in Ran Bahádur's time, as was stated to you after much investigation."

Routes from Darjeeling to Thibet, by A. Campbell, *M. D. Superintendant of Darjeeling.*

In March last, I had the pleasure to forward to the Society an Itinerary from Darjeeling to Lassa, which appeared in the April No. of the Journal; I would not so soon again be a contributor of conjectural information regarding this portion of the Himalaya if any thing at all was known to the Society of its geography: or if circumstances did not preclude the obtaining of precise information by the travels and observations of competent geographers. So it has been however, and the Sikim division of the mountains, with the contiguous border of Thibet, is as yet almost unknown to the public. This will, I am sure, be accepted by the Society as a sufficient excuse for the presentation of these Routes.

They have been compiled with a good deal of trouble from native travellers. The rude diagram annexed, exhibits the line of 7 routes from Darjeeling towards Thibet. Five of these pass all the way through Sikim to the Thibet frontier, and cross the Snowy range to the east of Kunchinjinga.* The remaining two run through Sikim to the north and westward of Kunchinjinga, and uniting at Yamgatcha in the Nepal territory, cross the frontier of that state into Thibet by the Kanglachema Pass.

Boundaries of Sikim.—Sikim is continuous with Thibet on the north and east from the western shoulder of Kunchinjinga to the Peak marked Notolah. Its south-east boundary is formed by the Rungoh river, which rises from Notolah and falls into the Teesta, dividing it from Bootan; on the north-west the boundary with Nepal is formed by the Kanglanamoo spur of Kunchinjinga and the continuous ranges of Singalelah, Phugloot, Jonglah and Myong, to the head of the Mechi river; on the west by the Mechi river and on the east by the Teesta river. The southern boundary is on the plain and continuous with our Province of Purneah.

Mountains.—The grand feature in the geography of Sikim is Kunchinjinga; it towers over all the neighbouring peaks of the Himalaya, and is I believe, one of, if not, the highest mountain in the world. The highest peak is about 40 miles north by west of Darjeeling, and is a

* For "Chola route," see Journal As. Soc. for April 1848.

stupendous object from every part of Sikim. Besides the highest peak of Kunchinjinga, and forming portions of this glorious mountain, are the subordinate ones of Pundeem, Kubroo, Nursingh, &c. covered with perpetual snow. To the north-east of Darjeeling and at no greater distance are the snowy peaks of Chola, Gangri and Yakla. These latter mountains, with the giant Kunchinjinga, form the great barrier between India and Thibet in this direction, and lying under their mighty shadows is the sub-Himalaya, which forms the principality of Sikim.

Rivers.—All the rivers of Sikim noted in these Routes have exit in the plains by the Teesta, or the Koosi. The Teesta is the great drainer of Sikim, and receives all the waters of its upper regions. The lower hills being drained on the west of the Darjeeling Tract by the Balasun and Mechi, and on the east by the Mahanuddi. The feeders of the Koosi which occur in the route viâ Kanglachema No. 1, all rise in Nepal to the north and west of the Kanglanamoo spur of Kunchinjinga, and by a south and westerly course fall into the Tambur or most eastern branch of the Koosi, the principal feeders of the Teestah. West of Kunchinjinga are the little and great Rungeet, the Rummam, the Kullait, Ratong, Chooroong and Rungbee. From the east of Kunchinjinga the Rungbo, Lachoong, Lachen, and the Teesta proper so called, which rises in the eastern face of Kunchinjinga itself. The Rungbo is sometimes called the little Teesta, and divides Sikim from Bootan above its junction with the Teesta, whence to the plains the Teesta is the boundary between these two countries.

The Tashirukpa and Choomachoo of the Route No. 1, rise in Thibet and are feeders of the Arun which is, I believe, the greatest branch of the Koosi.

The Machoo noted in the Yakla and Chola routes runs through Bootan and reaches the plains I believe by the Gudada, which falls into the Burumpootra at Rangamutty.

I hope by and by to furnish the Society with a protraction of these routes by Major Crommelin.

No. I.

Route from Darjeeling to Digarchi (Shigatzi) by Jongri and the Kanglachema Pass of the Snowy Range.

1. *Seriong viâ Tuqvor.*—Cross the little Rungeet, ascend to Goke,

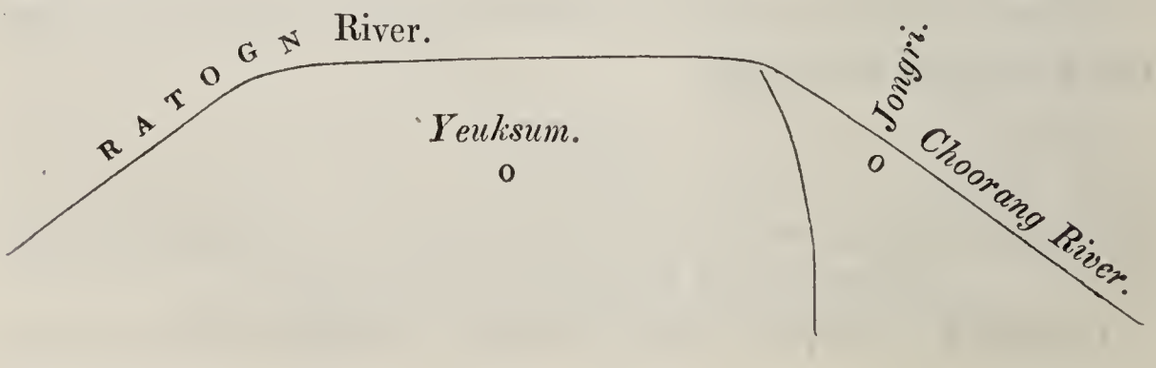
cross the Rumam and then ascend to Seriong, which is a village inhabited by Limboos and Lepchas. Direction north.

2. *Hee.*—Ascend to "Murmium Lah," then descend to encamping ground—a village of Limboos. Direction north.

3. *Pemiong Chi.*—Descend about a cos cross the Kullait river; ascend gradually to Linchong in an easterly direction, thence to Tigzhuk still in an easterly direction and by a gradual ascent. From Tigzhuk the direction is north and the ascent steep to Pemiongchi. The Kullait rises at Singalelah or Tolimbo. Old Sikim is about 2 miles from Pemiongchi to the east. The Lepchas name the Old Durbar "Pheeoong Ghurry;"—the Bhotiahs "Rabdengching;"—Limboos "Lapteuchi."

4. *Yoksum.*—Descend to "Chongpoom;" cross the Ringbi Nuddi, ascend to Tingleng, a village of Bhotiahs, Lepchas, and Limboos. Descend to and cross the Ratong river, whence ascend all the way to Yoksum where there is much level ground and which is a place of ancient note. Before there was a Raja of Sikim, there were three Goompas here, and it was the head Lamas of these who agreed that it would be desirable to have a king for their country, and they accordingly despatched Agents to Gantoke, whence the first Raja of Sikim was brought and installed. This individual had previously come from Thibet, was a Khamba, and the ancestor of the present Raja. "Yeuk," in the Lepcha language, means a chief; "Yeuksum" is three chiefs, hence the name of this place as the residence of the three great men above alluded to. Direction north by west.

5. *Jongri.*—Ascend gently in a westerly direction from Yeuksum. Descend a very little and cross the Ratong river, whence you ascend all the way to "Jongri." The Ratong rises from Kunchinjinga, takes a westerly course, where it is crossed in this march, and then turning round Yeuksum runs east to the Great Runjeet, which it joins at Tassiding, thus—



"Jongri" is at the west foot of Kunchinjinga and half a day's journey or less from the perpetual snow. The snow lies at Jongri for two or three months in severe winters and is continuous with the snow of Kunchinjinga, which descends a long way below Jongri and lies there in severe weather.

6. *Yalloong.*—Descend to the Choorong Nuddi, which is about 4 or 5 miles in a north-west direction, then ascend to the Kanglanamoo ridge, which is a spur of Kunchinjinga; thence descend to Yamgatcha, and go along the Yamgatcha choo due west to Yalloong, which is at the confluence of the Yalloong choo and the Yamgatcha choo. The Choorong rises from the east face of the Kanglanamoo, and falls into the Ratong, half a journey below Jongri. The ridge of Kanglanamoo is the boundary of Nepal and Sikim, and always has snow on it. The Yamgatcha choo rises from the north-west side of Kanglanamoo, and runs into the Yalloong river, which falls in the Tambur river two journies below Yalloong.

The Tambur is the great eastern feeder of the Koosi. Yalloong is a village in the Nepal territory, through which passes the trade from Thibet with Nepal and Sikim by the Walloongchoong and Kanglachema passes. Singalelah is about three journies from the crossing of Kanglanamoo above described, in a south and west direction. The ridge is continuous to Singalelah. Laden Yaks, sheep and goats, travel from Jongri to Yalloong and onwards by Kanglachema and Walloongchoong to Thibet. Direction N. W.

7. *Kanbacheu.*—Cross the Yalloong and ascend to the ridge of Choomjerma, whence descend to Kanglachen, which is a village of Bhotiahs on the river of the same name. Opposite the village—and across the river—is the Tassichooding Goomba, which belonged to Sikim when the Raja occupied the old Durbar, but since then it is in the hands of the Nepalese. The Kanbacheu river is a feeder of the Tambur, into which it falls one day's journey below Tassichooding Goomba. Direction N. by W.

8. *Nangola.*—An easy journey, the usual stage for unloaded travellers being "Yangma." Cross to the Tassichooding Goomba and ascend gradually to Nangola. Direction west by north.

9. *Yangma.*—Descend to the encamping-ground, which is on the Yangma river. On the opposite bank is "Mending Goomba."

The Yangma and the Walloong river unite half a journey below Mending Goomba and their united waters fall into the Tambur one day's journey from their confluence, whence the course is southerly. You may go on from Mending to Thibet by Walloongchoong, but the thoroughfare is to

10. *Kanglachema.*—Direction west by north. The route lies along the Yangma for half a journey, then leaving the river ascends to Kanglachema, which is the boundary of Nepal and Thibet, and is always under snow. The descent from Kanglachema to the Choomachoo is about 5000 feet; road good. No trees on north face of Kanglachema, nor any on this side above "Yangma"

11. *Choomachoo.*—Descend to this river, which runs west by south and into the Arun. It is the source of the Arun. At the crossing is the Tashirukpa Chaiten (Chaitya) a very fine and large one. Here 4 roads meet, viz. the Yangma road just described. 2. The Walloongchoong road. The Tokpay road, leading from Duncoota by the Arun river. Shingsha is at the junction of the Choomachoo with the Arun; there is a gola here. I have been to it from Tashirukpa all the way; the bed of the Choomachoo is the route for the greater part of the way; after leaving the bed of it I crossed the Kakula Pahar to Shingsha. It is too far round to go by the river all the way. From Tashirukpa to Kakula is nearly level; quite a plain, but very cold; Shingsha is in Nepal and here it is mountainous.

The Tashirukpa choo is a small stream which falls into the Choomachoo at the Chaitya.

12. *Koodoojong.*—Along the Tashirukpa all the way. The direction is north, country level and pretty well inhabited by Bhotiahs. No cultivation, it is too cold for anything to ripen. The people live by trading and get their supplies from Shingsha on the south: and also from the north. They keep Yaks, make butter from their milk and sell it. There is a Thibetan officer stationed here. He is styled "Neabo."

13. *Chankpook Goomba.*—The route lies all the way in the bed of the Tashirukpa river, which has still a southerly course. The country is level, and at the Goomba there are about 40 houses. There is cultivation here and wheat ripens; also pease, radishes and turnips. Koodoojong is like Phari; nothing ripens at either place. They are too near the snowy mountains. The country along this march is quite level.

14. *Sarrh.*—Direction north. The Neela range is crossed on this march. The ascent is commenced about half way from Chankpook, and is not above 500 feet. No snow on Neela in August, or till the cold weather.

15. *Badong.*—Direction north, country level, but not cultivated; thinly inhabited by herdsmen who keep herds of Yaks and live by the sale of the butter, which is very fine. There are no trees nor shrubs even. The Yaks browse on short grass, and people use their dung as the only fuel.

16. *Dobtah.*—A hundred houses here or more. The people are all Bhotiahs, and cultivate a good deal. They are subject to the Sekim Raja and pay their rents at Choombi, which is 4 horse journey to the east viâ Phari, 6 on foot. The country is quite level from Badong to Dobtah, but very bare and stony. There is a large lake close to Dobtahjong and east of it. It takes more than a day to walk round it. It is very deep and has sweet water. The Tashirukpa rises from it. The name is "Tsomootethoong," which means the "Lake the mule drank of,"* and the origin of this is as follows. "There was a well here originally, but a mule one day knelt down and drank out of it. No sooner it did so than the waters rose and formed this large lake." The neighbouring lands are irrigated from it; the banks are grassy, and it is well stocked with good fish. There are no trees to be seen here and the cultivation is confined to wheat, pease, turnips and radishes.

17. *Kochoochen.*—About 5 cos over a level bare country, but thinly inhabited. There is a hot spring here which is used medicinally; it rises out of the level ground, not from a hill. The Sikim Raja visits it when he comes to Dobtah from Digarchi. When at Choombi he uses the hot springs of Kamboo Sachoo, which are near the Phari road at Bukcha. Kochoochen belongs to the Thibetans, not to the Sikim Raja. Direction north.

18. *Shejong* or *Bhejong* on the She river. This is the residence of a Soubah, and has about 100 houses. The route is due north and over a level country, i. e. there are but small hillocks scattered over a plain. No trees except the willow, which however is not indigenous but brought from a distance—Lachen-Lachoong. The only crops grown are wheat, pease, radishes and turnips; grass is abundant; rains

* Tso, lake; te, mule; thoong, to drink.

fall but seldom. There is more rain at Phari and Choombi than here. The "She" choo, which runs close to the village and the Soubah's residence, has here a westerly course, and I believe it falls into the Yaroo. The "Jong" or Shoubah's dwelling is on the top of a small hill, and this is the general usage in this part of Thibet.

19. *Looghri.*—Direction north ; cross the Shechoo, which is fordable ; at 2 cos further on ascend the Lassoom ridge, which is 2 or 300 feet high, and descend to your ground, which is on the plain.

20. *Digarchi.*—About 5 miles due north over the level land, which is very bare, nothing to relieve the eye except a few willows and the "Shaboo," a large tree brought from a distance and much liked in Thibet. Around Digarchi there is a good deal of cultivation, which is irrigated from the Painomchoo, which falls into the Yaroo about 2 cos below Digarchi. This is a good-sized river, not fordable in July, August and September ; "it runs from the eastward, being close to Giangtchi, where it rises I do not know. It is as large as the great Rungeet ; the ferries are served by leather boats. There is a bridge over it at 4 miles above its confluence with the Yaroo. The Yaroo comes easterly and takes a northerly turn at Shigatzi."

The Tingri road from Nepal is joined by this route a cos from Looghri.

No. 2.

Route from Darjeeling to Yamgatcha by Yangpoong Gola and Doomdonglah.

This route runs through Sikim to the west of the Jongri one, and by Tuqvor and Seriong to Hee, and thence to

Lingcheet.—Cross the Kullait river and ascend to Lingcheet ; direction north by west.

Talett.—Ascend to the top of the Tengchok Yongchek ridge, cross it and ascend to this stage. Direction north-west.

Phiongdang.—Descend to the Rungbee-nuddi and go along its banks to this encamping-ground ; direction north. The Rungbee falls into the Ratong below Yoksum.*

Choonjom.—Along the Rungbee all the way and due north. The Rungbee rises from the Singalelah ridge.

* See Jongri route.

Yangpoong.—Leave the Rungbee to the left and ascend to this place, where there is a customs chokey of Sikim. Salt is brought into Sikim by this route from Thibet, but the trade is liable to interruption from the Nepalese, who stop its passage in the portion of their territory through which the road runs beyond Choolongkook.

Gomothang.—Ascend the Pekionglah ; cross the ridge and descend to this stage, which is on a small stream of the same name.

Chodomdong.—Cross the Gomothang stream and ascend along it to this place. There is a lake here which is the source of the Gomothang ; it runs easterly and falls into the Ratong below the junction of the Choorong with that stream.

Choolangkeok in Nepal.—Ascend to the crest of Domdonglah, cross it and descend to this ground. The Domdonglah ridge forms the present boundary between Nepal and Sikim, and is a continuation of Kunglanamoo. There is a small stream at this stage ; it is a feeder of the Tambur Koosi.

Yamgatcha.—Ascend and cross the Giroonglah, whence descend to this stage, where you fall into the Jongri road.

No. 3.

Route vid Lachen and the Latong Pass.

From Choongtam, at the confluence of the Lachen and Lachoong rivers to

Dema.—All the way along the Lachenchoo, direction north-west.

Latong, on the plain of Thibet.—About 5 cos from Dema ascend to the ridge of Latong, cross it, and without any descent you are on the Table-land of Thibet. On either side of the pass there is a high peak. You can go round by the bed of the Lachen, but the pass is the better route. Taloong is on the Lachenchoo, which rises to the eastward from a lake near Cholamoo.* The Lachen cuts off Kunchin from the range to the eastward.

Geeroo.—Over the level land in a north by west direction, and here you join the road from the Dankia pass. There is a fifth route to Thibet east of Kunchinjinga and west of this Lachen one, of which I have no particulars. It strikes off at Garrh† on the Teesta, whence the

* See Lachoong route. † See route by Lachoong.

next stage is "Barfok," thence Lingjah "Ba;" at Taloong, the confluence of Taloong and "Ba" streams there is a Goomba. The Teesta proper is left to the west at Lingjah, where it is crossed to the east bank. The road beyond Taloong is not known to my informants, but it goes along the stream of this name and over the Tekonglah into Thibet; Takong is a continuation or spur of Kunchinjinga.

No. 4.

Route from Darjeeling to Choombi by the Yakla Passage of the Snowy Range.

1. *Darjeeling to Sumoong.*—Viâ Lebong-Ging and the guard-house above the Rungeet. Cross the Rungeet at the cane bridge, and ascend in an easterly direction to the encamping-ground, which is about 1000 feet above the river.

2. *Chadam.*—Direction easterly, with a good deal of ascent; Chadam is about the same elevation as Namgialatchi, from which it is one day's journey.

3. *Namten.*—Direction northerly and easterly. The road skirts the base of Tendong, and there is little ascent or descent. The Ting, a small feeder of the Teesta, is crossed on this march.

4. *Took on the Teesta River or Changchoo.*—Descend all the way from Namten to the Teesta. The Rungbo river falls into it 2 cos below this ferry.

5. *Nadok.*—Cross the Teesta on a bamboo raft (Sa pan) and ascend in a northerly direction to this place, which is inhabited by Lepchas and Bhotiahs.

6. *Dikeeling.*—Ascend almost all the way in a northerly direction. Dikeeling is a permanent village of Bhotiahs, with a good deal of cultivation in wheat, barley, maize, rice, kodu, buckwheat, &c.

7. *La Ghep.*—This is not the "La Ghep" on the Tumloong and Chola route, but it is the same name for the same thing; it means, *the other side of the mountain,* and it is here so called by the Thibetians, and means the other side of Yakla or the Pass. It would be quite correct in a resident of this side of Chola to call Tangzoo, La Ghep.* Ascend all the way from Dikeeling. There is snow here all the winter,

* See route from Tumloong to Phari, Journal As. Soc. for April, 1848.

and no permanent habitations onward to Choombi. Yak herdsmen however frequent La Ghep and Yakla in the summer and rains.

8. *Bangrong.*—Direction west by north with very little ascent; cross the Bangrong Choo, a small stream which falls into the Rungbo.* The forest continues to Bangrong and beyond it. The Doom Shing (yew) is abundant and so is the Kema, a large flowering tree which is peculiar to the snowy regions. It is common at Jongri.† "There are seven sorts of Kema distinguished by the colour of the flower." The Kema is neither Rhododendron or Magnolia; flowers in May and June, is strongly scented.

9. *Yaten.*—Direction east by north; a gradual ascent. The forest ceases before reaching this place, which is bare and rocky. Snow in winter, no inhabitants. The pass of Yakla is close by; travellers put up in caves at Yaten.‡

10. *Charafook.*—Ascend about 100 feet to the Yakla passage, which is over a narrow ridge; cross it and descend all the way in the bed of the Yakla Choo to Charafook. From Yaten to Charafook is not more than 4 cos. Above the Yakla passage on the left is the peak of Gangri, not more than 600 feet high. It is not covered with snow during the rains, is visible from Darjeeling, and is a peak of some note, and venerated by the Lepchas; it is second however in this respect to Kunchinjinga, but annual sacrifices are made to it, and a festival held in honor of it. To the right of the Yakla passage there is no peak or elevation of the ridge. The Yakla Choo falls into the Chola Choo (Tangzoo Nuddi, of printed Itinerary to Phari§) a cos from Gangajong, at which place their united streams fall into the Machoo. The course of the Machoo is east and into Bhootan. Gangajong is 3 or 4 cos to the east of Charafook.

11. *Choombi.*—Direction north; a short way from Charafook you leave the Yakla Choo, and at 2 cos you cross the Chola Choo;—about a cos further on and beyond E-tok you fall into the Chola road from Tumloong. There is forest at Charafook and onwards to Choombi, principally of pines and yews.

* The Rungbo divides Sikim from Bhootan to the east of the Teesta; its course to the Teesta is westerly.

† See route to Digarchi viâ Kanglachema.

‡ There are two lakes to the east of the road near Yaten.

§ Journal As. Soc. for April, 1848.

No. 5.

Route from Darjeeling to Digarchi by Lachoong and the Donkialah passage of the Snowy Range

The stages from Darjeeling to the Teesta are the same as those noted in the route to Tumloong, viz. by Namgialatchi and Temi to the Samphoo or Sanadong Ghat, whence keeping the west bank of the river the next stage is

Kedong.—The road is difficult and runs for the most part parallel to the river, and about 500 feet above it. General direction north by west.

Garrh.—West of the Teesta, ascend from Kedong to Singdam, which is a Lepcha village, thence descend to Garrh. Road difficult.

Balla Samdong, on the Teesta.—Direction due north ; descent all the way to the Teesta.

Rungoon.—Cross the Teesta at the Balla Ghat* by a cane suspension bridge, and ascend to the encamping-ground ; direction north, road good, and habitations along it.

Singtam.—Ascend a short way, cross the Singtam ridge, then descend to this stage, at which there is a village ; there is a small stream which runs west to the Teesta.

Miangh.—Ascend the Miangh hill, cross it, and descend to the encamping-ground, direction north-west. The united streams of the Lachen and Lachoong fall into the Teesta below Miangh.

Namgah.—A good road, north by west, moderate ascent to Namgah.

Tongh.—About half way from Namgah you come to the Lachen Lachoong Choo, along the east bank of which lies this place. The Lachen choo rises from a lake beyond the snowy range, and after running west, penetrates the range at Latong, where there is a passage into Thibet, to be presently described. It unites with the Lachoong Choo at Choongtan, one day's journey above Tongh, and forms the Lachen-Lachoong feeder of the Teesta. The Teesta proper rises from the east of Kunchinjinga. The Lachoong rises from the Donkia mountain and runs down the passage that bears that name and to which this present route appertains.

* Sandong is Thibetian for ferry. Samphoo, the Lepcha word. Changchoo is the Bhotiah name of the Teesta ; Lepcha, Runew ; Limboo, Toongwama.

Choongtan.—At and just above the junction of the Lachen and Lachoong. There is a Goompa here, and a few houses of Lepchas; rice grows at the riverside.

Lachoong.—The road, which is pretty good, lies all the way along the riverside, west bank. The river is as large as the little Rungeet.

Yeumtang.—All the way on the west bank of the Lachoong, and close to it; direction north, road good, no inhabitants, and forest heavy.

Momay Samdong.—Still along the west bank of the Lachoong. There is a warm spring here; no forest, some Juniper bushes only.

Cholamoo.—Leave the Lachoong at Momay, and after proceeding some distance ascend the Donkia Lah for about 300 feet, when you cross the ridge through a pass or depression in it, flanked by two high peaks, which are not snowed before September. The pass itself is not snowed before November, and may generally be crossed till December, if the winter is not severe. The Lachoong is formed at Momay, by numerous small rills from the Donkia mountain.

From the pass to Cholamoo the descent is very steep and may be about 800 feet. Here begins the plain of Thibet. No inhabitants at Cholamoo.

Geeroo.—Direction west, road good and all the way over level land, which is quite bare of vegetation, and generally stony. The Lachen road over the Latong pass falls in at Geeroo.

Kambajong.—Direction west, road good and over level land, which has occasional hillocks rising from it. A village of Bhotiahs here, and some cultivation. The station of a Soobah.

The road from Choombi to Dobtah and this place is by Phari, which is three journeys to the east.*

Uchee.—Direction west and over level ground. Hot springs here of some celebrity, they deposit a white salt, called Peu, which is I believe carbonate of soda. No inhabitants here, country very bare and barren.

Koorma.—Direction north, cross the Tagilah, a ridge of 3 or 400 feet high, within a short distance of Uchee, then along a sandy plain to Koorma, which has 100 houses or so. The people are pastoral and traders, no cultivation.

* The stages are Dokshala, Mendingbooding, Phari; the road is easy and over the plateau of Thibet.

Potheet.—Direction north, road good and over level ground, no houses, a "Dennkang" or rest-house.

Rhejong.—Cross the Kiongola, a range of 300 feet or so. Direction north. Here you fall into the road from Dabtah to Digarchi. The Rhe Choo, which runs to the west, flows by the village.

Lassoom, and thence to Digarchi, as by the Kanglachema route.

Report on the Salt Range, and on its Coal and other Minerals.

By Andrew Flemming, *M. D. Edin., Assistant Surgeon, 7th Bengal N. I.*

On approaching the salt range from the Jhelum opposite Jelalpore, a traveller is at once struck with the brick-red tint and barren appearance which the strata forming the principal part of its steep southern escarpment present to view, and with the peculiar white color of the rock, which particularly to the westward, seems to cap the range, resting on the inferior red strata, with which it forms a striking contrast.

Height and course of salt range.—Its height as stated in Malte Brun and Balbi's Gazetteer is 2100 feet above the level of the sea, and from Jelalpore the hills stretch W. S. W. until within about 20 miles of the Indus, when they take a turn to the north, crossing that river at Maree and Kalibag in a N. W. direction, from which latter place they divide into two or three branches.

The part of the salt range which first came under our observation was in the neighbourhood of Pind Dadud Khan, where we arrived on the 19th March 1848. From thence, after examining a locality 10 miles to the eastward called Baghanawalla Davee, we crossed the hills to Choee and Kutass, marched down along the foot of their northern declivity to Noorpoor, crossed over the low hilly district towards Mokhudd, on the Indus, came down that river by water to Kalibag, which we reached on the 14th April, and from whence we returned along the south side of the range to Pind Dadud Khan, where our labors closed on the 28th of that month.

By adopting the above route, we were enabled to obtain a general idea of the structure of both sides of the range, and though, on account

of the lateness of the season, the extreme heat of the weather and the shortness of the time allotted for our researches, we were unable to examine in detail the whole extent of the hills, yet from the uniformity of character which, with one or two exceptions, these present at the different points visited, we feel assured that little of practical importance has been overlooked, and that the conclusions we have arrived at will generally be found correct.*

Foot of salt range.—Intervening between the Jhelum and the acclivity of the salt range in its eastern part, there exists a level plain which extends west towards the Indus and stretches down between the two rivers. In their immediate neighbourhood cultivation is pretty extensive, but towards the foot of the hills, the soil becomes extremely barren and is covered with a thick saline incrustation of sulphate and muriate of soda, which to most plants appears to be highly injurious.

Water.—The water in this plain becomes more and more brackish as one approaches the hills, that which issues from their base being a perfect brine and quite unfit for culinary purposes, the inhabitants being entirely dependent for the supply of this necessary, on rain water, or water brought from the Jhelum or upper point of the range, and which is collected in tanks. These are generally kutcha except in the neighbourhood of Pind Dadud Khan, where through the exertions of Misser Rulla Ram, the intelligent Superintendent of the salt mines, good sized pucka tanks have been constructed and yield an abundant supply of sweet water to the miners and natives around.

Rolled Boulders.—The commencement of the acclivity of the range is marked by a succession of small hills of a reddish sand, in which rolled boulders of rock become more and more numerous as one ascends, and at last cover the base of the hills. These are of all sizes, from a filbert up to a ton in weight, and consist of granite, gneiss, mica slate, porphyry quartz, limestone and red sienite closely resembling what is known in Scotland under the name of Peterhead granite.

* Since writing the present report we have had the pleasure of perusing a paper by Dr. Jameson of Saharunpore, which was reprinted from the Asiatic Society's Journal for 1843, in a late number of the 'Bombay Times,' and contains an account of his observations made during a trip to the salt range, which generally coincide with our own, although in some of the details we will be found to differ. We regret extremely not having been aware of the existence of this interesting article, until we found it in the pages of the Bombay paper.

Red sandstone conglomerate.—These boulders have resulted from the disintegration of the rocks superior to them, and particularly of a coarse red conglomerate on which the other strata of the range appear to rest, and which only here and there crops out under a coarse rusty red sandstone. The conglomerate is best seen on the Indus below Kalibag, where the imbedded boulders are numerous and of the same character as those to the eastward. In this, as also in the sandstone superior to it, no organic remains could be discovered.

Red sandstone.—Red saliferous marl with Gypsum and rock salt.—Succeeding to the sandstone, which varies in the thickness of its strata at different points, is a red ferruginous marl including beds of gypsum, both earthy and saccharine angular masses of which stand out in bold relief on the sides of the hills, the softer matrix having been washed away by the rains. The marl contains large crystals of Selenite or crystallized Gypsum, known to the natives under the name of *Aberach*, but they seem neither acquainted with its valuable properties when burned or of that of the Gypsum, which can be had in any quantity and with a very trifling amount of labor. The saccharine variety is generally of a light grey color with a shade of blue, translucent on the edges and yields a plaster of Paris by calcination, of good quality.

But of far greater importance are the deposits of rock salt that the red marl includes, and which we will merely allude to here as characterizing it, which though irregular in the depth of its deposit, seems to attain its greatest thickness in the neighbourhood of Pind Dadud Khan, thinning out towards Baghanawalla to the east, where no salt is excavated, but yeilding that mineral in abundance in all the western course of the range, with the exception of one or two localities, where the hills are of small altitude.

Variegated sandstones.—Above the marl, a breccia of masses of gypsum, sandstone and limestone cemented in a red calcareous matrix is occasionally to be noticed, lying unconformably on the marl, and to this succeeds a series of arenaceous and argillaceous beds, the prevailing color of which is blood red and presenting all the characters of the usual variegated strata of the saliferous formation. In the lower part of this series at Baghanawalla there occurs a succession of blue slaty soft argillaceous sandstones of considerable thickness, becoming highly calcareous towards their upper part, and above these is a light fawn

colored limestone on which rest the variegated sandstones and conglomerates interlaminated, with their beds of a bluish green indurated clay, nodules of the same being abundantly diffused throughout the strata. This limestone, though in appearance resembling magnesian ore, does not contain a trace of that earth, and is, as far as we could ascertain, devoid of organic remains.

Saline efflorescence.—Up to the highest point to which the variegated strata extend, their surface, as well as that of the rocks inferior to them, are incrusted with a saline efflorescence, which by solution in the water which flows down the valleys, renders it a perfect brine.

Absence of Organic Remains.—Ripple marks are by no means uncommon in the sandstones which, with the exception of what probably may be Fuci, are particularly free of fossils, a fact quite in conformity with what is usually observed in other countries in the red strata of the variegated sandstones. Whether these originally contained organic remains is a question which it is impossible to solve, but the same action, probably igneous in its origin, which has caused the peroxidation of so much iron in the strata, and to which they owe their color, may have destroyed any traces of organisms which at the period of their deposition they may have contained. That the rocks composing the salt range have been exposed to violent disturbing agencies is evident from the contorted and confused appearance which in many places they present, and from the general dip of the strata to the N. at angles varying from 40 to 50 degrees. What the elevating power may have been which has raised these to the position they are now in we will not presume to offer a conjecture, but the absence of Plutonic rocks in situ among those of the salt range, might lead us to seek for an explanation different from the usual one which these afford of the elevated position of strata. Much of the disturbed appearance which the red marl and sandstones present, is the result of ordinary causes, the most important of which are the periodic rains which in tropical climates produce such extraordinary effects, and in the salt range by undermining the rocks, cause immense slips, which give rise to a state of confusion among the strata often most embarrassing to the observer.

Calcareous strata with Fossils.—Above the variegated sandstones are others of a lighter tint alternating with light yellow sandstones, calcareous conglomerates and coarse limestones. These are well seen in

the neighbourhood of Pind Dadud Khan, at Noorpoor to the westward, and are much developed at Kalibag. To the east of Pind Dadud Khan they are very deficient, and do not exceed a few feet in thickness, being represented by a soft yellow fine grained friable calcareous sandstone and yellow marl.

In these strata organic remains, exclusively of marine origin, are found in considerable abundance, particularly at Kalibag, Musakhail and Noorpoor. Nummulites and other Foraminifera abound, becoming more and more plentiful at a higher position in the series of rocks forming the range.

At Kalibag Belemnites associated with Ammonites, species of Echinodermata corals, &c. occur, their color being light brown. The former have never been found in strata inferior to the Lias formation, and this circumstance, together with the fact stated by Professor Ansted in his excellent work on Geology, that Echinidæ for the first time in an ascending order appear in rocks of the Oolitic Æra, induce us to believe that the variegated strata of the salt range are succeeded by others of a different formation, which in all probability belong to an age more recent than the Lias. At Musakhail, about 10 miles E. of the Indus, the fossils found in the limestone differ considerably from those of other localities, and will be noticed hereafter.

Lower Yellow Marl.—We have alluded to a yellow marl as occurring above the calcareous strata. This is seen along the whole of the range, presents a strikingly uniform appearance and is full of marine shells, some of which do not occur in the strata inferior to it.

Bituminous Shales including Seams of Coal.—The marl forms the basis of a series of bituminous shales interlaminated with beds of blue clay and full of iron pyrites and large crystals of gypsum. These shales differ much in thickness at various points, and include seams of coal. A few shells are occasionally to be found in the shales similar to those of the marl on which they rest, and in a marl of the same character which is superimposed and passes into a very compact limestone of a light grey color, sometimes however separated from it by strata of a yellow calcareous sandstone of no great thickness.

Upper yellow Marl.—The upper marl is in some places so compact and composed of the comminuted remains of shells and a few corals, as almost to entitle it to the name of shell limestone. From it we obtained

two species of Echinidæ and a single tooth resembling that of a shark, which is the only trace of the remains of vertebrata, we had the fortune to discover.

Compact Nummulite Limestone with Flints.—The compact limestone, from its light grey, almost white color, and the great abundance of flint nodules deposited in it in regular layers, together with the appearance of its fossils, which are sometimes incrusted with a white chalk, has a certain resemblance to some of the older members of the cretaceous formation.

Chemical character of Limestone.—Its fine grained, almost flinty appearance, at first sight induced us to believe it was highly saliceous; but this is not the case, it being a very pure limestone, rapidly dissolving in diluted acids and leaving a mere trace of clay or mud. Its weathered surfaces have a glazed appearance, and present occasionally an oolitic structure, which is caused by the numerous nummulites and other foraminifera which frequently form the rock. The influence of these and of the more minute but not less wonderful class of infusorial animals in building up the crust of the earth is well illustrated in the strata of the salt range, all of which appear to be of marine origin, the sea at the time of the formation of the upper deposits having been highly charged with calcareous and saliceous matter, which through the agency of these minute organisms has been separated from their solutions and deposited in the masses we now behold. This limestone, which for the sake of distinction we will call *nummulite limestone*, forms the ridge of the hills presenting a steep southern escarpment from 150 to 200 feet high and giving to the range the peculiar white color before alluded to. It presents indistinct marks of stratification, except in its lower part, but reposes conformably, as far as we could ascertain, on the rocks inferior to it. Its surface, as exposed in the precipices on the southern escarpment of the range, weathers into large cubical masses, which give it the appearance of a wall built of loose fragments of rock, which by their gradual disintegration have fallen down and cover the declivity of the hills over a considerable surface, rendering their ascent a matter of no ordinary labour.

On surmounting the saliferous strata the saline efflorescence before noticed, as occurring on their surface and on the banks of the small streams which flow down the ravines, entirely disappears, and the water

which issues, but in small quantity on the south side of the range from the strata above, is sweet and pleasant to drink.

General appearance of vegetation.—The difference in the character of vegetation in the two districts is also striking in the extreme. Where the salt prevails, the few plants which occur are, with one or two exceptions, diminutive and unhealthy, but on reaching the limestone their appearance changes to a lively green, grasses and ferns are to be seen along the sides of the rivulets; and an Acanthaceous shrub which abounds generally throughout the range, becomes of at least twice the size. But the contrast is even more striking when the summit of the range is reached.

From this the limestone dips to the N., presenting on the northern declivity of the range a series of valleys separated by rounded hills. By its disintegration, it yields a soil which in the valleys is productive of excellent crops of wheat and barley, where the loose stones have been removed. These are generally piled up around the fields into low walls and remind one of the peculiar fences so common in the counties of Kincardine and Aberdeen in the north of Scotland, and known under the name of consumption dykes.

Calcareous Tufa, used as a source of fine Lime.—In some places, but particularly in the neighbourhood of Dundhote, Choee and Kutass, the surface of the limestone is covered with a deposit of calcareous Tufa, passing here and there into Travertine, and frequently containing impressions of leaves and fragments of wood. This Tufa is extensively burned by the natives and yields a lime of a perfectly white colour, admirably suited for a building cement. The nummulite limestone is also burned for chunam, but as the Tufa is soft and easily excavated, it is generally preferred. It has apparently been deposited from springs, the waters of which were charged with calcareous matter, held in solution by carbonic acid, but none of these appear now to exist.

Springs.—Springs are generally abundant in the limestone district on the N. side of the salt range, but no hot ones occur as far as we could discover. The natives assert that such do exist, but those pointed out to us as hot, were at the time we visited them, cooler than the atmosphere, being on account of the depth from which they spring, unaffected by the ordinary changes of atmospheric temperature. Such

springs usually indicate the mean annual temperature of the district, and hence appear to be hot in winter and cold in summer.

Tank of Kutass.—At Choee several streams of water issuing from the limestone hills unite to form a good-sized clear stream, along the grassy banks of which a road leads to Kutass, famous for its tank of water, a sacred resort of the Hindoos, and around which numerous faqueers have taken up their abode in fine mansions built by different Sirdars who have made them over to the holy men. This tank is supplied by the stream above mentioned, and has no apparent outlet from the limestone rock which surrounds it. Its depth is declared to be unfathomable by the faqueers and natives of the place, who informed us that Runjeet Sing, Burnes and several others had tried to ascertain it, but without success. A faqueer too, it is said, was engaged for two years manufacturing a rope, but in this period could not make one of sufficient length to fathom its abysses.

Being anxious to ascertain the truth of the statement, we got a charpoy tightly bound on four inverted gurrahs, and having seated a man on this frail craft, directed him to navigate it about the tank, taking soundings in our presence, at the different points, stated by the Faqueers and others as those of greatest depth. To their great disgust however, the deepest part was found not to exceed 23 feet, and as the soundings were repeated in so many different places within the area of the tank, we are inclined to believe that its depth is entirely fabulous, and that the story has been invented and perpetuated by the cunning faqueers, with the view of conferring greater sanctity on their pleasant residence. Probably the water escapes to a lower level through some crack or fissure in the limestone, and we suspect that a considerable stream of water which we observed to the westward at a place called Nurwa near Kuhar, is the drainage of the above tank. At the time we visited it, thousands of pilgrims were bathing in its clear waters, and a fair was being held in the town, giving the place quite an air of bustle and importance.

Soft Sandstone strata with Conglomerates, &c.—All along the north side of the salt range from Kutass to Noorpoor, the nummulite limestone occurs full of flints, rising up by a series of rounded hills with intervening valleys to the ridge of the range. To the north of Kutass and extending east and west along the foot of the hills, strata of a

much more recent date occur, resting on the limestone and gradually covering it from view. These consists of calcareous conglomerates, including small boulders of primitive rocks, sandstones and limestones, identical with those found in situ in the range, and gradually passing into highly calcareous friable grey sandstones interlaminated with beds of blue and red clay, occasionally inclosing patches of conglomerate, which towards the Indus at Mokhudd become very abundant. The dip of these strata diminishes regularly as one descends from the range into the plain, stretching north to the Hazara country and westward to the Indus, where they are nearly horizontal and are covered with a very thin soil on which but little vegetation exists. On the banks of nullahs and neighbourhood of wells which are but thinly scattered the water being at a great depth from the surface, fair crops of barley, wheat and grain are raised, but the culture of the two former is rather precarious from the great droughts to which the district is liable.

Gold.—Gold is obtained in considerable quantity in this district, being washed from the sands, which have resulted from the disintegration of the soft strata in the beds of the numerous nullahs which intersect the country and during the rains pour their waters into the Jhelum and Indus.

With the exception of some indistinct vegetable organisms associated with masses of jet near Kuhar to be afterwards noticed, and still more indistinct traces of amulidæ in a fine indurated clay, we did not observe any organic remains in these strata. The large amount of calcareous matter which the soft sandstones contain and which by solution in a weak acid, leaves the sand in its original state, has doubtless been derived from the calcareous waters which seem to have existed at the time of their formation. At no point does the lime appear to have been more extensively diffused through the strata, than at Mokhudd, where the Indus, about 300 yards wide, rushes with considerable force between two walls of conglomerate, presenting the appearance of a hardened mortar into which, in a soft state, rounded boulders of all kinds of rocks had been indiscriminately thrown.

From Mokhudd downwards to Kalibag in the course of the Indus, admirable sections are seen of these more recent strata on both sides of the river, which from a position of comparative horizontality, gradually ascend towards the central ridge of the range, and at Dundhote, about

2 miles above Kalibag, dip to the N. at an angle of 35°, forming rugged precipices of considerable height, which overhang the river.

The sandstones become more and more compact as the central ridge of the range is approached, have a dirty red colour and are seen to rest on the nummulite limestone, beneath which the usual deposit of bituminous shales, strata of variegated sandstones and saliferous marls occur, and are well seen at Kalibag, where the Indus escapes from its rocky channel into the wide plains of Esaukhail and Kutcha.

Coal of the salt range.—From the remarks which we have made in the course of our report, it will appear that the oldest formation noticed in the salt range, and that on which the others are based, is a number of what is commonly known under the name of the new red sandstone formation—a formation, which as far as the observation of geologists have yet extended, invariably occupies a position superior to the true coal measures in the crust of the earth, and has never yet yielded a coal of any commercial value. The neglect of this fact has on too many occasions been the cause of the outlay of large sums of money by individuals who, had they possessed but a slight amount of geological knowledge might have saved themselves from much disappointment.

The remark of Sir H. De la Beche, on this subject, is so true, that we give it in his own words. He says, "a little black shale or piece of lignite is often sufficient to cause the expenditure of £2 or 3000 in localities where there is not the slightest probability of success."

"Good bituminous coal," says Ansted, "fit to be worked extensively for economical purposes, does not occur out of the carboniferous group of rocks in Great Britain," and the same rule applies to the continent of Europe. To declare however, that no good bituminous coal will ever be found on the surface of the globe except in the position above stated, would be rash in the extreme, and the researches of Professor Rogers in Eastern Virginia, in the United States of America, would seem to render it extremely probable, that the thick beds of coal, which there occur, do not belong to the true coal measures, but represent on a large scale, the coal fields of Brora in Sutherlandshire, which has been worked from time to time since the close of the 16th century, and which by the researches of Mr. Lyell and Sir Roderick Murchison, have been clearly proved to belong to the oolitic formation. Similar deposits of coal occur and have been worked at Scarborough, &c., but

these, as well as the lignites of the tertiary strata of the Rhine, &c. present characters so totally different from those of true bituminous coal, and usually contain such a large amount of earthy matter intimately mingled with their component structure, that they are incapable of giving out a continued heat, and have only been worked, in the absence of other fuel or in localities where they occur near the surface and are easy of extraction.

We have already mentioned the bituminous shale, or in other words, the carboniferous deposit of the salt range, and its geological position among the other strata. That it is more recent than the saliferous formation we entertain no doubt, and are inclined to refer it to the oolitic era, believing that the coal in general character will be found to bear a close resemblance to those coals above alluded to as occurring in that formation.

General character of the Coal.—In general appearance the more compact specimens of the coal of the salt range, procured from parts of the seam out of the reach of atmospheric influence, resemble that variety known under the name of splint coal. It is however much softer and more brittle, and its relationship to the more imperfect class of coals, known under the name of lignites, is established by the fact of the occurrence of patches of brown half-decomposed vegetable matter associated with it, and at times to be found included in its most compact portions.

To the natives of the district its properties, as a fuel, are unknown, but under the name of *Sangee Momiai*, it is used by them as a medicine, given internally in powder along with milk, in all bruises or wounds both of men and animals, the cure of which it is said greatly to facilitate.

The coal is somewhat difficult to ignite, and at first emits a large quantity of smoke. When combustion however is once established, it burns without caking, gives out a considerable amount of flame and heat, and leaves a large quantity of ash.

It is particularly free of iron pyrites, which abounds in the bituminous shales, with which it is invariably surrounded, and hence in burning gives out no sulphurious smell, an objection to which lignites in general are liable.

For the purposes of steam navigation, or when flame with a moderate

amount of heat is desireable, we believe this coal would answer well, but it is certainly not adapted, from the small amount of coke it yields, for the smelting of ores, where a high and continued heat is so urgently demanded.

The point of the salt range where the coal appears to be best developed, is in the neighbourhood of Pind Dadun Khan and to its eastward, while towards the Indus, and particularly at Kalibag, it does not occur in a seam of any size, but is spread through an immense deposit of bituminous shales, in thin films, rendering them admirably adapted for the purposes of alum manufaeture.

All the localities which we had an opportunity of examining, where the coal crops out, are on the southern escarpment of the range. It is best seen at Baghanawalla, Keurah, Dundhote, Ruttipind and Noorpoor, where the coal is of pretty good quality and in considerable quantity. At Mukrass, and Numbhul, or Bukkh, the same eoal occurs but it is of inferior quality and in but small quantity.

We shall notice these different loealities as they are situated, proceeding from E. to W., and here we may state that it appears to be the same seam or seams, whieh run along the whole extent of the carboniferous deposit.

Baghanawalla Coal.—This coal was first brought to the notice of Sir H. Lawrenee by Licut. Robinson of thc Engineers, who forwarded samples of it to Lahore in the autumn of 1847. From these we made an analysis, the results of which, along with a few remarks on the gcneral charaeter of the coal, were laid before the Asiatie Society in February, 1848.

Baghanawalla Davee is a small village about 10 miles E. of Pind Dadun Khan and about the same distance from Jelalpore. The coal seam oecurs in a ravine about 3 miles N. E. of the village among the hills. The aceess to it is very difficult and steep, and no beast of burden ean at present approaeh it. It is ineluded in shales and yellow marl resting on the variegated sandstone strata, above which is a shell limestone passing into eherty limestone, which apparently is the representative of the calcareous deposit so abundant to the W. but which at this point is but little developed. This is not morc than a few feet thick, and on it rests a grey friable sandstonc, whieh is succeeded by a series of soft arenaceous strata forming a range of low hills running

N. N. E. towards mount Doomeyala, and between the village of Futtipoor and Mount Tilleh. In some places, and particularly where it crops out in the ravine, the coal appears of good quality in a seam 5 feet thick, and on each side of this can be traced for at least $\frac{1}{2}$ a mile, in some places appearing to degenerate into highly bituminous shales. The seam dips conformably with the strata above and below to the N. N. W. at an angle of 45° or 50° which would render the sinking of a shaft through the strata superior to the coal, in such a locality, a matter of considerable difficulty and expense.

Keurah Coal.—This occurs above the salt mine village of Keurah near Pind Dadun Khan, and about a mile to its N. E. It is seen cropping out on the side of a ravine, the access to which is as difficult as to the locality last described. The coal is found in the same geological position, above the variegated sandstones, and is included in a series of thin laminated sandstone marls and bituminous shales, the latter of which are charged with aluminous earth and iron pyrites, and are here and there incrusted with an efflorescence of sulphate of iron and alumina. The seam is about 2 feet thick and rests on a blue clay inclosing septaria, into which we dug 6 feet without getting through it. In this as well as in the shales large crystals of gypsum are abundant. The coal appears to dip with the other strata to the N. W. at an angle of from 40° to 50° and may be traced across the ravine for about 30 yards, where it seems to thin out among the blue clay on which it rests. Where exposed to the atmosphere it is very brittle and covered with a yellow crust of iron alum, but on digging into the seam it is of good quality, pretty hard and compact, but here, as in other places, affording abundant evidence of its imperfect mineralization. Above the coal shales the same yellow marl occurs, and is succeeded by a considerable deposit of the nummulite limestone, on which repose a series of soft sandstone strata, that have evidently been much disturbed.

Ruttipind Coal.—This locality is to the W. of the road to Kutass, and about 3 miles from Keurah. The coal occurs among shales from 30 to 40 feet thick, full of large crystals of gypsum and pyrites and interlaminated with their films of yellow clay. Two seams occur, the lower one two feet thick, and separated from the upper, by shales of about a foot in thickness. This measures 4 ft. and along with the other may be traced down a deep ravine for 50 or 60 yards. The coal does

not appear so good as that of Keurah, being very brittle and containing a quantity of earthy matter. The dip of the strata is here to the N. at an angle of 35° to 40°. Above the shales is seen the yellow marl and then a bold escarpment of nummulite limestone, on reaching the top of which the village of Ruttipind is seen in a valley on the northern declivity of the range.

Dundhote Coal.—This seam is only about 2 feet thick, occurs in a similar position and is of much the same quality as the last. The only access to the locality is by a footpath very difficult to ascend, and above the coal seam the nummulite limestone with flints rises to the top of the range on which the Fort of Dundhote is built.

Mukrass Coal.—Coal also was found at this locality by some of Misser Rulla Ram's men, who brought me specimens, on my return from the Indus. It is of inferior quality, but evidently part of the same seam as noticed above.

With the exception of Baghanawalla the localities mentioned are included in a circle of 4 or 5 miles, in the neighbourhood of Pind Dadun Khan, and though these were all we had an opportunity of examining, yet doubtless at numerous other points both E. and W. the same seam will be found to crop out if due search be made.

Noorpoor or Nilawan Coal.—We are satisfied on this point, as at Noorpoor, 15 miles west of Pind Dadun Khan, we found a coal of a character identical with what occurs to the eastward. It is to be seen above the Nilawan salt mines, in two small 8 inch seams, included in shales on which a steep escarpment of the nummulite limestone rests at least 150 feet high. The coal seam dips to the N. W. at an angle of from 25° to 30°.

Numbhul or Bukkh Coal.—Between Noorpoor and the Indus only one locality came to our notice, where coal occurs. This was in the neighbourhood of Musakhail, about 3 miles from Numbhul, at a place called Bukkh. The position of the coal appears identical with that to the E. being included in shales beneath the nummulite limestone forming the ridge of the range. It is best seen in a deep ravine formed by a stream which escapes from the hills into the plain near Musakhail, presents a charred appearance, and patches of it occur in a calcareous white sandstone which is in relation with the shales at their inferior part. This appearance is no doubt the result of the shales charged

with pyrites, having during the oxidation of the latter undergone spontaneous combustion, a phenomenon of frequent occurrence, and one which has produced much mischief in some of the British collieries. From the shales downwards to the base of the hills on the S. W. side, there is a development of calcareous strata evidently superior in geological position to the red saliferous marl, and which we have observed nowhere in the range to the same extent.

In contact with the shales is a calcareous sandstone which gradually passes into strata of limestone of a light bluish-grey color, containing abundance of nummulites, and towards the base of the hills enclosing layers of flints. These latter have a brownish tint, derived from peroxide of iron, with which they are frequently incrusted, but in none could we detect organic remains, which abound in the limestone, and particularly in its lower strata, which are of a much darker tint, and coarser character, than the upper beds. From the former we obtained several specimens of shells of the genera Productus, Terebratula, and probably one Spirifer, associated with Ammonites, Belemmites, &c. The appearance of these fossils, as well as of the limestone in which they are imbedded, is more ancient than that of any of the other fossiliferous strata we have noticed. Shales of the genera Productus and Spirifer are generally considered characteristic of strata inferior to the Lias, and abound in the magnisian limestone. There are however exceptions to this, and at least 3 species of Spirifera, and we think one or two Producti have been found in the Lias itself. Terebratulæ are by far the most abundant of all the fossils we noticed in the limestone, and this genus has been found to occur through all the strata from the chalk formation downwards.

At first sight we were inclined to believe that we were dealing with magnesian limestone, but on subjecting a portion of it to chemical analysis, we failed to detect any magnesia in its composition, which earth does not, as far as we can ascertain, exist in any limestone of the salt range.

We regretted much that our time did not permit us to examine this interesting deposit more thoroughly, as we are satisfied that from it a very fine collection of Fossil shells could be made, by which the true age of the calcareous strata might be established. In the ravine where the coal is seen beautiful sections of the strata are exposed to view, which

from the top to the hollow of the range seem to dip to the N. E. at an angle of 45°.

From the preceding details of the character of the coal seams, it will be apparent, that a very considerable quantity of fuel could be obtained from the various localities mentioned. At present however no beasts of burden could reach the places where the coal crops out, these being near the top of the range, and hence, until a road or path could be made, a work in these rugged hills of some difficulty, the mineral would have to be carried by coolies to a depôt, from whence it could be removed by bullocks, mules or camels, to the banks of the Indus or Jhelum.

By working the coal from the surface when it crops out, and parallel with the seam, it could be easily obtained, although considerable annoyance would be experienced from the falling in of the soft strata and loose boulders of rock which cover it. Until some locality is found where the coal seam appears of regular thickness and not developed in nests or patches, as we are inclined to believe is the case in the salt range generally, we could not recommend to government the propriety of attempting mining operations, except on a small scale, and by way of experiment. Perhaps Baghanawalla Davee and Keurah would be the most favorable positions for such attempts, which could be made at a moderate expense, labour being so cheap in the district and the inhabitants experienced in mining.

Jet Coal.—Besides the coal seams we have noticed, we met with a variety of coal at Kuhar, on the north side of the salt range, and at Kalibag, on the Indus, totally different both as to the geological position in which it is found, and in its physical characters, but in a commercial point of view, likely to be much less valuable than that we have previously described. It is what is known to geologists and mineralogists under the name of Jet, and never occurs in quantity sufficient to render its mining a work of any practical importance.

Kuhar Jet Coal.—This coal occurs among the soft calcareous sandstones which skirt the base of the hills. It is best seen at a place called Nurwa, a little to the N. of Kuhar, where a clear stream of fresh water has cut its way, to the depth of at least 200 feet, through soft sandstones interlaminated with beds of red and blue indurated clays, which dip to the N. N. W. at an angle of 25°. The coal occurs in flattened masses resembling the compressed trunks of trees, is of a glistening

black color, with a brown streak, and sectile when first removed from the rock. Its broken surfaces present a distinct woody structure, and brown patches of imperfectly carbonized wood, resembling peat, are frequently to be found in it. The Jet occurs but in small quantity, and would never be worth working.

Kalibag Jet Coal.—This coal, though in external appearance the same as the last, occurs in a totally different position, being found in strata inferior to the regular carboniferous deposit, and separated from it by a series of calcareous sandstones of a light yellow color, which are highly fossiliferous. Beneath these follow a succession of conglomerates of the older rocks and variegated sandstones and clays, towards the lower part of which occurs an extensive development of highly bituminous shales, in some places closely resembling coal, and interlaminated with strata of a white fine-grained sandstone, in which, as also in the shales, detached masses of jet occur, occupying a horizontal position, and may be picked out in considerable quantity. About 40 or 50 maunds of this coal and about the same quantity of bituminous shale supposed to be coal, were taken as fuel by Capt. Christopher in his return trip down the Indus in the "Conqueror" steamer. The results of his experiments with the jet coal, have, as was to be expected, been very favorable, and it is only to be regretted that the coal exists in small masses, evidently the remains of trunks of trees and no regular seam. In almost any portion of it which we excavated the woody structure was apparent, and in numerous specimens which we have preserved, nests of peat are to be observed in their interior, showing the imperfect mineralization of the coal, which presents even a less close approximation to the character of true coal than that which occurs in the regular carboniferous deposit.

The very short time we had at our disposal while at Kalibag, and the extreme heat of the weather, prevented us from examining the locality with the care we could have wished; for though our short search for coal was unsuccessful, the extensive development of bituminous shales in the strata around afford a hope that a seam of coal (though not of the true coal measures) may be found, which will yield a fuel suitable for the purposes of steam navigation.

In no part of the salt range have we seen a locality so fraught with interest, as at Kalibag, where strata are developed in many respects

different from those to the eastward, and from the careful examination of which much geological and probably practically useful knowledge may be obtained.*

Iron Ore.—The frequent occurrence of the most valuable of the British iron ores, known under the name of Black Band Ironstone, in the true coal measures, induced us particularly to search for this mineral and other iron ores, which might be found in relation with the carboniferous deposit of the salt ranges, but we regret to record that we met with but little success. Veins and nodules of hæmatite or red peroxide of iron, are abundantly diffused through all the strata of these hills, but the want of suitable fuel to reduce the ores to a metallic state, will, we fear, prove an obstacle to its being turned to much account. At Kamgoorum, 30 miles to the W. of Kalibag, iron is manufactured, probably from this ore, wood charcoal being used for its reduction. It is brought to Kalibag in the form of lumps of pig iron, which appear to be of inferior quality.

Petroleum.—This mineral is of frequent occurrence in the hills around Kalibag, and is obtained in considerable quantity at Jabba, S. of the Indus, and about 7 coss from Kalibag. It exudes from the rocks and floats on the surface of water. It is known to the natives under the name of *Gunduk ka tel*, who use it in place of oil in their lamps. We had not time to visit the locality where it is found, but from the enquiries made we are satisfied that it exudes from the neighbourhood of bituminous alum shales, and is probably one of the results of their destructive distillation, when undergoing the process of spontaneous combustion. The petroleum is of the consistence of tar, has a dark brown color, most penetrating smell, and burns with a yellow smoky flame. Its medicinal properties do not seem to be known to the natives, who use it only as a source of light.

Sulphur.—Associated with the petroleum, sulphur is also found in small quantity, and its origin is probably identical with the former.

Lead Ore.—The only other mineral which we shall notice is the galena ore or sulphuret of lead. This occurs in grains or small cubical

* We regret extremely our not being able to append a series of analysis of the coals from the different localities mentioned in the preceding pages, in consequence of the loss of the greater part of a small stock of chemical apparatus which we possessed, and which for a time we will be unable to replace.

crystals in a limestone near the Keurah salt mine, and in a similar rock on the N. side of the range, on a hill called Kuringuli, 2 miles N. W. of Choee. The natives give it the name of *Soorma,* believing it to be sulphuret of antimony, of very fine quality, and is consequently in much repute among them as a cosmetic. It however contains no antimony, its only impurity being a trace of silver, which is generally present in galena, and sometimes in such quantity as to render its extraction a work of commercial importance. In the localities above mentioned the mineral occurs in such small quantity as to be of no value.

On the Salt Mines.—The mines from which the principal supply of salt is obtained, are those of Keurah, in the vicinity of Pind Dadun Khan, of Surdi, near Kuhar, and of Maree and Kalibag, on the Indus.

The general superintendence of these is entrusted to an agent of the Lahore state, Misser Gyan Chund, who, with his son Misser Rula Ram, reside at Pind Dadun Khan, where the largest salt depôt in the district exists.

Salt mine village of Keurah.—The mineral is brought in greatest quantity to the depôt, from a village called Keurah, about 4 miles distant, and around which no fewer than 10 shafts are sunk into the red marl for the purpose of extracting the salt. From the foot of the hills a narrow path, strewed with boulders and masses of rock, which have fallen from the height above, leads through a deep ravine to the salt mine village, which is built in terraces on its east side, and is inhabited by the miners and their families during the dry season. In the rains, on account of the heat and musquitoes, they desert Keurah and take refuge in the small village of Tobu, which is built on the opposite side of the ravine, but at a considerable height above the salt mines, and where they enjoy a cool breeze and an immunity from the attacks of their winged tormentors.

The inhabitants of these villages amount to about 650, four hundred of whom are employed in the salt mines, an occupation which, if we may judge from their appearance, does not seem to be particularly prejudicial to health.

Of the mines around Keurah two particularly deserve notice, and receive the names of the Keurah and Sujoowalla mines.

Keurah Salt Mine.—This is a little to the E. of the village, and on a higher level, the path leading to it passing over red marl containing

angular masses of gypsum. The entrance to the mine is by an opening cut in the marl about 7 feet high, and leading into a passage which preserves throughout a height of 6 feet and a width sufficient to allow two individuals to pass.

From the entrance to the end of the workings, the distance is 640 feet, where a chamber has been excavated entirely out of the rock salt 40 feet long by 30 feet broad, and about the same height, in which at the time we visited it men, women and children, were busily engaged quarrying the mineral by the light of small oil lamps, formed of the salt and hung by iron hooks on its walls the crystalline surface of which, reflected the light on a deep pool of brine situated in one corner of the chamber, and which is said to communicate with several of the neighbouring shafts.

In the interior of the mine, which was remarkably dry, the heat was most oppressive, and the thermometer hung on the rock salt stood at 85°, while in the shade at the mouth of the shaft it indicated 75°.

The appearance of the miners as seen in the dim light which illumined the mine, was highly striking, their faces and bodies being covered with a saline incrustation. Their dress is of the lightest description, the men wearing nothing but a bit of cloth wound round their loins, and a pad of numdah or thick woollen cloth tied over their skins to protect them from injuries from the sharp angles of the salt or blows from their instruments. These are but few, the one of most importance being a hammer sharpened at one end into a highly tempered point, combining advantages of a pick and chisel. With this and a small crowbar, almost all the salt is excavated, large hammers being occasionally requisite to fracture the larger masses of the rock.

The salt is generally removed from the mine in square lumps of such a size, that two will form a good load for a camel, by which animals it is conveyed, after being weighed at the mouth of the shaft, to Pind Dadun Khan, where it is sold at the rate of Rs. 2 per maund, the miners receiving from two rupees to two rupees eight annas per 100 maunds, according to the quality of the salt turned out.

Varieties of the rock salt.—The mineral occurs in three varieties, the pink, the white and the transparent, but the former is preferred by the natives for culinary purposes, from its containing, it is said, less *Reshuh*, a term the exact meaning of which we could not discover. The pink

color is generally supposed to be derived from organic matter, and is not the result of the admixture of a minute portion of iron or manganeese which the color might have led one to suppose.

Chemical characters.—When submitted to a chemical examination, all the three varieties of the salt are equally pure, and contain neither sulphate of lime nor chloride of magnesium, the common impurities of the mineral. In consequence of the absence of the latter, it is very slightly deliquescent, an advantage which it possesses over common bay salt, which if exposed to a moist atmosphere, rapidly attracts water.

What the thickness of the deposits of salt may be it is impossible to ascertain, but certainly that of the principal bed, in which the chamber is excavated, cannot be less than 150 or 200 feet. It does not seem to occur in regular strata, but rather in masses of irregular thickness, in which a stratified structure is observable, the general dip being to the N. at an angle of from 30° to 40°. These masses are separated from each other by portions of marl, including beds of gypsum, and are seen all along the sides of the passage, where they are occasionally worked. By the passing and repassing of the miners, portions of gypsum and salt have become highly polished in some places, and in the floor of the passage, where very imperfect steps exist, are extremely slippery.

Great annoyance is experienced particularly during the rains when all mining operations are suspended, from the falling in of the roof and sides of the various workings, which might in a great degree be prevented and many lives saved, if proper means were adopted to support the marl and soft rock, as the salt is removed from beneath. At present this is done in a most careless manner, and hence the frequency of accidents to the unfortunate miners, whose life is one of ill-remunerated labour.

According to the Superintendent of the salt mines, from 48 to 50,000 maunds are annually obtained from the mines around Keurah, the one just noticed yielding alone about 15,000 maunds.

Sugoowalla mine.—This mine yields a very large quantity of salt of the best quality, and is very easily worked. The entrance to it, is about $\frac{1}{2}$ a mile to the E. of the Keurah one, and on a much higher level. From the surface, one descends the passage by a series of imperfect steps cut out of the marl, in which beds of salt occur close to the mouth of the shaft.

In the interior of the mine, enormous masses of the mineral are to be seen, which have become detached from the roof and sides, and under which the various passages lead to an immense distance in the interior of the hills.

The temperature of this mine was much lower than that of Keurah, but having accidentally broken our thermometer we were unable to make any accurate observations. The amount of moisture which exists, and which is seen trickling in a small stream down the steps in the passage, may possibly be the cause of the comparative coolness of the mine, the roof of which was in several places covered with stalactites of salt upwards of a foot in length.

We were warned against entering this mine, which is considered unsafe, its roof and sides being rent and cracked in all directions. However any risk run was well repaid by the magnificent spectacle which the resplendent walls of salt afforded, dimly illumined by the twinkling lights of the miners.

Surdi Salt mines.—The salt mines of Surdi, about 10 miles to the W. of Pind Dadun Khan, have been more recently opened than those around Keurah, and appear to be constructed on a better plan, good flights of steps being cut out of the salt, which occurs in quantity close to the surface, and the roof of the passages well supported by strong beams of wood. The salt is of excellent quality, and remarkably compact. As it is raised from the mine it is conveyed on camels to a depôt about 2 miles from Kuhar, on the road to Kutass, none of it being sent to Pind Dadun Khan, but yielding a supply to Cashmír, and the districts to the N. of the salt range.

Kalibag Salt.—The salt is worked on both sides of the Indus above Kalibag, which village is built on the side of a hill of red marl, which extends along the N. bank of the river about a mile, and in which a vast deposit of rock salt exists.

The mineral is very near the surface, frequently cropping out and behind the terraced houses of Kalibag, forming a wall which overhangs the village. It is chiefly worked in the bed of a nullah called the *Loon*, a name derived no doubt from the character of its water, and which enters the Indus on its north bank opposite the village of Maree, where a large quantity of salt is also obtained.

No shafts are sunk in the marl as at other places, the rock salt hav-

ing fallen down in immense masses from the heights above the nullah, requiring only to be broken into portions fit for removal. On the east side of the marl hill the salt is of excellent quality, the transparent variety occurring in great abundance, but on the west side towards Kalibag, it is mixed with a great deal of marl and hence is little worked. The stratification of the salt is more apparent here than in any of the mines to the eastward, and the strata appear to dip to the N. W. at an angle of 40° .

The marl abounds in gypsum, which generally is of an earthy character, the saccharine variety being less abundant than in the other localities we have noticed.

APPENDIX.

On the Alum Manufactories of Kalibag.

Alum Shales.—Next in importance to the rock salt which the strata of the salt range afford, are the *Bituminous shales,* which abound in all its extent, in connection with the coal seams, and from which, at Kalibag, Alum is extensively prepared.

These, as before mentioned, contain clay, abundance of iron pyrites, and their seams of coal, by the mutual reaction of which on each other, especially during combustion, an alum is formed.

The shale or rol, as it is technically called by the natives, is brought from several localities in the neighbourhood of Kalibag, the principal workings of it being at a place named Chatah, where the shales, corresponding to those in which the coal occurs to the E. of the Indus, are about 200 feet thick.

Regular shafts are sunk for the purpose of excavating the shale, and one of those we measured, extended 207 feet from the entrance. From the soft character of the strata accidents to the miners are of very frequent occurrence, the risk of which, as in the salt mines, might be considerably diminished were proper means taken for the support of the roof and sides of the shafts. In one of these, the shales spontaneously took fire, five or six years ago, and from its mouth a column of smoke resembling that from the funnel of a steamer is constantly issuing, no means being taken to extinguish the chemical action going on in the interior.

The rol or shale, as it is brought to the mouth of the pit, is placed in bags made of kummul or country blanket, two of which are loaded on bullocks, a narrow path having been made to enable them to ascend and descend the rocky side of the hill to the bed of the Loon nullah, from whence a road leads by the side of the Indus to Kalibag.

Price of the Alum Shale at Kalibag.—In this way the shale is landed at the alum kilns at prices varying from 14 to 17 maunds for the rupee, the workmen being supplied with mining instruments, but obliged to provide bullocks at their own expense.

Alum Kilns.—The kilns form the most striking feature of Kalibag, their red mounds rising up here and there in the middle of the village, and the smoke which issues from them tainting the air to a considerable distance around.

Injurious effect of Alum Kilns on the health of the inhabitants of Kalibag.—The injurious effect of impure air on the workmen employed about these kilns, is abundantly manifested in their sickly, emaciated appearance, many of whom labor under chronic affections of the lungs. Goitre prevails to a considerable extent among the inhabitants of Kalibag, but whether this is attributable to the pollution of the atmosphere by carbonic and sulphureous gasses, to the highly calcareous waters of the Indus, or to other more obscure causes, we will not venture to offer an opinion. In other parts of the salt range, we did not notice particularly the prevalence of goitre, whereas at Kalibag it is very common, some of the tumours being of large size.

Number of Kilns in Kalibag.—In the village there are no fewer than 14 kilns, to each of which the necessary arrangements for the preparation of alum are attached, but at the time we visited Kalibag only 12 were efficient.

Formation of the Kiln.—In preparing the kiln, a thin layer of brushwood (generally Tamarisk jungle, which abounds on the banks of all the Punjaub rivers) is spread on the ground to an extent varying according to the size of the one about to be constructed. On this a layer of the rol or shale in fragments is deposited to the depth of about a foot, to which succeeds a second layer of brushwood and then another of shale. When several of these have been arranged, the kiln is set fire to from below, care being taken that the combustion is not too rapid, which from time to time is moderated by sprinkling water

on the shales. The kiln being well lighted, fresh layers of shale and brushwood are added, and when the whole has attained the height of 30 or 40 feet, it is left to burn, 6 or 8 months being generally sufficient to effect the thorough decomposition of the mass, which when completed has a brick-red color from peroxidated iron, its surface being covered with an efflorescence of alum, containing a large proportion of sulphate of iron or green vitriol.

Preparation of the Alum.—Close to the kiln, and on a level a little below its base, there is a baked earthen vat 12 ft. square by 1 ft. 5 in. deep. Into this a portion of the burned shale is thrown and lixiviated with water for several hours, which rapidly acquires a dark brown color. When a saturated solution of the soluble matter in the shale is obtained, it is drawn off from the vat by an aperture in its side (which during the lixiviation is stopped by a plug), into another vat of similar size, but on a lower level. Here the crude alum liquor is allowed to deposit any mud which it may contain, and is then run off into a third but smaller vat on a still lower level, where it is again allowed to deposit any remaining impurities. From this it is transferred into an iron evaporating pan, where it is rapidly boiled and mixed with a brownish impure salt called *Jumsan*, from which it derives alkali necessary to convert the crude alum into an alum of commerce. When a proper quantity of this has been added, which is judged of from the appearance of the liquid, the whole is allowed to settle, and the clear brown alum solution removed into vats, 8 ft. 8 in. long, 5 ft. 5 in. broad and 1 ft. 5 in. deep, a series of which are arranged beneath a shed, close to the evaporating pan. In these the solution, which is concentrated to a point a little short of that of crystallization, is allowed slowly to crystallize for several days. During that time small alum crystals are formed of a slightly pink color, derived no doubt from the impure mother liquor which contains a quantity of muriate and sulphate of iron. When a considerable crop of alum has separated, the crystals are removed from the vat, slightly washed with cold water on a sirkee frame and allowed to dry. These are afterwards fused in an iron pan, in their own water of crystallization, and when in a fluid state, are removed into large conical earthen jars or gurrahs, 1 ft. 8 in. deep, the same breadth at the shoulder, and 6 inches wide at the mouth, where for eight or ten days they are allowed to crystallize. At the end of this period a hole is made in the mass

of alum, which is generally hollow in its interior, the gurrah inverted and the uncrystallized alum liquor, should any remain, allowed to escape. The gurrah is then broken and the alum moulded to the form of the vessel, and removed to the depôt for sale and exportation.

By acting on successive portions of the kiln in the manner above described, the whole is by degrees exhausted of the alum which it contains.

Quantity manufactured.—The average daily expenditure in all the Alum works at Kalibag was stated to us to be only Rs. 12, while the amount of alum annually prepared is about 12,000 maunds, which at Rs. 3 per maund, the price of the article at the manufactory, will yield a return of Rs. 36,000 per annum.

It is indeed singular that a process almost identical to that employed in European alum works, should have been discovered and adopted by the natives of India, and practised by them for several hundred years. We could not ascertain how long alum has been manufactured at Kalibag, but the proprietor or Malik of the place, by name Ullah Yar Khan, a remarkably obliging and intelligent old man, informed us that his ancestors for eight generations had carried on the trade.

Alkaline base of Alum.—We have stated that the substance from which the alkali of the Kalibag alum is derived, is a brown salt called Jumsan. This seems identical with the saline efflorescence so abundant throughout the N. W. provinces, and particularly so in all the grass jungles and waste ground in the neighbourhood of Lahore, and which is chiefly composed of sulphate of soda, with a little common salt and a trace of carbonate of soda giving it an alkaline reaction.

For the supply of the alum manufactories the efflorescence is scraped from the soil in the jungle E. of the Indus, and is particularly abundant in the plain which skirts the S. side of the salt range at the villages of Gurree and Tuttee, 8 or 9 miles from the Indus. The efflorescence is denominated *Kullur*, and from it Jumsan is obtained by treating the former with water and drying up the solution of its saline matter in gurrahs exposed to the sun.

This on analysis turns out to be nothing but a mixture of sulphate of soda and common salt, with varying proportions of carbonate of soda, its quality depending chiefly on the amount of sulphate of soda which it yields.

In all the commercial European alums, as far as we can ascertain, the alkaline base is Potash or Ammonia—the former alkali being characteristic of British alums, while the latter occurs in those of France. In the alum of Kalibag however, and in another sample of alum of a different external appearance, which we obtained in the Jullundur bazaar, soda forms the alkaline base, a fact which the addition of Jumsan to the crude alum liquor first led us to suspect, and which a chemical analysis of the alum has subsequently confirmed. A soda alum, as far as we can ascertain from the chemical or pharmaceutical works we have at present access to, is only known as an interesting chemical preparation; but we are not aware that such has been noticed as a staple article of commerce in the N. W. provinces, and probably throughout British India.

Purity of the Alum.—Considering the coarse apparatus in which the alum is prepared, its purity is astonishing. It effloresces considerably on exposure to the air, has a slight pink color, arising from the presence of a little iron which strikes a blue color with yellow prussiate of potash, and only contains a trace of muriate and sulphate of soda.

Besides the alum we have just noticed, another kind is prepared, from a light grey shale, containing silky crystals of what appears to be subsulphate of alumina. It is found associated with the other alum shales around, but in small quantity. To prepare the alum, the shale in coarse powder is mixed up with the impure liquid, from which the alum crystals have separated. The mixture is then dried in the sun, in irregular shaped masses of about a seer in weight, and which are of a brownish color. When dry they get a second dip in the same alum liquor, and are again dried, becoming of a tawny yellow color, in which state, under the designation of *Kaee*, they are sold to dyers at 8 annas per maund. This alum is a mixture of sulphate of alumina and sulphate of iron, and where mixed with the infusion of pomegranate rind yields a good black dye.

Although alum is only manufactured at Kalibag, yet as the same shales occur in quantity to the eastward, similar manufactories might be established with advantage in other parts of the salt range—the only obstacle being the difficulty of access to the shale deposits, which, as well as the coal, might be brought to the foot of the range on bullocks, were paths made similar to the one which leads to the Kalibag alum shale pits before noticed.

Explanation of the Elevations of places between Almorah and Gangri, given in Lieut. STRACHEY'S *Map and Journal.*

The elevations of places on my route to the lakes of Gangri, additional to the few that were already determined by the Trigonometric and Barometric operations of Captain Webb, have been deduced, in the way common with ill-equipped private travellers, from the observed temperature of boiling water.

My thermometer was small and bad, unfurnished with proper boiling apparatus (which is essential to correct observations), and lastly, it was broken before any comparisons could be obtained with a standard instrument to ascertain its error, for which purpose I had sent it to the Simla Observatory. The deduced heights are therefore liable to a wide range of uncertainty, for which I have been obliged to make arbitrary allowances, assisted only by a few boiling observations at or near places of known elevation on my route, which are inserted in the accompanying table. As my instrument was not readable to less than half degrees,—that is, when boiling in a common kettle over a smoky wood-fire,—the elevations cannot pretend to any precision within 250 feet, and I have, in most cases, therefore, made them up to the nearest quarter thousand; but the other causes of error, affecting measurements of this sort, will at least double that range of uncertainty, and the results cannot be considered anything better than rough approximations within 500 feet or so.

I have made the calculations by Prinsep's Tables (given in the Asiatic Society's Journal), which, though not strictly correct or complete, suffice for such rough observations. The mean temperature of the stratum of air under measurement (which materially affects the resulting elevation), is calculated as is done by Herbert in his Survey of the Alpine Sutluj (vide Asiatic Researches), by assuming the rate of refrigeration of the atmosphere to be 1° Fahrenheit for every 300 feet of elevation, and by deducing, according to this supposition, the temperature of the air at the level of the sea from the *observed temperature and the approximate* height.

I have reduced one or two Barometric observations by Manson, recorded in the Asiatic Society's Journal, for a few places about Rálam and upper Jwár, the mean temperature of the column of air being calculated as just explained, and neglecting the minor corrections, for temperature of instrument and decrease of gravity, as likely to be compensated, more or less, by the capillarity of the tube, regarding which no information is forthcoming.

Table of Elevations of places between Almorah and Gangri, to accompany Lieut. H. Strachey's Journal and Map.

No.	Name of place.	Nature of observation for determining the Altitude.									Elevation above the Sea in feet.
		Trigonometrical by Webb.	Barometrical.		From Temperature of boiling water by H. Strachey.						
			Deduced Height.	Authority.	Date.	Hour.	Temp. of Boiling Water.	Temp. of Air.	Elevation deduced.	Presumed Error.	
					1846.		°	°			
1	J. Strachey's hut on Binsar, near Almorah (estimated to be nearly 600 feet below top of hill, 7969 feet, T.) ..	..	..	..	21 Nov.	3 P. M.	199½	57	7007	393	7400
2	Khazánchi's house, near St. Mark's Tower, Almorah, 50 feet below Tower (5488 B.)	..	..	..	7 ,,	10 A. M.	202½	59	5280	158	5438
3	Dol Bungalow, ...	..			4 ,,	sunset	201	52	6065	35	6100
4	Dew Dhura (vulgo Dee) Bungalow, ...	..	6867	W.	3 ,,	,,	199½	53	6948	81	6867
5	Pharka Bungalow, ...	..	5914	W.	1 ..	,,	201½	61	5880	34	5914
6	Lohughát (Mr. Ramsay's house), ...	..	5649	W.	31 Oct.	,,	202	63	5630	19	5649
7	Dhargara Bungalow, ...	..	..	..	29 ..	,,	204	65	4474	36	4500
8	Iron Bridge on the Sarju, 2 miles below confluence of Rámganga, estimated to be about the same height as Rámeswar, (1587 B.)	..	..	..	..	..	..	..	..	..	1600
9	Kantagánw Bungalow, ...	..	..	..	28 ,,	,,	205	64	3892	8	3900
10	Petoragarh (Major Drummond's house), estimated 25 ft. above fort (5549 B.)	..	..	..	27 ,,	5 P. M	202½	64	5328	256	5574
11	Satgarh (Major Drummond's hut), 100 feet below top of Pass, ...	..	..	..	25 ,,	sunset	201½	59	5859	41	5900
12	Singhali khán, (50 feet below Pass,)	..	..	..	24 ,,	,,	202	60	5579	21	5600
13	Village of Askot, (camp, 50 feet above,).. ..	5089	..	..	23 ,,	4½ P. M.	204	76	4519	570	5089
14	Garjia Ghát, (estimated 35 feet below confluence of Gori and Káli, 2059 B.)	..	..	..	21 ,,	5 ,,	208½	63	1918	176	2094

15	Bank of Káli river under Balwakot,	..	..	..	..	..	21 Oct.	5 P. M.	208	67	2192	58	2250
16	Dhárchula, 100 feet above,	..	..	..	..	..	20 ,,	5 ,,	207	69	2784	66	2850
17	Confluence of the Relagárh with Káli River,	..	3794	..	..	..	..	..	..	..	..	..	3794
18	Village of Kela,	..	..	..	..	..	18 ,,	4½ ,,	204	72	4536	214	4750
19	Bridge on the Dhauli, under Kela,	..	3883	..	..	..	..	..	..	..	..	..	3883
20	Confluence of Dhauli and Káli, (estimated 383 feet below No. 19,)	..	..	..	..	..	..	..	..	..	..	..	3500
	(In Chaudáns,)	..	..	..	..		16 Sept.	5½ P. M.	198	58	mean	68	8000
21	Village of Titila,	..	..	..	..		18 Oct.	4½ P. M.	198	62	7932		
22	Sosa village, (estimated 250 feet below No. 21,)	..	..	..	..	..	..	..	..	..	..	..	7750
23	Rholing Dhura, top of Pass, (estimated 2000 feet above No. 21,)	..	..	..	..	..	..	..	..	..	..	..	10,000
24	Bunbun Hamlet, (estimated to be about the same height as No. 26,)	..	..	..	..	..	..	..	..	..	..	..	7500
25	Syankwang, crossing of the Gárh, (estimated 250 feet above No. 26,)	..	..	..	..	..	..	..	..	..	..	..	7250
26	Gala hamlet,	..	..	..	..	..	17 Oct.	4½ P. M.	199	62	7363	137	7500
27	Nirpania Dhura, top of Pass, (estimated 3000 feet above No. 26,)	..	..	..	..	..	..	..	..	..	..	..	10,500
	(In Byáns.)	..	..	..	..		22 Sept.	7½ A. M.	198	52½	mean	182	8000
28	Golam-Lá, (at the great rock,)	..	..	..	..		16 Oct.	7 A. M.	198	52	7818		
29	Thin, hamlet, (left bank of Kali), (estimated 500 feet below No. 28,)	..	..	..	..	..	..	..	..	..	..	..	7500
30	Crossing of the Najangárh, (estimated 1000 feet below No. 28,)	..	..	..	..	..	..	..	..	..	..	..	7000
31	Confluence of the Najangárh with Kali River (estimated 1500 feet below No. 28,)	..	..	..	..	..	..	..	..	..	..	..	6500
32	La-máre (on River bank,)	..	..	..	..	..	22 Sept.	sunset	198	61½	7961	39	8000
33	Confluence of the Palangárh with Kali River (estimated 250 feet above No. 32,)	..	..	..	..	..	..	..	..	..	..	..	8250
34	Budhi village, 100 feet below,	..	..	..	..	..	12 Oct.	2½ P. M.	197	62	8564	86	8650
35	Cheto Binaik, top of Pass, (estimated 1750 feet above No. 34,)	..	..	..	..	..	..	..	..	..	..	..	10,500
36	Garbiah village,	..	..	..	10,272	..	11 ,,	4 ,,	194	50	10,177	95	10,272

No.	Name of Place.	Nature of observation for determining the Altitude.									Elevation above the Sea in feet.
		Trigonometrical by Webb.	Barometrical. Deduced Height.	Barometrical. Authority.	From Temperature of boiling water by H. Strachey. Date.	Hour.	Temp. of Boiling Water.	Temp. of Air.	Elevation deduced.	Presumed Error.	
37	Confluence of the Tinkar River with Kali, 100 feet above,	..	..	..	23 Sept.	4 P. M.	194½	60	10,046	54	9900
38	Changrew village, (Estimated 500 feet above No. 37,) ..	..	..	..	..	..	..	..	..	..	10,500
39	Confluence of Kali with Kunti-Yankti, supposed to be the same as Webb's "*Kalapani and Kali*," ..	11,413	..	..	..	..	..	..	..	..	11,413
40	Mangdang, or Kunti River, ...	..	..	..	25 Sept.	4½ ,,	192	56	11,518	232	11,750
41	Kunti viliage, ...	..	..	..	26 ,,	4 ,,	190	57	12,762	238	13,000
42	Sangchungma, encamping ground above the River, ..	..	..	..	28 ,,	5 ,,	188	41	13,652	348	14,000
43	Phia-mungba, ...	..	..	..	29 ,,	5 ,,	185	33	15,363	387	15,750
44	Lánkpya Dhura, top of Pass, (estimated 2000 feet above No. 44, and 1750 feet above No. 45,) .. (In Gnari. Gugi. Pruang.)	..	..	..	..	..	..	..	..	..	17,750
45	Welshia, ...	..	..	..	1 Oct.	9 A. M.	184½	29	15,598	402	16,000
46	Bhaweti, at the Dharm-shála, ...	..	..	..	2 ,,	7 ,,	185	20	14,970	780	15,750
47	Lama-Choktan, (Estimated 250 feet above No. 46,) ..	..	..	..	..	..	..	..	..	..	16,000
48	S. E. End of Chujia Tol, (estimated same height as the Lakes,)	..	..	..	..	..	..	..	..	..	15,250
49	Pass between Chujia Tol and Amlang, (estimated 1750 feet above valley on either side,) .. (In Gangri.)	..	..	..	..	..	..	..	..	..	17,000
50	Amlang, bottom of valley, ...	..	..	..	3 Oct.	Noon.	186	45	15,025	225	15,250
51	Jungbwa Tol, bottom of valley (estimated same height as No. 50), ...	..	..	..	..	..	..	..	..	..	15,250
52	Cho Lagan (Rákas Tal), lével of Lake, ..	..	..	..	4 Oct. ..	2 P. M. ..	186 ..	54· No. 55,	15,291 14,878	166	15,250
53	Gangri Mountains, average Height (estimated 4250 feet above Lakes), ...	..	..	..	..	..		mean	15,084	..	19,500

54	Peak of Tise (Kailas), Estimated 1500 feet above the average of the Range, and 5,750 above the Lakes, ..	..	..	..	..	..	..	..	..	..	..	21,000
55	Cho Mapan (Manasarowar), [deducting* 175 feet height of station above Lake,]	..	..	..	5 Oct.	3 P. M.	186	46	14,878*			
	(In Pruang,)							No. 52	15,291			
56	Momonangli (Gurla), (Estimated 8250 feet above the Lakes, and 2500 feet above Kailas,)	..	..	..	..	..	..	mean	15,084	166		15,250
57	Pass between the Lakes and N. head of Pruang valley, (Estimated 1000 feet above Lakes,)	..	..	..	..	..	..	..	..	..		23,500
58	Baldak Dharmshala, (Estimated about the same as Lakes,)	..	..	..	..	..	..	..	..	..	..	16,250
59	Kardam Karh, (Estimated 250 feet below No. 58, and Ditto above No. 60,)	..	..	..	..	..	..	..	..	..	..	15,250
60	Camp in Ravine next above the great Ravine of Toiyon,	..	..	..	7 Oct.	2 P. M.	187	56	14,709	41		15,000
61	Toiyon village, (Estimated 250 feet below No. 60,) ..	..	..	..	..	..	..	..	..	..		14,750
62	Bridge over Karnáli R. between Toiyon and Taklakarh, (Estimated 200 feet below No. 61,)	..	..	..	..	..	..	..	..	..		14,500
63	Confluence of Tidya-Chu with Karnali, (Estimated 50 feet below No. 62,)	..	..	..	..	..	..	..	..	..		14,300
64	Takla-karh, summit of hill, (Estimated 500 feet above No. 63,)	..	..	..	..	..	..	..	..	..		14,250
65	Maghram village, (Estimated 250 feet above No. 63 and Ditto below No. 64,)	..	..	..	..	..	..	..	..	..		14,750
66	Pala-Dúng, (Estimated 500 feet above No. 65),	..	..	..	..	..	..	..	..	..	..	14,500
67	Ningri, Estimated 100 feet above No. 66, and 1,744 feet below top of Pass, ...	..	..	..	..	..	..	..	..	..	..	15,000
	In Byáns.											15,100
68	Lipu Lekh, top of Pass. [14* Oct. 1828? Vide Calcutta Gleanings of Science, April 1829,]	..	16,844*	M	..	..	..	..	..	..		16,844
69	Ravine entering left bank of Kali, supposed to be Webb's ["Mandarin's Camp,"]	14506	..	..	..	..	..	..	..	..	..	14,506
70	Yirkha hamlet, above Kalapani (Estimated 1500 feet below No. 69), ...	..	..	..	..	..	..	..	..	..	..	13,000
71	Kalapani Bridge. [Site* not identified as there are now three bridges over the Kali in this vicinity, but supposed to be not far below Yirkha,]	12742*	..	..	..	..	..	..	..	..	..	12,742

NOTE.—In the above Table, and in H. Strachey's Map and Journal,

W.	Signifies	*Webb.*	B.	Signifies	Barometrical.
M.	,,	*Manson.*	b. t.	,,	Boiling Thermometer.
T.	,,	Trigonometrical.	?	,,	Estimates by Eye.

Note on the Construction of the Map of the British Himálayan Frontier in Kumaon and Garhwál, by Lieut. H. Strachey.

My map is based on the *Indian Atlas*, Nos. 65 and 66; the cis-Himalayan parts of which, being the result of Mathematical Survey, I have copied exactly, with the following alterations and additions:

1. Some alteration made about the extreme north-eastern Káli in Byáns, the original being decidedly wrong.

2. Other occasional defects in the positions of small streams, villages, &c. here and there amended, from observation or information.

3. Glaciers inserted in many places: these for the most part show the general position merely as derived from information or distant view; approximation to the true size or figure being attempted only in the Gori Glacier above Milam in Jwár, from personal inspection.

4. Entry from information, of sundry inter-Himálayan passes between the several Alpine valleys of Kumaon: there are doubtless many more of these remaining to be mapped in northern Garhwál.

5. All elevations of places to be found in Capt. Webb's book, reduced to sea level by the addition of 87 feet for the (supposed) height of his Calcutta comparisons above the sea; and the mean of all measurements given where more than one is recorded for any place. I have also got elevations of one or two places on the Alpine and sub-Alpine Káli (neither in Webb's book, nor in the map), from Vol. XII. Asiatic Researches, adding 72 feet for correction of the starting point from which they were derived trigonometrically in Webb's survey.

6. In south-eastern Jwár, I have marked in the map the Rálam valley, with the Pass from upper Jwár, Barjigánw-Dhura: the village of Rálam, and the river down to its confluence with the Gori at the entrance of Munshári: in northern Jwár details have been given of the intricate passes into Tibet.

The last mentioned additions to the maps of the "Indian Atlas" are mostly from my own observations, in June, 1846, which, though unaided by surveying instruments of any sort, will give an idea of the

* This map, a part of which only has been reduced to illustrate Lieut. Strachey's Journal, will be published hereafter, but it seems desirable that these remarks on its construction should be printed with Lieut. Strachey's other papers. —Eds.

ground preferable to the total blank left by the surveyors. I have obtained the elevations of a few places on the route from Bhuni to Rálam and from Milam to the Unta-Dhura pass, from the Barometric measurements given by Manson in Vol. XI. (part II. 1842, No. 132, Article III.) Asiatic Society's Journal, which, being without any comparison, I have reduced in a manner similar to that adopted for my own boiling observations. Manson makes his own measurement of Unta-Dhura "about 17,500 ft." but, according to my computation, it is not less than 18,200 ft. and the latter elevation agrees much better with my own personal experience of the pass and adjacent places, as also with Lieut. Weller's boiling observations.

I have also availed myself of the account given by Lieut. Weller (in Asiatic Journal, No. 134, 1843) of his journey to the Balch pass in May and June 1842, but his boiling observations were far too loosely conducted to give any thing in the shape of certain measurement for the elevation of places.

The most probable mistake here and there, doubtless must be much error, is in the longitude of Laptel and the Balch pass (as also Chirchun, &c.) which should, perhaps, be a mile or two further west, so as to make the Balch route to Dungpu more direct than that by Shelshel Sakh, &c., as the Bhotias declare it to be. I was not sufficiently aware of this till my map was past further correction, but the fault may easily be remedied in another copy. It will be observed in this quarter that I have made the British frontier include a good deal of ground unexplored and omitted by the surveyors: the valley of Laptel being so much more open and accessible to Gnari than to Jwár or to Painkanda, it seemed questionable whether it did not belong to Lhassa, but I have allowed its place in the boundary map to be decided by the flow of its water into Painkanda, so as to advance the British frontier to the crest of the Balch mountains and the low pass into Shelshel: the value of the ground itself is little or nothing to either party. Lieut. Weller then penetrated not "three day's journey into Chinese Tartary" (as a certain "pilgrim" supposed) but just up to the frontier line; Laptel has been visited by two or three other English travellers, but for venatic rather than geographical purposes.

Between the Jwár passes and upper Painkanda the map is compiled from the best information I could get of the Jwári Bhotias. The

Girthi valley has been once explored, I believe, by Manson and Irving in 18—? but without any record of results that I am aware of. My accounts of the Hoti valley between Laptel and Niti were very obscure and contradictory, and in this part of the map there may be great error!

The central part of Munshari is studded with a multitude of small villages and hamlets, the spring and autumn residence of the Jwári Bhotias, not half of which are shown in the Atlas No. 66. I have endeavored to supply the defect from information, and my map shows the approximate position of nearly all these places, but they are so crowded together that I was forced to omit the names of many of the hamlets.

In the trans-Himalayan part of my map, I have copied all of the Indian Atlas No. 65, which shows the explorations of Moorcroft and Hearsay in 1812, taken, I believe, from actual rough Survey of Hearsay's, though not so acknowledged on the map, and the positions there assigned to Gartokh and all the principal villages, rivers, &c. in the route of those travellers, remain unaltered up to longitude 81°, saving the direction of a stream here and there, which I had reason for knowing to be otherwise. East of that longitude, where the Atlas No. 65 terminates, is the result of my own explorations now recorded, including the lakes with the details of Kailás, and Gángri, the eastern and south-eastward sources of the Sutlej, the sources of the Karnáli, Momonangli, and the valley of Pruang, with its numerous villages. My survey was a very rough one, made with pocket compass (Smalchalder) and a watch: I took bearings of my course here and there, as I observed any particular change of direction, as also of Kailas, Momonangli, &c., from many different points, and I estimated my distances from noted times by supposed rate of progress according to nature of ground: from the road distances thus computed (at very moderate rates) I made liberal deductions for the map protraction, so that my errors are, I trust, always on the side of diminution rather than exaggeration. As even these rough methods of observation were often interrupted by night marches, &c. the survey is, of course, inaccurate in many respects; but, at the worst, I suppose that the place which I have assigned to Kailás, the furthest extremity of the survey, lies within a circle of 5 miles radius, described about the true position, and other parts accordingly. Kailás and Momonangli were placed from the average of a number of

intersections. In such rugged country no good flying-route survey is possible without constant latitudes: I regret that I had no instrument for getting them. I ascertained the deviation of my compass by bearings of the principal peaks of the Kumaon snowy range taken from Binsar (a high mountain near Almorah) compared with the protraction of the same upon the Atlas No. 66. This gave an average of some $3\frac{1}{2}^{o}$ eastern declination, which I was obliged to apply to my survey of the lakes, &c. as I could get no means of checking my compass on the spot, in the whole course of my route from Almorah to Kángri; however inaccurate this process and its result may be, it is good enough to match the other operations of my survey.

My topography of Pruang from a nocturnal survey and bad information is far from perfect; some of the villages given in Angil's list are wanting, and the place of others doubtful, but it will give a fair idea of the position of the four principal places, Kardam, Taklakhar, and Jidi, the three *Khar* and Kajarh (Kocharnatti), of which the second Khar only is exhibited in previous maps under its Hindustani name of "Taklakot," and all the rest superseded by names and places purely fictitious.

It will be observed that in the trans-Himálayan part of my map (as also east of the Kali) I have given a rough representation of hills and mountains over extensive tracts of country which the Atlas (65 and 66) leaves all blank. These delineations of the mountains of Gnari, are such as I could make from partial and distant views, with scarcely any data for details or true positions of ridges, &c., but I thought it best to adopt this method, however inaccurate, because the other, contrasted as the blank is with the vivid representation of the cis-Himálayan mountains, tends insensibly but forciblly to convey the still more erroneous impression of a vast continuous plain on the north side of the passes, whereas the face of the country of Gnari is, for the most part, extremely mountainous.

It would have been interesting and useful (and may still be so, should the wanting material be hereafter forthcoming) to compare my delineation of the lakes, and adjacent places, Gangri, &c. with Hearsay's map of the same, but I have not been able to find any authentic copy of the latter, including the parts east of longitude 81°, which lie outside of the Atlas No. 65; the last mentioned map does indeed show the north-western part of Rákas Tal, with an effluent falling into the Sutlej be-

tween Tirthapuri and Kyunlung, but this at least, I have proved to be quite wrong, no part of the lake extending so far west, and the river in question being properly the Dárma Yánkti, rising in the Byáns Himálaya. In order to make this part of Hearsay's (?) map unite with my own, I have been obliged to bend down the portion of his route next east of Tirthapuri 2 or 3 miles to the southward, so as to enter the Gangri valley south of Kailás and Darchin, and the rivers crossed by this route have been similarly adjusted to meet the Lajandak Sutlej. In other respects Hearsay's map, as also Moorcroft's narrative, agrees very well with the information I have received from the Bhotias, and I have been able to identify many points of the route of those travellers with the Bhotias' descriptions. In the hilly ground between the Sutlej and Gartokh, I have merely had to insert the names of a few streams, encamping-places, &c. in Gugi, i. e. the valley of the Sutlej ; I have added some villages and hamlets and corrected the names of others previously mapped, together probably all that exist (and more than are at present inhabited) from Mangnang eastward, many villages in Gangri were ruined by the plunder of the invading Sikhs in 1841, and have since been deserted. I could not get so much information about the country west of Mangnang, and the mapping of that part is comparatively defective, but I have obtained a material correction for the course of the Sutlej there, and the position of Tholing, hitherto wrong on all maps.

All the routes in Gnari, with the several encamping-places on them, are the result of most minute inquiries, where not personally explored. The road from Laptel viâ Shelshel to Dungpu, and thence back to Jwár by Chirchoon, I explored myself in June last, 1846, without surveying instrument however, and the present draft of it is subject to the possible correction suggested for the positions of Laptel and Balch, (viz. a mile or two more westward.) For the routes on information, I am indebted chiefly to the Jwári Bhotias (particularly to the family of the Patwári of Milam) who so far surpass the others in intelligence that I learned more from them about the lakes and Pruang than from the Byánsis, whose constant resort is to those places, and these parts of my map are perhaps as correct as they could be made without personal exploration.

A separate paper, accompanying this, gives all requisite particulars

regarding the determination of the elevations of places on my journey to the lakes, which are entered on that part of the map.

My orthography is always after the system of Sir W. Jones, and the Asiatic Society, but for Hunia names it follows the simple Hindustani pronunciation of the Bhotias, and not the complex Tibetan spelling, which can only be mastered by a critical knowledge of the language. I have had to ascertain de novo and re-write most of the names of places given in the Indian Atlas, the mistakes of which surpass belief: those which I have now given are, I hope, tolerably correct for most of the places in Kumaon and in Gnari, but I had not equal opportunity for revising those of Garhwál.

In my map I have made and explained the distinction between agricultural villages and mere temples and monasteries, places permanently inhabited and mere encamping-grounds, and all other requisite discriminations, the neglect of which simple but necessary details, together with the abominable kakography of names, has much impaired the value of the sheets in question of the Indian Atlas.

The separate sheets of the Atlas (Nos. 65 and 66 at least) though with scales, margins and other marks of completeness, omit to state their scale referred to a known standard, and their mode of projection. I had no access to authentic information on these points, till after the completion of my own map, and the latter was drawn, from one or two old copies of the Atlas, the paper of which had lost its proper size and shape, so that my scale is 25 miles to 6 inches, the nearest Aliqout measure that I could find to my originals, instead of 4 miles to one inch, as it should have been. My map differs from the Atlas also in its graticule, being on the conical development, which I adopted for its facility of execution (being without proper drawing instruments) and in ignorance of the projection applied to the Atlas. The latter I have since found to be based upon the most scientific elaboration, emanating from high authority, notwithstanding which it is palpably inferior to the simple geometrical process of the conical development, both in theoretical accuracy and in facility of practical application. My copies of the Atlas, sheets 65 and 66, gave the length of the meridional arcs sensibly in excess of the truth (like the Tables of Baily); in my map I have reduced them to the lengths given in the tables of Pearson, &c. (after Lambton). In other respects however my map does not pre-

tend to any accuracy of execution, for which I had neither the requisite mechanical appliances nor sufficient time, but all the cis-Himálayan part of it traced from the Indian Atlas is quite correct enough for practical purposes: the trans-Himálayan ground, nowhere fully explored or accurately surveyed, is of course open to much correction.

Description and Analysis of a large mass of Meteoric Iron, from the Kurruckpore hills, near Monghyr. Presented to the Museum of the Asiatic Society, by Captain W. S. Sherwill, *B. N. I. By* Henry Piddington, *Curator Museum Economical Geology.—With two Plates.*

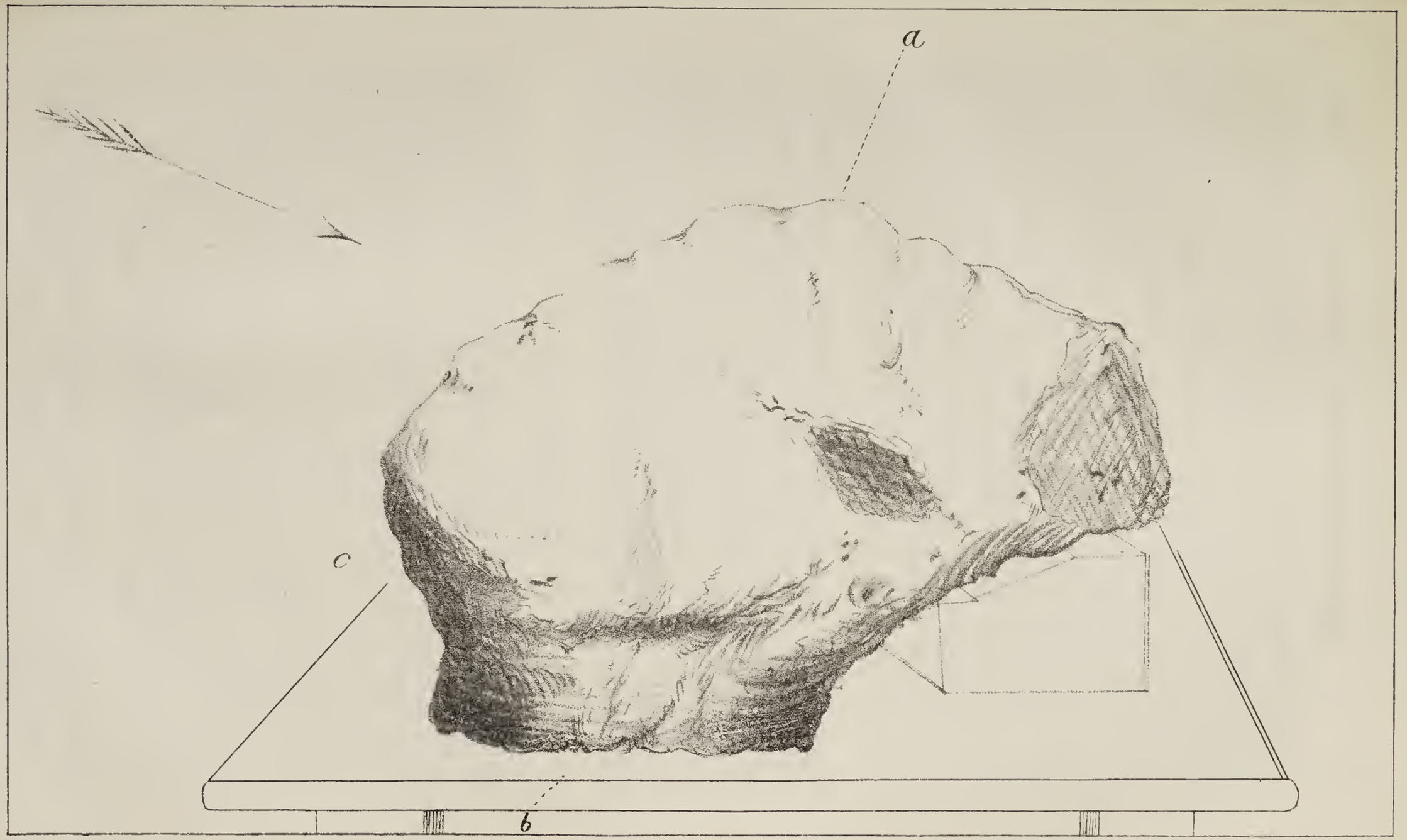
The Museum is indebted for this magnificent specimen to our valued member and active contributor, Captain W. S. Sherwill, of the Revenue Survey.

Upon his first visit to the Museum some months ago I showed this gentleman amongst our mineralogical treasures and curiosities, the Aerolites, and next to them our specimens of meteoric iron, upon which he remarked that he had a large lump of iron "*of some kind*" which had been found in the Rajmahal hills "*a good deal like that.*" I begged of him forthwith by all means to send me at least a specimen of it, which he did, and my conjecture (from his account of its qualities, such as toughness, &c.) that it might prove a mass of meteoric iron, were, after some baffling in the research which mineralogical chemists will understand from the chemical details which follow, was crowned by indubitable proofs that it was so! Captain Sherwill, when recently here, at my request desired a friend to send the whole mass down, and the Society now possesses this most valuable specimen, which I proceed first to describe as to locality and physical properties, before detailing my examination of it.

Locality.

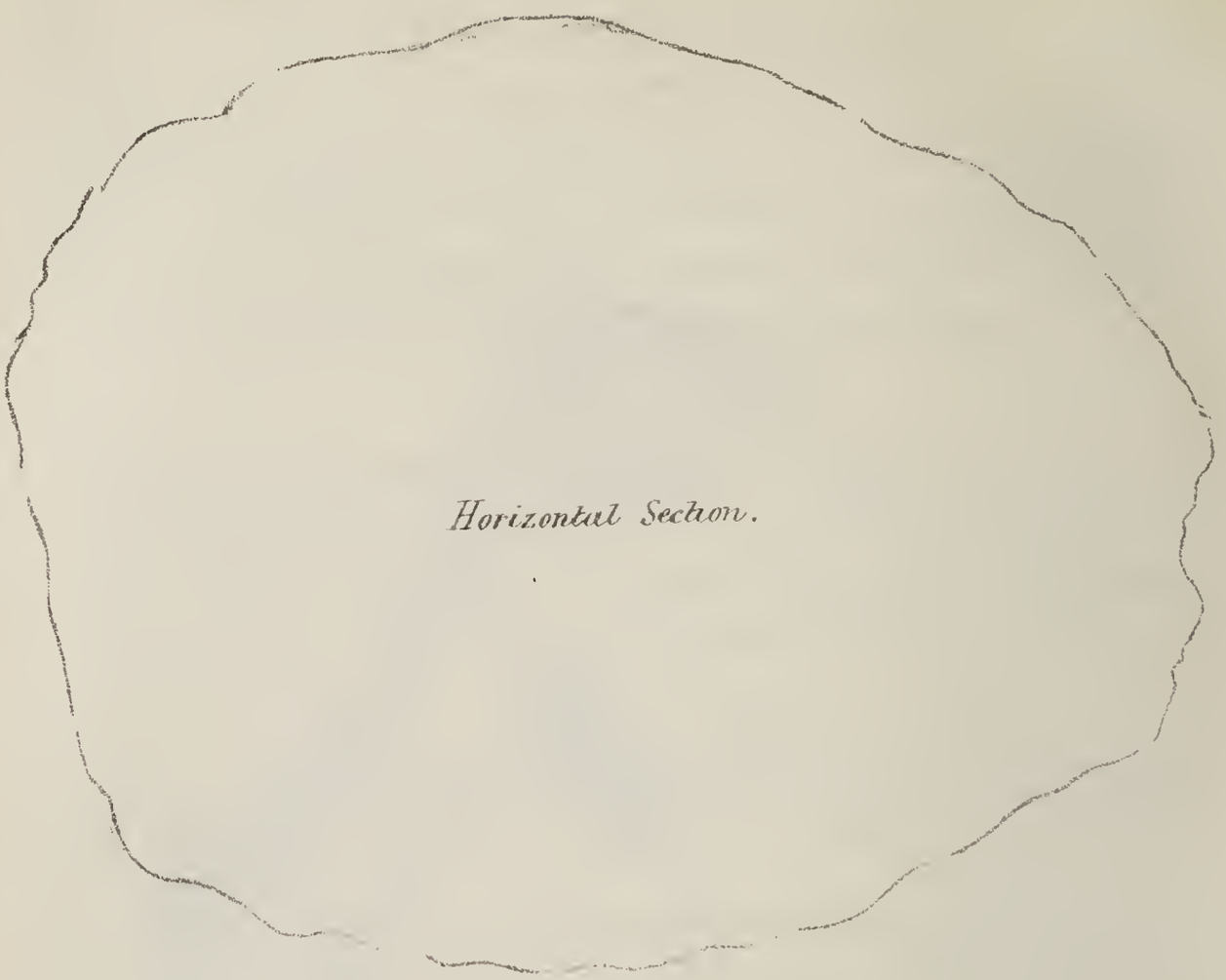
Captain Sherwill's note is as follows:

"*The accompanying mass of iron, supposed to be of meteoric origin, was found imbedded in the soil on the top of the forest-clad Kurruckpore hills near Monghyr. It had been exhumed and worshipped for many years by the hillmen.*"



H. Piddington delt.

Mass of Meteoric Iron from the Kurruckpore Hills Weight 160 lbs.
Presented by Captn W. S. Sherwill 66th B.N.I.



H. Riddington delt.

Scale 3in. to a foot.

Horizontal and vertical Sections of Captn. Sherwill's Mass of Meteoric Iron shewn in Plate XIX.

He added in conversation that the gentleman who first obtained it was an Indigo planter, but omitting to note his name, I have not been able to make further enquiry as to any traditions about it. Captain Sherwill also mentioned that there are native forges in the vicinity, but he has sent us some of their ores, which are common brown iron ore, and of their smelted masses, which are quite different from the specimen, and this would not have been worshipped without some very special reason for it. Our mass is also, to say nothing of its physical and chemical properties, of a size and weight far beyond what any native forge could produce, at a cast, and moreover, is most certainly not cast iron. Nevertheless before submitting it to the scientific world as meteoric iron, we are bound to omit no proof direct or collateral, that it is really and truly such, and this will be, I trust, my excuse, if thought prolix.

I proceed now to describe our specimen, noting in parallel columns coincidences from Mr. Mornay's description of the great Brazilian mass, (*Mornay and Wollaston, in Phil. Trans.* Vol. CVI. *for* 1816,) Pallas' description of the mass of Siberian iron, which is now known to be meteoric, from the French edition of his voyages, (Vol. VI. p. 346, and following,) and from several descriptions and notes on meteoric iron, from various sources in the Quarterly Journal of Science, which I shall note as I proceed.

I.—*External appearance.*

Our specimen is a block of a somewhat conical, oviform disk-shape, standing, as it were, on a sort of foot, as in the plates,* but it must be supported by a block of wood not to fall forward. It is slightly truncated at both ends. Its colour is, in some parts, mostly at the more prominent knots and bosses, a chesnut brown, in others and in the numerous cellular cavities with which it is in many places honey-combed, it is more of a dark iron-slag colour. Generally it resembles in colour a mass of some of the more compact brown iron

The mass of upwards of 3000lbs. in weight from the banks of the Red River, Louisiana, and now in the New York Institution, is described as "shape irregular, inclining to oviform, much broader at bottom, where it has rested on the earth, than at the top, inclining somewhat in the manner of a cone," Quarterly Journal, Vol. IX. p. 193.

Mr. Mornay's description and drawing of the Brazilian mass gives also a sort of foot on which it stands as well as a tail behind. He says also that the foot is about six inches in height; colour of the

* Plate XXIX. is a perspective view of it, Plate XXX. are vertical and horizontal sections to scale.

ores than anything I can liken it to; but they are rarely or never honeycombed. Small water-worn specimens of this last named mineral sometimes are so, and one of these magnified, or a huge lump of dark coloured ferruginous *Kunkur*, gives one the best mineralogical notion of the appearance of our large specimen. If seen in the bed of a torrent it would indeed have been thought a mass of water-worn ironstone, if no accidental friction had shown its bright metallic streak, which is apparent upon the slightest scratch; except at the few scoriaceous parts.

When closely examined there are seen to be parts which are evidently more scoriaceous and cellular in appearance than others. In a very few places minute fragments or patches of a yellow and reddish or orange-coloured felspar or sandstone-like mineral, with a slight gold-coloured lustre in a strong light, are found imbedded and evidently fused in, with the scoriaceous part; sometimes having a very little green glassy mineral like broken bottle glass fused around or close to them; both are highly brittle, and in such minute quantities, and so imbedded in the mass that it is only by careful poring over it with a magnifier that they are detected; and it is impossible to do more than to obtain minute blowpipe fragments, from which it however appears clearly that the glass is Olivine, being just fusible on the edges, and first discolouring, and then so far disintegrating as to fall to pieces when touched, after two or three days' digestion in muriatic acid; which then gives the reaction of peroxide of iron.* The Brazilian specimen that of a chesnut, but with thick flakes of oxide below.

The glossy surfaces of his block are not smooth, but slightly indented all over, as if hammered with a rather large round-headed hammer.

The Siberian specimen, Pallas thinks, was originally covered with a rough ferruginous (oxided?) crust which had been broken off to obtain pieces of it.

The brown colour of the surface of the block is merely a very thin coat of rust, for the slightest scratch with a knife produces a bright metallic streak.—Pallas' Voyage.

* The olivine of meteoric stones does not gelatinise like that of basalt and other volcanic specimens, (See Vol. XIII. of Journal, p. 884, Examination of the Kandeish Aerolite.) Specimens are too small and scarce for us to ascertain what this is owing to.

yellow sandstone-looking mineral when digested in muriatic acid loses its colour, and the acid gives traces of iron. The mineral is then a compact dead white-coloured mass, like milk-quartz, and before the blowpipe it proves to be quartz without any trace of alumina or magnesia.

The lower or foot part of the specimen is much more corroded than the upper part (as if it had oxidated more rapidly by lying on the damp ground?) In some of the cavities a lining of a pitchy lustre is to be detected, but this does not appear to be the remains of nests of crystals, as in the Brazilian and Siberian specimens.

Our mass having laid apparently in an exposed situation in a bungalow, has yet many specks of white-wash upon it, which will not scrub off, and as to use an acid would I fear alter the fair appearance of the specimen, I have thus preferred to allow them to remain.

II.—*Dimensions, Weight, &c.*

The dimensions of this mass of iron taken with callipers, are as follows:

	Inches.
Extreme length,	15
Extreme breadth,	$12\frac{5}{8}$
Greatest thickness from the foot to the bosses at the vertex,	$9\frac{7}{8}$
Average thickness, excluding the foot, about	$8\frac{4}{8}$
Thickness at the small end,	$5\frac{1}{8}$
Breadth at the small end,	$7\frac{4}{8}$
Diameter of the foot, which is somewhat circular,	$7\frac{2}{8}$
Diameter of the foot at the base,	6
Foot projects from the lower part about	$1\frac{4}{8}$

Its weight, carefully taken for me by Mr. Laidlay, in a good balance, is 1 factory maund, and 36 seers, or 156½ ℔s. English. I have cut off a small piece, and Captain Sherwill told me he had taken a piece or two, besides the one he first sent down, so that altogether its original weight must have been close upon 160 ℔s. English.

The weight of the Elbogen mass of Meteoric Iron in the cabinet of the Emperor of Austria at Vienna, is 141 ℔s. German, or 174 ℔s. English.

III.—*Internal Structure and Appearance.*

I have not yet been able to detect in our specimen any decided crystals. On one splinter I certainly found a crystallized facet, and traces of them are to be seen frequently, but nothing sufficiently distinct for us to speak of it as being crystallised; however, this may exist, and be partially destroyed by the violent action of separating any fragments from the mass.

When a portion of the metallic part is broken or cut off, it is of a bright platina-white colour, and when polished and acted upon by a dilute acid, it exhibits the damask watering known to be a characteristic of meteoric iron. Its fracture may be called very sharply uneven, and cellular, exactly resembling that of a tough rod or bar, of iron which has been torn asunder; and it almost pricks the fingers upon handling it roughly. It is full of small cellular cavities, which give it almost a spongy appearance in some places.

Pallas, p. 350, says of the Siberian mass that,—

The crust being taken off, the rest of the mass is a soft iron, white at the fractures and full of holes like a coarse sponge, and he goes on to describe the olivine with which the cavities of it were filled.

The Santa Rosa and other masses are also described by Bossingault, (Quarterly Journal Science, Vol. 17, p. 395,) as cellular and without a vitreous coating—malleable, of a granular structure and easily giving way to the file; of a silvery aspect, and of Sp. Grav. 7.3. Another mass at Santa Rosa is described as cellular, very hard to the file, malleable, of a silvery aspect, and of a fracture resembling tilted cast steel. Another mass is said to have exhibited small facets in its fracture, malleable and of a silvery lustre.

The damasking appearance is stated in the Quarterly Journ. Vol. 5, p. 372, (upon what authority is not given) to have been first pointed out in Germany, and to have been found in all the well known specimens of meteoric iron, as well as in the grains found in meteoric stones, but as not to be found in some of doubtful origin.

IV.—*Magnetism.*

I have not been able to detect any thing approaching to polarity in our mass. It attracts like common iron both ends of the needle indifferently.

Dr. Wollaston failed also to find any polarity in Mr. Mornay's fragments.

V.—*Hardness, Toughness, &c.*

It is by no means hard, being readily indented or flattened at the bosses like any soft iron, and yielding easily to the file. It is however of extraordinary and almost incredible toughness, so that, while it yields to the cold chisel, or steel wedges, to a certain extent, it is half a day's work for a native carpenter with steel wedges to cut off a small piece from the metallic part. In the few scoriaceous parts pieces are much more easily detached, but when these are pulverised, the grains and minute portions of the metallic iron amongst them, are beaten into tough flat disks.

It has been found by Messrs. Jessop and Co. to forge easily at a moderate heat and a forged piece is exhibited.

I had provided myself with a sledge hammer, and tools for cutting off some specimens of the iron, but it was with the utmost difficulty, I could detach the few small pieces which you have seen. —*Mornay.*

Though Pallas in the preceding page, (that is, his French translator) has, as just quoted, called the iron soft *(doux)*, he now says in the next page, 351, using the words *dur* and *compacte* to express tenacity and toughness, that, The iron is so hard and compact *(dur et compacte)*,* that three or four smiths have employed ten and twelve men with steel wedges, and sledge hammers to cut off a piece, which weighed at most two pounds. In one instance only did they succeed in cutting off a piece, which weighed about a pood, (36 lbs. English.)

Remarks on the foregoing physical characters.

Amongst these the shape of our Aerolite is certainly the most noticeable, and we are at first sight much puzzled to account for the foot-like appendage, which, as was naturally enough at that time supposed by Mr. Mornay in the Brazilian mass, we are inclined hastily to suppose a *ramus* or branch attaching it formerly to some larger mass. Mr. Mornay however showed for his specimen by digging under it, that there was no mass or vein to which it could have been attached, and improved chemical research now satisfies us that there is no terrestrial native iron which contains Nickel and Chromium, and on this conclusion we rest in addition to other collateral evidence for the meteoric origin of our's.

But the foot still remains to puzzle us.

* The proper words are *tenace, tenacite.*

We first attribute it to the more rapid oxidation of the part in contact with the soil, but the legend says it was *dug out* of the ground; so that while it was interred, if it was altogether so, the whole would have been equally subject to oxidation. When dug out and placed as an object of worship it probably was kept under cover; but the expression and the account are altogether too vague to serve us as data from which to deduce conclusions. It is doubtless possible (though but remotely so) that the foot may have been formed by the gradual oxidation of the lower part, yet this we should think—supposing the mass to have been originally an egg-shaped lens, and as compact below as above—would have gone on equallly over *the whole* of the lower surface, instead of one part of it, and also at the large end (at *c* in Plate I.) but it has not done this at all, and so, unless we also suppose unequal tendency to oxidation, this process does not satisfactorily account for its present shape, and this moreover, we cannot fairly suppose, because at present the foot is as hard and as metallic as any other part. One supposition only remains, i. e. that there might have been more of the scoriaceous or earthy parts below, which have separated in time from the mass, and the traces of these parts *are*, it is true, more frequent below and at the rim of the disk than on the upper part. Yet this is very poor aid to prove that there ever was so much more of it, as this supposition demands, and it seems now as little liable to oxidation and decomposition as any other part, and if we admit this fully, still we have *the* question of why the metallic nucleus (for such it would then be) has assumed this shape? which is in fact coming back to our original enquiry.

I think one way of accounting for it may be this—

If we suppose a ball of semi-fluid matter (whether rendered so from heat or otherwise) to fall vertically to the earth's surface without breaking into fragments, such a mass would, it is clear, form a circular and lenticular disk, which would be more or less flattened at the lower surface; for the motion of the mass would be then derived from a single force, the earth's attraction, and the resistance would meet it in a line directly opposed to that motion.

But if we supposed our semi-fluid mass to fall in any line deviating from the vertical, as in one for example like that of the arrow in Plate XXIX, we have then altogether a new state of things; for here are first two forces in the mass, the vertical (from attraction) and the projectile force,

and then the resistance of the earth, which no longer meets the other forces in their direct path. If we next suppose the mass to fall diagonally upon a tolerably soft soil—and our mass, if semi-fluid, must have done this, for if it had fallen upon a hard one it would have been broken to pieces, unless indeed it fell in a solid state from the heavens, which we do not assume*—we can suppose it also to be *driven* into the earth for a certain distance till the vertical part of the force was exhausted, but during this process the projectile force would, particularly for the part above ground, be urging forward the remainder of the mass, so as upon its final cooling to produce a disk somewhat like what we see in our specimen, and place the centre of gravity somewhere in a line about that which I have marked at *a*. *b*. in Plate XXIX.

In the course of this cooling we might also find that one part of the mass, being more rapidly cooled by the contact of the earth, would be more porous, which our mass is ; and that the lower and front part of it (the front part in relation to its supposed motion) might be drawn out into a ridge-like prominence, which *is* the case with our specimen also ; and I have marked this ridge, which however is sharper and better defined than there shown, in the vertical section at *x*. in Plate XXX.

With means at command it might perhaps be possible, as by projecting a ball or mass of softened fusible metal on a yielding soil at various angles, to test the truth of all this, which I beg to be understood as submitting as a mere theory, but even if we were to obtain a solid somewhat in the form of our specimen, we should merely thereby increase the probabilities that this was really the cause of its assuming this shape; for, after all, its original form may have been nearly what we see it, and upon the hypothesis of these bodies being originally projected from the Lunar Volcanoes, we may suppose it to be a huge lava-drop† detached from some mass of botryoidal concretions, and blown into the sphere of the earth's attraction. The coincidence of our mass with the Brazilian one in having a foot (though it wants the *tail* which Mr. Mornay delineates) is too remarkable to be passed over. I have been unable to

* There are instances of stony Aerolites being found in a soft state immediately after their fall, but I do not recollect any of the metallic ones being so found. Nevertheless we may fairly assume that, as less heat is required, the probabilities are that they also fall in a semi-fluid state.

† A French writer would have a better word, "*une larme de lave*," or lava *tear*.

find a copy of Bongainville's voyage, and to consult Boussingault's work, if they give any description of the forms of the masses noticed by them; and it is one of the great difficulties which all colonial research labours under, that we are either wholly deprived of references or can find only the brief and abridged notices to which scientific periodicals are necessarily limited, and which for some part of the matter in hand are wholly insufficient for our purpose.

Since this was written I find in the Quarterly Journal of Science, Vol. 12 for 1822, p. 330, an account of some meteoric stones, one of which fell in Courland, on the banks of the Kolupschen Lake in the presence of some labourers, and was hot enough to burn their hands when they touched it. It is said to have penetrated a foot and a half into a dense dry clayey loam, and that its shape when entire *resembled a rounded anvil, of which the narrow end was undermost.* This is not very explicit, but it serves to show that there may be a tendency to these elongated anvil-like forms either with or without a foot. The Chinese give all manner of fantastic names to the stones recorded in their annals to have fallen from the heavens, of which some it is known are iron, such as "anvils, hammers, nails, hatchets, &c." and our own name of thunder*bolt* and the German *Donneraxt* (Thunder-axe) seem related to this sort of popular record of these phenomena.

I put any classical conjecture with diffidence, but a curious question arises here. Is this falling of *anvil*-shaped masses from heaven (in the case of our Indian specimen, and the Brasilian and Courland ones too, they are of iron) the parent source of the myth of the Lemnian Vulcan's being hurled from heaven by Jupiter on the island of Lemnos? where the anvil-God was "received" by the Sintians? as described by Homer, Book I. l. 593.

Κάππεσον ἐν Λημνῳ ὀλίγος δὲτι θυμὸς ἐνῆν.
Ἔνθα μέ Σιντιες ἄνδρες ἄφαρ κομίσαντο πεσόντα.

Literally,

"Till upon Lemnos I fell, and but little of breath was remaining,
When of the Sintian men I was received, at my falling."

The paraphrase of Pope being inexact I do not quote it. The little of breath (θυμὸς life, soul, ardour, &c.) may well be understood as the mythic amplification of the original fact that the Vulcan (the meteorolite) was nearly cold when he reached the ground and was approached;

and *certes,* our Indian Sintians of the Kurruckpore hills, "received" and comforted their Godling, in the worship they paid to him, and perhaps also have their legend and myth respecting him, if we could only obtain it? More than one of these wonderful bodies were worshipped by the ancients and have been even held to be personifications of the heathen divinities. The thunderstone in Crete, regarded as the symbol of Cybele; the Ancyle or sacred shield of Numa, and "the mother of the Gods" at Pessinus, are all cases which will readily occur as fortifying my conjecture (see Art. Meteorolites, Ure's Dict. &c.) Cicero (De Natura Deorum, Lib. III. par. XXIII.) describes four well known Vulcans; the Athenian, Egyptian, Lemnian and Menalian or Liparian Vulcans.

Chemical Examination.

The examination of the siliceous specks and olivine I have already described.

The specific gravity of a small specimen of the metallic part, carefully chosen to avoid cavities, was, ... 6. 76
The specific gravity of the forged bit is,..... 7. 31
Scoriaceous part,..... 4. 03

I have satisfied myself by repeated and careful examination that our specimen contains

Iron,
Nickel,
Cobalt,
Chromium,
Silica,
Alumina,

and traces of Arsenic and Selenium.

But these again are most variable in their presence and amount, so that no two assays will give like results, and thus the whole contradicting each other, as it were, renders it impossible to give a quantititative analysis either of the metallic or the scoriaceous parts in any degree satisfactory.

I estimate therefore from several trials that the metallic part contains about

Metallic iron,	87.	00
Silex,	11.	50
Alumina and Loss,	1.	50
	100.	00

With traces of Arsenic.

The Scoriaceous part

Metallic iron,	77.	00
Silica,	17.	
Aluminum,	1.	50
Cobalt,	3.	20
Nickel,	1.	
Chromium,		50
Arsenic and Selenium,	Traces.	

It seems at first sight to be treating the subject loosely to give only these approximate quantities, but it was only after long and repeated and most careful work that I could be satisfied of what I have above announced, and that it was wholly impossible to take any one analysis as representing the average constituent parts of the specimen; but I do not regret my labour, for it enables us to explain how it is that chemist after chemist in Europe, and these men of the first talent, have successively differed in their results, or have found new products, such as the Chromium, in the same specimen in which others had failed to detect it. It is evident to me that they obtained assays from different parts of the specimen* and have thus differed, as I again and again found I did from myself, to my no small surprise and perplexity.

And philosophically considered this is what (so to speak) *should* really occur, for if we admit these meteorites to be revolving round us as their primary, and thus to be, for us, a sort of satellites, we might imagine that if the earth, when *it* too was an incandescent asteroid had fallen, like our specimen, in upon some huge siderial primary, and had been there "examined and reported upon" that a chip from about the

* And indeed this is a matter almost of course. The small specimens brought from foreign countries and the minute fragments obtained from great museums as special favours must all have been very imperfect averages of the whole of any large mass.

Cape of Good Hope might have given different results from a splinter off Cape Comorin; and a knob from one of the Andes, with a vein of silver in it, might differ widely from a fragment of Madagascar or Siberia or Sussex. When our specimen was an incandescent spheroid (assuming it to have once been so), the scoriaceous and purely metallic parts may have made spots and districts on the nucleus as marked as the various formations of our globe.

In the examination of both I find a minute portion of the insoluble residuum described by Boussingault, (Journal of Science, Vol. 17. p. 395,) which is in the form of a black dense granular powder,* and in ours is wholly insoluble in nitro-muriatic acid, and even fusion in caustic potass alone has very little effect upon it. The only menstruum which will properly act upon it, being a mixture of caustic and nitrate of potass, which by long fusion dissolves out the chromium as a chromate of potass, when the powder is first carefully pulverised, and the heat kept very high. By the blowpipe the chromium is readily detected by microcosmic salt on the platina wire, the iron separating as a metallic bead, and the assay bead remaining dull from the silica in the compound. It appears to be a silico-chromate of iron, but with such minute assays it is impossible to say more at present of such a refractory compound than that it contains silica, iron and chromium, the silica and iron being in large proportions and the chromium in a very small one. It may possibly be a siliceous sub-chromate of iron?

With reference to the presence of the arsenic (which was distinctly ascertained by Marsh's process), and to what I have said above as to the successive oversights of first-rate chemists, the following extract from a notice of M. Walchner entitled "Observations on the general distribution of copper and arsenic" in the *Comptes Rendus Septembre*, 1846, which I take from the Quarterly Journal of the Geological Society may not be out of place.

After affirming the presence of copper and arsenic in many iron ores, mineral springs, soils, rocks, &c. the author goes on to say,—

"It now remained to demonstrate that these metals were equally

* I think also so described by some other chemist, but I cannot now find the reference.

contained in meteoric iron ores,* my first experiments were made on the meteoric iron of Pallas, well known and repeatedly analysed by distinguished chemists, and in reality I have found in it both copper and arsenic, also in the Mexican meteoric iron of Yuanhuitlan, near to Oaxaca, brought home by my colleague M. Sommerschu principal engineer of mines; in a meteoric iron from Tennessee described by M. Troost in Silliman's Journal; and finally in a fragment of the great mass of meteoric iron, deposited in the museum of Natural History of Yale College in Connecticut. Consequently it is not only at the surface of the earth that iron is mixed with copper and arsenic, but also in the solid portions of other celestial bodies."

Copper I have as yet failed to detect in our meteorite, but I should be far from affirming that it does not exist in it.

H. Piddington.

The Aborigines of Central India.—By B. H. Hodgson, *Esq.*

At the close of last year I had the honour to submit to the Society a summary view of the affinities of the sub-Himálayan aborigines. I have now the honour to submit a similar view of the affinities of the aborigines of Central India. The extra copies of the former paper which were sent to me by the Society I forwarded to Colonels Ouseley, and Sleeman, to Major Napleton, Mr. Elliot of Madras, and other gentlemen, with a request that they would get the vocabulary filled up from the languages of the several aborigines of their respective neighbourhoods. The three former gentlemen have obligingly attended to my wishes, and I am assured that Mr. Elliot also is busy with the work. Of the seven languages which I now forward the comparative vocabulary of, the three first came from Chyebossa, where Colonel Ouseley's Assistant, Capt. Haughton prepared them; the 4th and 5th direct from Col. Ouseley himself at Chota Nagpur; the 6th from Bhaugalpur pre-

* M. Rammler of Vienna has found the arsenious acid in the peridot of the meteoric iron of Pallas (Pogg. Annal, 1840, No. 4.)

pared by the Rev. Mr. Hurder; and the 7th from Jabbalpur where Colonel Sleeman's principal assistant drew it up for me.

The affinities of these tongues are very striking, so much so that the five first may be safely denominated dialects of the great Kól language; and through the Uráon speech we trace without difficulty the further connexion of the language of the Kóles with that of the "hill men" of the Rajmahal and Bhaugalpur ranges. Nor are there wanting oblious links between the several tongues above enumerated—all which we may class under the head Kól—and that of the Gónds of the Vindhia whose speech again has been lately shown by Mr. Elliot to have much resemblance both in vocables and structure to the cultivated tongues of the Deccan. Thus we are already rapidly approaching to the realization of the hypothesis put forth in my essay on the Koch, Bodo and Dhimál, to wit, that all the Tamulians of India have a common fountain and origin, like all the Arians; and that the innumerable diversities of spoken language characterising the former race are but the more or less superficial effects of their long and utter dispersion, and segregation, owing to the savage tyranny of the latter race in days when the rights of conquest were synonymous with a license to destroy, spoil and enslave. That the Arian population of India descended into it about 3000 years ago from the north-west, as conquerors, and that they completely subdued all the open and cultivated parts of Hindostan, Bengal and the most adjacent tracts of the Deccan* but failed to extend their effective sway and colonization further south, are quasi historical deductions† confirmed daily more and more by the results of ethnological research. And we thus find an easy, and natural explanation of the facts that in the Deccan, where the original tenants of the soil have been able to hold together in possession of it, the aboriginal languages exhibit a deal of integrity and refinement, whilst in the north, where the pristine population has been hunted into jungly and malarious recesses, the aboriginal tongues are broken into innumerable rude and shapeless fragments. Nevertheless those fragments may yet be brought together by large and careful induction; for modern ethnology has actually accomplished

* Telingána, Gajerat and Maharáshtra, or the Maratta country.

† Brachmanes nomen gentis diffusissimæ cujus maximapars in montibus (Ariana Cabul) degit, reliqui circa Gangem. Cell Geogr.

elsewhere yet more brilliant feats than this, throwing upon the great antihistoric movements of natious a light as splendid as useful. But, if I hold forth, before hand, the probable result of this investigation in the shape of a striking hypothesis, in order to stimulate the pains-taking accumulator of facts, and even intimate that our present materials already offer the most encouraging earnest of success, I trust that the whole tenour and substance of my essay on the Kóch, Bódo and Dhimál will suffice to assure all candid persons that I am no advocate for sweeping conclusions from insufficient premises, and that I desire to see the ethnology of India conducted upon the most extended scale, with careful weighing of every available item of evidence that is calculated to demonstrate the unity,* *or otherwise*, of the Tamulian race.

* This unity can of course only touch the grander classifications of language, and be analogous to that which aggregates, for example, Sanscrit, Greek, Teutonic and Celtic.

Comparative Vocabulary of the Aboriginal languages of Central India.

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Air	Hoiyo	Hóyé	Hóyó	Tháká	Hóyóh	Táké. Táphé	Báribá ítá
Ant	Múí	Múṇi	Múé	Póh	Múnj	Pók	Patté
Arrow	Sarh	Sarh	Sarh	Chár	Sáár	Chár	Jiyatúr
Bird	O′é	Chéné	Chéné	O′rak	Uré	Púj	Itté
Blood	Myún	Myún	Myún	Khéns	Myún	Késú	Nattúr
Boat	Dúngá	Dúngá	Dúngá	Dóngá	Dóngá	Návé H	Dóngó
Bone	Jáng	Jáng	Jáng	Khóchal	Jáng	Kochal	Hára
Buffaloe	Kérá	Kará	Kérá	Mánkhá	Bhitkil	Mángé	Háliyá
Cat	Bilai H	Púsí	Bilai H	Bírkha	Pússí	Bérgé	Bílal
Cow	Gúndi	Gai H	Gai H	Udú	Urí	Oi	Dhóriyal
Crow	Ká	Kahú	Kóvá	Khákhá	Kóvá	Káké	Káwá
Day	Súgi, Má	Sing. Má	Din H	Ullah	Sing	Diné H	Patti
Dog	Sétá	Sétá	Sétá	Alla	Sétá	Allay	Naï
Ear	Lútúr	Lútúr	Lútúr	Khebda	Lútúr	Khetway	Kavi
Earth	O′té	O′t	O′té	Khékhél	Wathé	Kékal	Dharti S
Egg	Pitú	Billi	Pito	Bí	Billi	Kírpan	Méj
Elephant	Háthi H	Háthi H	Háthi	Háthi H	Háthi H	Ati H	Yéje
Eye	Mét	Mét	Mét	Khán	Méd	Káné	Kank
Father	Ápúng	Bábá	Bábú	Bábé	Apúng	Abá	Wáwó
Fire	Sengel	Sengel	Sengel	Chik	Singil	Chiché	Kis
Fish	Hákú	Hakú	Hái	Injo	Hákú	Min	Min
Flower	Bowh	Búhá	Baha	Phúp	Baha	Púp	Phúl H
Foot	Kátá	Súptijánga	Kata	Dappé	Kata	Kév	Kalk
Goat	Méram	Méram	Méram	E′rá	Méram	Cré	Bókra H
Hair	Ub	Ub	Ub	Chúttí	Up	Tali	Róbáng
Hand	Thí	Thí	Thí	Khékháh	Tihi	Sésú	Kaik
Head	Bu	Buho	Buho	Kúk	Bóhú	Kúpé	Talla
Hog	Súkri	Súkri	Súkri	Kiss	Súkri	Kís	Paddi
Horn	Dring	Darring	Derring	Márag	Daring	Márg	Singh H
Horse	Sadham	Sadham	Sadham	Ghoro H	Sadam	Goro H	Kóṇdand ?
House	O′á	O′rá	O′rá	Erpá	Uráä	Ává	Rón
Iron	Médh	Mérhad	Mérhd	Panná	Marhan	Lóhá H	Kachchi
Leaf	Sákam	Sakam	Sikkam	Átkhá	Sikam	Átgé	Áki
Light	Maskal	Marsal	Tetaytúrra	Billi	Marsa ?	Ávéli	Bérachí

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Man	Hó	Horh	Horro	Alla	Horl	Málé	Mánébábá mawsal
Monkey	Sarrha. Gári	Hanú. Gári	Gari	Bandra H	Bandra H	Múgé	Bandara H
Moon	Chándú H	Chando H	Chandú H	Chando H	Chandú H	Bilpé	Chanda H
Mother	E'áng	I yo	Mai H	Ayyo	E'ngan	Áyá	Aval
Mountain	Búrú	Búrú	Búrú	Partá	Búrú	Tóké	Dongar
Mouth	Á	Mocha	Alang	Bái	Mocha	Soro	Udí
Moschito	Sikí	Sikri	Lútí	Bhúséndi	Bhúsúndi	Minko	Misi
Name	Nútúm	Nútúm	Númú	Nám H	Natúm	Námi H	Battí paról
Night	Níndhá*	Níndhá	Nídhá	Mákhá	Nidak	Máké	Narkaát
Oil	Súnúm	Súnúm	Súnúm	Issúm	Súnam	Isgné	Níng
Plantain	Kodal	Kaira	Kodal	Kérá H	Kélá H	Kalvi	Kérá H
River	Garra	Garra	Garra	Khár	Garra	Caret	Dóndá
Road	Horra	Hor	Horren	Dáhári	Hórah	Sarké H	Sarrí
Salt	Búlúng	Búlúng	Búlúng	Békh	Búlang	Béké	Sabbar
Skin	Ur	Harta	Ur	Chapta	Harta	Chámé S	Tól
Sky	Sirma	Sirma	Rimmil	Mírkhá	irma	Sarángé	Bádúr ? H
Snake	Bing	Bing	Bing	Nír	Bing	Nér	Tarás
Star	E'pil	Ípil.	Ípil	Bínká	Ipil	Bindéké	Sukú
Stone	Dirri	Dirri	Dirri	Pakhná	Diri	Chaihé	Tóngí
Sun	Singi	Sing marsal	Singi	Dharmi†	Singi	Bér	Súraj H
Tiger	Garúmkúla	Kúla	Kúlá	Lakhrá	Kúlah	Sad	Púlli
Tooth	Dáthá H	Dátha	Dátta	Páll	Dátá H	Páll	Palk
Tree	Dárú S	Dáré	Dárú	Man	Dárú S	Man	Mará
Village	Hattú	Athú	Hathújé	Padda	Hátú	Kép	Nár
Water	Dáh	Dáh	Dáh	Um. Chéïp	Dhá	Ám	Yér
Yam	Merúmtosang	Dá sáng	Sángá	Álú H	Árú H	Caret	Náska kángda
I	Aing	Ingé	Ing	Enan	Ing	En	Mánú
Thou	Um	Umgé	Am	Níen	Am	Nin	Imma
He, She, It	Ini	Uní	Ini	Asán	Inni	Áth	Caret
We	Caret	Caret	Caret	En	Allégé	Nam. Om	Caret
Ye	Caret	Caret	Caret	Ású	Inkoghí	Nina	Undé
They	Caret	Caret	Caret	Caret	Ánkó	Ásabar. Áwar	Caret
Mine	I yan	Ingréá	Inya	E'nghi	Jhátaná	Ongki	Nává ángdo
Thine	Ummá	Ami	Ummá	Níenghi	Amátaná	Ningki	Níávútriánd

* A misapplication probably of the Hindi word for sleep or sleepy.

† Sanscrit ? and implies that the Sun is worshipped.

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
His	Ini	Uńéá	Aigé	Á'sghi	Annerá tana	Á'hiki	Oná
Our's	Alléá	Alléá	Á'búsaban	E'mhí	Ahúá tana	E'mki. Námki	Mábaí
Your's	Appéá	Appé	Caret	Á'ssghi	Apiá tana	Nimki	Níá hillé
Their's	E'nkóá	Uńkúré	Caret	Caret	Ankóá tana	Á'sá bériki	Oná ánd
One	Mí	Midh	Moy	Uńtá	Míá	Ort.† Ondong Pándong. Kivong	Uńddí
Two	Barria	Barria	Barria	Enótan	Baria	Twr. Mákis indual	Ranú
Three	Apia	Pía	Apia	Manótan	Apia	Same as Hindi and Urdu.	Múnú
Four	Uńpúnia	Ponia	Uńpúnia	Nákhótan	Uńpniá		Nálú
Five	Moya	Moné gótang*	Monaya	Panjé gotan H	Moria		Saijhan
Six	Túria	Túrúí gótang	Túrúyá	Sé gotan H	Túriá		Sáróng
Seven	I'yá	I'air gótang	Sáth H	Sat gotan H	Sáth H		Yénú, Yétú
Eight	Irlia	Iral gótang	Á'th H	Á'té gotan H	Á'th H		Anamúr
Nine	Aréá	Aré gótang	Nou H	Nó gotan H	Nókó H		Nó H
Ten	Geléá	Gél gótang	Das H	Das gotan H	Dasgo H		Pada
Twenty	Hissi	Caret	Caret	Bís H	Bís H		Bísa H
Thirty	Hissi geléá	Hissi gél gótang	Moy hissi dasti	Dérh kori H	Tís H		Tís H
Forty	Bárhissi	Bár hissi	Bár hissi	Bísénd	Bár hissi dasgo		Chálís H
Fifty	Moy hissigil	Bár hissi gél	Bar hissi dasti	Dharihé kóri	Bár hissi dasgo	As in Urdu	Pachás H
A hundred	Moy hissi	Monay hissi	Sou H	Sé H	Midso		Só H
Of	Caret	Caret	Caret	Ye	Kí H	By affix to the noun.	Orá, Bará
To	Té	Té	Caret	Gai	Kó H		Baina
From	Té	Té	Caret	Té	Sé H		Caret
By, instr.	Tété	Túlé	Caret	Caret	Á'tam		Túrsé, Dúrsé
With, cum.	Tóté	Túlí	Caret	Sang H	Gatt. Minna	Gúni	Sang
Without, sine.	Banóá	Banóá	Caret	Ní	Sámá	Walo	Bigúr
In	Ré	Ré	Caret	Uńlá	Bhítar H	By affix to the noun.	I'mitté
On	Ré Chitan	Ré	Caret	Uńlá	Caret		
Now	Ná	Nítging	Caret	Uńkú	Náhá	Á'néké	Inga
Then	En	Ena. Uńí	Caret	Písá	I'nam	Á'ní	Ada
When ?	Chúílá	Tis	Caret	E'ká héré	Chíélo. Chimto	I kono	Vang pur
To-day	Ná	Teheng	Tising	I'nam	Tihin	Iné	Naiú
To-morrow	Gúphá	Gúphá	Gúphá	Nélá	Gappá	Lélé	Ningnai

* Gótang is surplusage and Hindi.

† Art to human beings. Others to diverse things.

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Yesterday	Hólá	Holánó	Hóla	Chélo	Hólá	Chéwr	Nara khai
Here	Néthá	Noáthi	Néthai	Isan	Nithi	Ino	Ingabará
There	Entai	Hanati	E'ta thái	Háhá	Uʼnthi	Áno	Caret
Where ?	Okotai	Okáti	Oko thái	E'ksan	Uʼthi	Ikéno	Vagá
Above	Sirma	Sirma	Sirma	Méyah	Chaitan	Méché	Parró
Below	Súbá	Phér	Athé	Kíyah	Látúr	Pissi	Khálai mandar H
Between	Talaré	Taláré	Talaré	Majín	Talar	Máji H	Bíchte mandar H
Without, outside	Racháré	Racháré	Racháré	Báhari H	Báhari H	Dwári	Bahiro mandar H
Within	Bhitar H	Bhitar H	Bhitar H	Uʼlá	Bhítar H	Uʼlé	Núpá mandar
Far	Sanginiya	Sanginiya	Sángiya	Gécha	Sangin	Géchi	Langkak mandar
Near	Nia	Súrgí	Járéyá	Hédi	Najík H	Atgi	Múntosa mandar
Little	Húring	Húringi	Húring	Sani	Húring	Jóká	Jarásó mandar
Much	E'sú	Oriúttar	Burra	Dhér H	Dhér H	Gánrí	Balé mandar
How much ?	Chi miáng	Tíná	Chi miáng	Yúng pagi	Chimna	Iná	Banchur
As	Carent	Carent		Carent	Nimnú	Caret	Inchur mandá
So					Sé	Caret	Aróbara
Thus	Iʼnlíkaté	Húnkaté	Nékagia	Yéli	Nikemeh	Indéki	Iʼhún
How ?	Chi líka	Chika líka	Chi líka	Yékassi	Chilké	Ikna	Báhún
Why ?	Chikan minté	Chér minté	Chi líka	Indarí	Chikanlé	Indrik	Bárad
Yes	Hán H	Hóé	Hán H	Háh	Háh	O'nón	Ingé
No	Bano	Banga	Bano	Málá	Bano	Mállá	Hillé
(Do) not	Alam	Alam	Alapé	Ampá	Alú	Caret	Hillé bará
And, also	Carent	Carent		Our H	Inní	Inséki	Uʼdé
Or				Iʼs	Áni	Malé	Idaré
This	Néá	Nóá	Ní	Edah	Nia	Iʼh	Caret
That	E'nó	Hono	Caret	Húdah	Áná	Áh	Caret
Which, jón	Carent Omnino			Ikrah	O'kah	Caret	Caret
Which, tón						Caret	Caret
Which ? Kón	Oko	Hana	Caret	Carent		Ik	Caret
What ?	Carent		Carent	Indrári	Chikina	Caret	Bará ánd
Who ?				Ekóá	O'kówé	Ik	Caret
Any thing	Oko bitté	Oka dhon	Okodhon	Indara	Jáhá, Nági	Indarbadi	Bittíchíj H
Any body	Oko ho	Okúrén horh	Okoji	E'koárten	Oko waihí	Né gôté	Vóndi ándi
Eat	Júméman	Júmmén	Júmiábo	Mokháh	Jamémí	Lápá, Móká Mina	Bárátit

English.	1. *Sinhbhúm Kól.*	2. *Sóntal.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Drink	Núéman	Nayman	Nayman	Ŭnáh	Noimi	Oná	Yérú undkar
Sleep	Gitíman	Gitikéman	Gitijúm	Khándara	Dúróng	Kándrá	Súngji
Wake	Birman	Biritman	Rúárman	Amha khandara	Adágya	Ejra	Jagémám
Laugh	Landaiman	Landman	Landai	Alíkah	Caret	Aĺká	Kavítoní
Weep	Raiman	Ragman	Eyamman	Chinkháh	E′yamtémi	Olgá	Arátó
Be silent	Hápauman	Hapékoman	Hapiakanman	Amhakachnékrah	Happá	Aslúbehá	Immakammeneman
Speak	Kajíman	Rorhman	Kajíman	Kachnékrah	Kajémi	Auda	Bárámanké
Come	Hújúman	Hijúman	Hijúman	Báná	Déla hájúm	Bárá	Báránígá
Go	Sanóman	Chalahman	Sanóman	Kálá	Dúsénámi	Eká, Kálá	Hannogáímá
Stand up	Tíngúnman	Matinggúnman	Tingúákanman	Illáhá	Tengúnmi	Choíyá	Tedánígá
Sit down	Dúbman	Dúrúpman	Dúrúbkanman	Ŭkha	Dúmí	Oká	Uddánígá
Move, walk	Sanóman	Dilangchalahman	Dholábúsanóman	Gúcha	Sénámí	Sakrá ?	Táká
Run	Níríman	Dúrman	Dúrman	Bóngá	Lírmí	Bóngá	Bittá
Give	Immaiman	Immaiman	Ŭmaiman	Chhíá	Dá	Katá	Sí
Take	Né	Né	Né	Oánda	Né	Kinda	Tará
Strike	Goiman	Dalmain	Magíman	Khórah	Dálí	Bája	Jím
Kill	Margojokai	Goidapolsmon	Margogojiman	Pítalchia	Márgóji H	Pitá	Jaksívaústi
Bring	Dá	Dan	Daigóáguéman	Ondrá	Ágómen	O′ndrá	Taránígá
Take away	Ďíman	Dúídíman	Idimengo	Hóná	E′dímé	Oiyá	Oumaníga
Lift up, raise	Rúkúbman	Túlrúkúbman	Ŭthaibaitman	Chódá	Rimémi	Chivá	Téhá
Hear	Jaimman	Jyúmman	Jyúmmanmego	Mijnka	Jyoumémi	Mená	Caret
Understand	Adaiman	Ŭnjúmkidda	Etwanachigúm	Bhújarka	Samújhai H	Bújiá H	Pútté
Tell, relate	Kajíman	Rorhman	Kajiman	Káchana	Kájí	Téngá	Kantáná manjé
Good	Búgí	Búgí	Búgí	Bésri	Bógí	Crú	Bésmanda H
Bad	Etka	Bariéna	Júdajanna	Maldau	Káhésá	Báná	Búró manda H
Cold	Rabang	Rabang	Rabang	Ekh	Réártana	Paniai	Múragta
Hot	Lóló	Loloa	Gúmár	Bidáh	Balhaltan	Kúrni	Kástai
Raw	Baral	Baralgia	Baral	Khéna, Arha	Béral	Kéné	Kachchomanda H
Ripe	Biriéna	Biliéna	Ihsinjanna	Panja	Bilia	Panjéké	Pútá
Sweet	Sibíla	Haramgía	Sibíla	Tini	Sihil	E′mbé	Mingatá
Sour	Jójó	Jójógía	Jójó	Tissa	Jojou	Tisé	Chúk manda
Bitter	Hárdá	Hawéra	Harrada	Harkhá	Harpand	Karkeh	Kaḍúta
Handsome	Búgi lika	Ŭní búgi	Búgikúri	Bésré H	Bés H	Crúgáré	Assal H
Ugly	E′súétka lika	Uni barigía	Utea neloa	Málá	Kaihés	Caret	Búrótá manda H

English.	1. *Sinhbhúm Kól.*	2. *Sóntal.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Straight	Múlí	Búgisajía	Búgi saj	Ujgó	Sójhia H	Jákró	Tukvá
Crooked	Kochamocha	Ochúr	Hessú bánka	Béngko	Kékúndo	Séró	Téḍhó
Black	Héndé	Héndé	Hendé	Mokharo	Hendí	Márgo	Kariyal
White	Púndí	Urí púnda	Hessú púnia	Pándrú	Púndí	Jimpro	Panguró
Red	*Hessú árá	*Uṛí árá	*Baṛaranga H	Khénsó	Árrah	Késó	Lál H
Green	Gadésosang	Hariyar H	Gadé sosang	Harria H	Harriár H	Kénkajro	Haro H
Long	Jilling	Uri jilling	Baroajilling	Digha S	Jiling	Digaro	Lamba H
Short	Dúngúya	Húrikatógia	Kándia	Phúdá	Húding	Jokka	Chúndur
Tall } man	Bátari salangi	Uḍi úsúlai	Baraisangaluma	Micha	Jiling	Digaro	Jhangchomanda
Short } man	Hessú imitingia	Bángorgaintia	Baṛa bángarba	Natúá H	Húding	Chápó	Chúndúrmanda
Small	Húring	Húringia	Huringia, Káto	Sanka	Húring	Caret	Pataro H
Great	Márang	Márangia	Hisso márang	Kóhá	Márang	Bévó	Mótó H
Round	Dingúrúgia	Gúlándia	Golandia, Gotagia	Gólgól H	Gótá ?	Golé H	Gola H
Square	Upúnkocha	Púnkóna	Upún kón	Chár kóna H	Gótá	Caret	Nálukhúnt [nur
Flat	Mitaulígia	Uri mirsang	Mórsóm	Chaptí H	Chaptia	Barábar H	Naphúral mandá-
Fat	Kiriéná	Uri móta	Barai móta H	Mota H	Mota H	Gandi tarvé	Caret
Thin	Bátaria	Pátalia H	Barai úsú	Serúá	Usú	Gandi walo	Sirsíhattúr
Weariness	E'súblagiéna	Langiéna	Laga jouálé	Kháridkar	Thakana H	Caret	Dikmandatúr H
Thirst	Totáng tanna	Totang tanna	Totang tanna	Amún kala	Titang	Amkírvá	Yétaksátúr
Hunger	Réngé	Réngé	Réngé	Kéïra	Ringat	Kiré	Karúsátúr.

Dorjiling, Nov. 1848.

B. H. Hodgson.

N. B. The postfix H indicates a Hindi or Urdu etymon and the S a Sanscrit origin.

* Hessú, Uḍi, Baṛa, Barai, mean ' very' ' extremely' and are mere expletives I suspect.

*Fragments of the history of Mooltan, the Deraját, and Buhawulpoor, from Persian MSS.** *By Lieut.* R. Maclagan.

1. *Account of the arrival at Mooltan of Mulik Sohrab, Dodáee Belóch, with Ismael Khan and Futteh Khan, his sons, and of Hájee Khan and Gházee Khan, from the country of Kéch Mekrán: and the foundation of the Deraját.*

It is related in the history called Huft Goolshun, that in the year 874 H. (A. D. 1469,) Sooltan Hoossein, son of Sooltan Kootub-ood-deen, upon the death of the latter, obtained the government of Mooltan. He held the forts of Shór and Chuneewut, Kot Kuror, and Deen Kót. Sheikh Yoosoof, who had been removed from the government of Mooltan on the appointment of Kootub-ood-deen, came to Sooltan Belól Lodee, governor of Delhi, and earnestly entreated his assistance. The Sooltan sent his eldest son, Bareek Shah, with a well appointed force. As soon as the Delhi troops appeared before Mooltan, Sooltan Hoossein issued to oppose them, and a battle ensued. Bareek Shah was discomfited and returned to Delhi.

It was at this time that Mulik Sohráb, of the tribe Dodáee, along with Ishmael Khan and Futteh Khan, his sons, and others of their tribe, arrived from Kech Mekrán,† and entered the service of Sooltan Hoossein. As the hill robbers were then becoming very troublesome in (the province of) Mooltan, Sultan Hoossein rejoiced in the opportune arrival of Mulik Sohrab, and assigned to him the tenure of the country from the fort of Kurór to Deen Kót. On this becoming known, many Beloches came from Kech Mekrán to the service of the Sooltan. The lands, cultivated and waste, along the banks of the Indus were assigned to the Beloches, and the royal revenue began to increase. The old inhabitants of Dera Gházee Khan and Mooltan relate that after Mulik

* These MSS. were obtained at Buhawulpoor in January, 1846. I have only one of them in the original now with me. The other I translated at the time, and have no means now of revising.

† Sir J. Malcolm mentions (Centr. Ind. II. 175), that mercenaries used to come annually from Mekrán to Central India for service. Are there Beloches there now?

Sohrab's arrival, Hájee Khan with his son Gházee Khan, and many of their kindred and tribe, came from Kech Mekrán to enter the service of the Sooltan.

When the tracts along the Indus were in the hands of Mulik Sohráb and Hájee Khan, Mulik Sohráb founded a Déra named after Ishmael Khan, and Hájee Khan another with the name of Gházee Khan.

During the lax and indolent rule of Muhmood, the grandson of Sooltan Hoossein, Gházee Khan seized the greater part of the dependencies of Mooltan and assumed the government. On the death of Gházee Khan, his son Hájee Khan succeeded to the same extent of authority, and, taking advantage of the weakness of the government of Hindoostan,* took possession of several districts on the Indus, towards the south, and became independent. His successors, each on the death of his father, took the name of his own grandfather,—being thus Ghájee Khan and Hájee Khan alternately.

When Mohummud Hoomáyoon Badshah reigned at Delhi, and the countries of the Punjab, Mooltan and Sindh came into the hands of the Chooghutta princes, Gházee Khan the 5th, having come and presented himself before the above named Badshah, and made presents, obtained the Déra, (Gházee Khan) and its dependencies in jageer: the charge of these districts and of all their affairs being committed to him. In like manner throughout the Chóghtáee supremacy, the jageer above named was secured to his family in regular succession.

In the year 1152 H. (A. D. 1739,) Nadir Shah fought and conquered Mohummud Shah, emperor of Hindoostan. Mohummud Shah resigned to Nadir Shah the fort of Attok, and other places to the north and west; also Mooltan, the Deraját, the country of Sindh, and Cabul.† When, consequent on this, the Badshah, with the design of

* Now under Ibrahim Lodee.

† The act of cession is thus given by Hanway in his history of Nadir Shah—after preface:—

"The ministers of the Sultan, who is merciful, and the emperor, who is august, formerly sent ambassadors to us to treat of certain demands with which it was our purpose to comply. The ambassador, Mahommed Khan Turkuman, not long since arrived here from Kandahar to remind us thereof; but our ministers having delayed the embassador and postponed answering the letters of his sublime majesty, it at length produced such a misunderstanding between us, that his victorious army

marching upon Sindh, came from Déra Ismael Khan and arrived at

came into Hindostan. We encountered in the fields of Karnal, where victory arose in the east of his undeclining fortune.

* * * * * * *

" But in regard to the illustrious family of Jurghin,* and the honor he professes for the original tree of Turkan, out of the greatness of his soul, and the overflowings of his humanity, he has been pleased to restore to us the crown and gem of Hindostan.

" In consideration of this act of generosity, which no father has ever shown to a son, nor any brother to a brother, we make over to him all the countries to the west of the river Attok, and that of Scind, and Nala Sunkra, which is a branch of the Scind. That is to say Peishor with its territories; the principality of Cabul and Gasna; Hazariját, the mountainous residences of the Afghans; with the castles of Buckhor, Sunkor,† and Khoudabad; the passes, territories and abodes of the Tchoukis and Ballouchees, with the whole province of Tata: also the castle of Ram; the towns of Chun, Sumawali, and Ketra, with all the castles, towns, ports, villages, and open country, from the first rise of the river Attok, with all the country comprehended within its branches, till it empties itself into the sea at Nala Sunkra.

" These we freely give up to the dominion of the powerful sovereign of Persia, and from henceforward our officers and subjects shall evacuate the same and resign the property and government to the Persian king, to be disposed of at his pleasure. We renounce all our right to command, controul, or collect revenues in any of these dominions. But the castle and town of Lohre Bunder, with all the country to the eastward of the river Attok, and of the waters of the Scind and Nala Sunkra, shall, as before, belong to the empire of Hindostan. Dated at Shahjehanabad, the fourth of Mohorim, 1152."—*Hist. of Nadir Shah, Chap.* 11.

There is no mention of Mooltan, which by the terms of the cession, as here given, is retained by the sovereign of Dehli. The meaning of the " towns, &c. and open country from the first rise of the river Attok, with all the country comprehended within its branches, is shown by the last paragraph to be restricted to the country west of the Indus. (Mill, II. 457), says " part of Mooltan" was included in the ceded territory, but he seems to reckon it among the " provinces west of the Indus." Col. Tod, alluding to this cession, says Mooltan was surrendered, (I. 419). It will be seen from the 4th paper here translated that the Sobahdars of Mooltan were appointed from Delhi until 1767, 28 years after Nadir Shah's invasion. The " Nala Sunkra, which is a branch of the Scind," is generally considered to be the Goonee, which now falls into the Sindree lake, and the country to the west of which used to be called Sancara. May it not be the river now called Nala or Nara, which passes Alór, at one time an important branch, and perhaps the main channel of the Indus? Mr. Hanway has this note:—" This is sometimes called Nale Sengure,

* This word is sometimes wrote Gourgan. † This is sometimes wrote Sekir.

Déra Gházee Khan,* Gházee Khan the 10th, who lived at that time, having paid his respects to the Badshah, obtained the royal favor, and was confirmed in the tenure of the Déra and its dependencies. On the death of this same Gházee Khan without issue, in 1172, H., (A. D. 1758,) none of his kindred and country succeeding to the government, they became dispersed in various directions. The Déra and its dependencies accordingly lapsed to the sovereign of Cabul; and Maharajah Koura Mull† was appointed governor by Ahmed Shah. After this Meeán Gholam Shah obtained the government, which he held for 16 years.

which seems to be the island betweeen the Indus and what De Lisle calls the river Drintade."

* The occasion and route of this march upon Sindh are thus given by the authority before quoted: "After passing the Indus, he directed his march to Peishor, where he halted for some days. * * * * From thence, continuing his route towards Cabul, he detached Abdul Baki Khan, with five thousand horse, to receive homage from Khudayar Khan, governor of Pekier. (This country is to the south of Cabul on the Indus bordering upon Multan: I do not find it laid down by De Lisle. There are several forts, and strong places in it, such as Lokheri, Sekier, and Tekier. The people in this country are partly Mahommedans and partly Pagans). This Khan had refused to pay homage to Nadir, now sovereign of that country; and collected a considerable body of forces to oppose the Persian army. * * * * Abdul Baki Khan soon arrived on the frontiers of this country, but was in no situation to reduce Khudayar Khan by force. * * * * Abdul Baki informed the Shah of the circumstances he was in. Nadir being now near Kandahar sent his treasures and heavy baggage under a numerous convoy into that strong fortress, and then directed his course south-east through the country of Hazarijât. * * * * *

"As soon as Nadir arrived in the neighbourhood of Khudaabad, the Indian Chief retired with his riches to Emir Kiout, a strong fort on the opposite side of the river Hest-nud, &c. &c."—*Hist. of Nadir Shah, by Jonas Hanway, p.* 393.

One would think Nadir could scarcely have been near Kandahar at that time, and if he had, his course thence would not probably take him viâ Déra Ismael Khan, as the MS. says.

If Hanway's note, given above in parenthesis, means that Roree was included in the country of which Nadir was "now sovereign" this would give grounds for supposing that the Nara is the boundary before alluded to. But no great importance is to be attached to his geographical notes of those regions. He is apparently quite unconscious that "Pekier" and "Sekier" are what he before gave as "Buckhor" and "Sunkur, sometimes wrote Sekir."

† He had been governor of Mooltan since 1746, and now received charge of Déra Gházee Khan in addition.

In the reign of Tymoor Shah, first Zeman Khan Dooranee governed three years, then Mirza Khan Atukzye, 9 years; Sumundur Khan Badoozye, one year; Saadut Khan, son of Mirza Khan, one year.

In the reign of Zeman Shah, Asaad Khan, brother of Futteh Khan Barukzye, governed for two years;—Sumud Khan Populzye, two years; Sheikh Kumur-ood-deen, one year; Ibrahim Khan Populzye, one year; Sumud Khan, brother of Futteh Khan, three years; Nuwab Abd-ool-jubár Khan, three years; Hubeeb-oollah Khan Suddozye, two years; Mohummud Zeman Khan Barukzye, three years.*

In the reign of the Shahzadah Muhmood, Sumundur Khan, two years.

Again, in the reign of his majesty Shoojá-ool-Moolk Muhummud Zeman Khan Barukzye was governor of the Déra, when in the year 1230 H., (A. D. 1814,) Maharaja Runjeet Singh took it from him, and conferred the tenure of that place, along with Hurund and Dájil, and the rest of its dependencies, on Mohummud Sadik Khan, (father of the present Nuwab of Buhawulpoor,) on an annual rental of 4 lakhs.

A. D. 1831, in 1247, Runjeet Singh took into his own hands the district of Déra Gházee Khan, and the rest of the country on that side of the river held by Nuwab Mohummud Buhawul Khan, and the administration was committed to General Ventura. He remained two years, and after him, Deewan Sanwun Mull was appointed Nazim.

Mohummud Ruheem Khan, and Mohummud Yar Khan, of the family of Gházee Khan, now live at Déra Gházee Khan (1845). Only two wells (land) are granted to them for their subsistence.

The Belochees having no royal house, have not been in the custom of making historical records from which details might be gathered, regarding the ancestors of Gházee Khan.

2.—*Account of the attack of Huree Singh, Chunda Singh, and Gunda Singh, called Bhungee,† on the estate of the Buhawulpoor*

* This gives a total of 17 years, but the reign of Zeman Shah was only of 7 years' continuance. Timoor Shah died in 1793, and Zeman Shah was dethroned by Muhmood, his brother, in 1800. Perhaps some of the first of these names should be transferred to the previous reign, and part of the three years of the last named governor may have extended into the reign of Muhmood.

† Thus designated, I was informed, not from their being of the caste so named, but from a progenitor, a noted *bhang eater*.

government; and the capture and occupation by these Sirdars, of Mooltan and its dependencies.

From the 'Jawaheer Abbaseeuh,' containing a history of the Abbasee Khalifs, ancestors of the Buhawulpoor rulers,* and from well-informed aged individuals, we learn that in the year 1180 H., (A. D. 1766,) the above named Sirdars made a descent upon Kussoor, from the Gunghoora valley, and took much spoil, jewels, coin, gold and silver. Encouraged by their success, these chiefs looked to further conquest of country and plunder, and many pergunnahs and estates in the Punjab, fell into their hands. In the same year, having arrived with a large force, on the further side of the river (Sutlej) opposite the fort of Moobarikpoor, in the Buhawulpoor country, which is 7 coss from the bank of the Sutlej, they prepared to invade the Buhawulpoor territory. The Khan, Mohummud Moobarik Khan, (great grandfather of the present Nuwab,) ordered his nephew and heir, Mohummud Buhawul Khan the 2d, to cross and oppose the Sirdars on the other side. An agreement was made that the country beyond Pak Puttun, on that side of the river, should remain in the possession of the Sirdars, and the country on the left bank of the Sutlej, as much as belonged to Mohummud Moobarik Khan, and the other Dáoodpootra chiefs, should continue as before, in their possession.

In the year 1185, (A. D. 1771,) Chunda Singh and Gunda Singh went again against Kussoor, in consequence of the complaints of the bráhmans against the violence of the Afghans of that place. They destroyed Gurhee Abdoor Ruheem Khan, and took four lakhs of rupees fine from the zumeendars of Kussoor, Humeed Khan, and Othman Khan, Dowlutzye.

On hearing of the death of the victorious Ahmed Shah,—of the accession of Tymoor Shah, and the weakness of his rule, they hastened to subdue Mooltan; and ordered Mujja Singh, at the head of his forces, to attack and pillage Kháee and Sadoollapoor, and the surrounding places on that side of the river subject to Mooltan, and held by the Bhawulpoor government, and other Dáoodpootra Khans. On this, Mohummud Moobarik Khan directed Mohummud Buháwul Khan, (afterwards his successor) to cross with the Dáoodpootra chiefs and a

* See "Account of the origin of the Dáúd Putras, by Munshi Mohan Lál," in the 7th Vol. of Journ. As. Soc. Bengal.

select force, and oppose Mujja Singh on the other side. In this encounter several Dáoodpootra chiefs were killed. On the other side many Singhs were killed and wounded. Mujja Singh himself was shot, and the rest fled. Mohummud Buháwul Khan, after this victory, returned to Buhawulpoor.

In the year 1186 H. (June 1772,) in the month Rubbee 1., Mohummud Moobarik Khan died, without offspring, and Mohummud Buháwul Khan succeeded his uncle.

At this time Hájee Shereef Suddozye was appointed Soobahdar of Mooltan by Tymoor Shah. His predecessor, Nuwab Shooja Khan, on being removed, went to Shoojáabad, his own jageer; and having arranged his affairs there, came to Buhawulpoor, to consult Buhawul Khan about getting rid of Hájee Shereef Khan. The Nuwab after this returned to his own jageer.

But Hájee Shereef Khan became careless in his government of Mooltan, and did not remit the stipulated payments to the Badshah's treasury. Having disagreed with Mirza Shereef Beg, who was appointed Tuhseeldar, this Mirza went to the Durbar of Tymoor Shah, and, along with Lala Dhurm Dás, merchant, inhabitant of Mooltan, brought the required amount of revenue and obtained the tenure of Mooltan. Hájee Shereef Khan, being displaced, took up his abode at Buhawulpoor. After some days, a difference arose between the two renters; Dhurm Dás was shot by a servant of Shereef Beg, and the Mirza seized the effects of the murdered man. At length, having come to his senses, in dread of retaliation, and punishment by the Badsha, he secretly sent for Sirdars Chunda Singh and Gunda Singh, promising to deliver up to them the fort of Mooltan. The Sirdars, immediately on the receipt of the letter, perceiving the attainment of their object, marched with a large body of their forces from Umritsir, and came with the utmost expedition to Mooltan.

Mirza Shereef Beg, to save his name, made a show of resistance by matchlock firing, and then fled to Tuloomba, 40 coss north of Mooltan. Not considering himself safe there he came to Khyrpoor, in the Buhawulpoor territory, 24 coss eastward from Buhawulpoor. There he died. The Sirdars became masters of Mooltan and its dependencies, and oppressed and plundered the district of Shoojáabad.

In 1190. (A. D. 1776,) Nuwab Shooja Khan died at Shoojáabad,

and was succeeded by his son Nuwab Mozuffur Khan. At this time the Sirdars came from Mooltan with a design of plundering Shoojáabad: but their purpose being defeated, they returned to Mooltan. Their army however spoiled the Shoojáabad district. In consequence of this, Nuwab Mozuffur Khan, in 1191 H. (A. D. 1777) came to Buhawulpoor, desiring the aid of Mohummud Buhawul Khan. The Khan also received an order from Tymoor Shah to expel the Singhs from Mooltan; accordingly, taking the Dáoodpootra chiefs and a select army, came with Nuwab Mozuffur Khan to Mooltan, and laid siege to the city. After 23 days they gained admittance within the city wall by the wicket of Sheikh Rájee Goordézee on the west, and began to slaughter the Singhs and plunder the residents of the city. At this time the Sirdars were staying at Umritsir. The Kiladar of Mooltan, who had been placed there by the Sirdars, with a force, being unable to offer opposition, retired into the citadel, and sent a swift messenger with an account of the state of things, to the Sirdars. The Dáoodpootra chiefs had taken much spoil, and without leave from the Khan had betaken themselves to their own homes, when Sirdar Gunda Singh, with a large force, came with all expedition from Umritsir, and engaging in battle, Buhawul Khan and Mozuffur Khan retired fighting to Shoojáabad. Thence, Buhawul Khan came to Buhawulpoor, and Mozuffur Khan remained in Shoojáabad, sending daily accounts to Tymoor Shah, of the disturbances, and the tyrannical behaviour of the followers of Nanuk. The Badshah, on hearing of the overbearing conduct of the Singhs, ordered Sirdar Behroo Khan, with a proper force, experienced in war, to proceed and expel the Singhs from Mooltan. In 1192 H. he came to Mooltan and besieged the fort. The fort was nearly being taken, but Tymoor having occasion to be engaged in hostilities at Tooran, (the Toorkomans having extended their conquests to the very gates of Khorasán), Behroo Khan was recalled, and, raising the siege, he returned to Cabul. Tymoor's operations at Tooran having ceased, Sirdar Ali Muddud Khan was sent with a large army to expel the Singhs from Mooltan. Tymoor himself, to afford a support to the Sirdar, came to Peshawur and encamped there. Ali Muddud Khan, coming with great speed to Mooltan laid siege to the fort, and reduced the inhabitants to great extremities. It happened that a party in the Badshah's army entertained a wicked design upon his life, on the discovery of which he recalled Ali Muddud Khan.

In 1193 H.(A. D. 1779,) the Badshah himself came with great celerity, with a conquering army, and having arrived at the Eedgah* a cannon shot north of Mooltan, directed the city to be besieged. In a short time it fell into his hands. At this time, Sirdar Gunda Singh was at Umritsir, engaged in a controversy with his brethren, consequent on the death of Chunda Singh, so that he had not an opportunity of coming to Mooltan, to afford assistance and recover the place. The Kiladar of Mooltan, having no hopes of aid from the Sirdar, and fearing the fury of the Shah's army, surrendered, and quitted the Fort, having, through means of Abdool Kurreem Khan, an Afghan of the tribe Babur, whose family were in the fort, obtained protection from the Shah for himself and his comrades. The Shah, entering the fort, caused his sovereignty to be again proclaimed, and bestowed the Khelut of Soobahdáree on Nawab Mozuffur Khan; with a lakh of rupees for the repair of the fort and city walls, and houses of the people, then marched towards Cabul.

Thus, the time these Sirdars held possession of Mooltan was from 1186 to 1193 H. (A. D. 1772 to 1779.)

3.—*Account of the country on the further side of the river (Sutlej) which continued to be held by the Buhawulpoor government, and other Dáoodpootra chiefs during the supremacy of the rulers of Khorasán in the Soobah of Mooltan. (The people of the Buhawulpoor Sircár and Dáoodpootra Khans yearly sent the regular payments to the Soobah of Mooltan, and constantly expended money in advances to the cultivators, and in the repair of forts and wells for their own benefit).*

From the 'Tuwareekh Abbaseeuh,' and verbal information from old persons well acquainted with the circumstances, its appears that in 1159 H. (A. D. 1746,) Maharaja Koura Mull, who is well known by the erection of the fort in the Mooltan country, which bears his name,†

* This appears to be the place which our two unfortunate political officers occupied on their recent mission to Mooltan. The description, 'a cannon shot north of Mooltan,' agrees remarkably with circumstances related to have occurred on that occasion. It is stated that after Mr. Vans Agnew was wounded, "Khan Singh conveyed him towards the Eedgah outside the town, which had been assigned as their residence. Directly they got into the Eedgah, the guns of the place opened on them, and continued firing the whole day. The range however was too long, and no damage was done, &c. &c."

Delhi Gazette, May 3, 1848.

† Gurh Maharaja, a fort about 28 miles from Mooltan, and 3 from the right bank of the Ravee.

was exalted to the Soobahdaree of Mooltan by Nuwab Moéen ood Dowlah, eldest son of the Nuwab Wuzeer Kumur-ood-deen Khan, one of the ministers of the throne of Delhi ;* and having killed in battle outside of Mooltan, the Nuwab Hyál-oollah Khan, entitled Shanuwáz Khan, entered on the government of Mooltan. In that year, (A. D. 1746) Nuwab Buhawul Khan, the 1st (great-great grandfather of the present Nuwab, Buhawul Khan the 3rd), founded the city of Buhawulpoor, and maintained a friendly correspondence with the Maharaja. At this time, Nuwab Ján-nisár Khan, at the instigation of Sheikh Mukhdoom Rajee Goordézee, withdrew his allegiance from the Shah. The Maharaja, having come, by desire of Nuwab Moéen-ood-dowlah from Lahore for the purpose of chastising Ján-nisár Khan, arrived by way of Kutchee, near Tanween, at the place where now stands Khyrpoor, in the Buhawulpoor territory. The Khan of Buhawulpoor, having in compliance with a summons, come to this place, had the satisfaction of meeting the Maharaja Koura Mull. Thence they went together to Tehr, called also Pooshtuk Wejranuh, near Khan Bela, in the district of Déra Gházee Khan. The fort of Khan Bela was taken in one day, and Ján-nisár Khan, coming down to the river, fought for three days. At length, during the night, he fled, leaving his camp standing on the bank of the river. After this victory, the Maharaja having settled the affairs of that neighbourhood, and bestowed goods and land on Buhawul Khan and the Dáoodpootras, turned towards Mooltan. He handed over also to Buhawul Khan, the village of Adum-wahu, on the other side of the water, opposite to, and four coss from Buhawalpoor, on a rental of 4000 rupees.

In 1163 H. (A. D. 1749,) Nuwab Mohummed Buhawul Khan died, and was succeeded by his brother Mohummed Moobarik Khan. He, in 1165 H. (A. D. 1751,) purchased the lands of Sheenee Bukhree and Mudwala, from the zumeendars of Tehr, also Bet (the island) and Donewala, from Mukhdoom Sheikh Rajee Goordezee, and brought them into cultivation. In 1174 H. (A. D. 1760,) he received the district of Loodun, as a friendly gift from Shaik Soobhan, the proprietor of Pak Puttun. In 1181 H. (A. D. 1767,) Nuwab Ali Mohummed Khan Khakwanee received the Soobahdaree of Mooltan from Ahmed Shah,

* And from the first MS. we find he was subsequently appointed Governor of Dera Ghazee Khan by Ahmed Shah.

and Sirboolund Khan (Suddozye) was appointed by the Badsha to Déra Gházee Khan. Nuwab Ali Mohummud Khan having taken Déra Gházee Khan and the Kinjoor district with the aid of Mohummud Moobarik Khan, gave him lands according to agreement, in the southern part of Kutchee, in the districts of Kinjoor, and Dera Gházee Khan. After this, he assigned to the Khan, on a rental of 8000 rupees, the lands on the further side of the Sutlej, of Khanwah, Kuhlwán, Adumwahu, Sirdarwah, Buhawulwah, Futtehpoor, Emamood-deen-poor, and Sheikh-wahn, and he cultivated these districts. In the same year Nuwab Ali Mohummed Khan having taken the land of the zumeendars of the Mylsee tribe from the zumeendars of Futanee, gave the same to Mohummed Jam Khan Dáoodpootra of Khyrpoor, on a rental of 400 rupees. He built the fort there named Mylseean and cut canals for irrigation.

In 1181, when Ahmed Shah returned from his expedition to Hindostan, Nuwab Ali Mohummed Khan, with his son, paid his respects. The Shah being enraged against Ali Mohummed Khan on account of the disrespect he had been guilty of towards Nuwab Shoojá Khan, caused the Nuwab and his son to be slain, and sent both the bodies into Mooltan, as a warning to others—that no one in future might treat the Suddozyes with incivility. The Soobahdaree of Mooltan was conferred on Nuwab Shoojá Khan. In 1194 Buhawul Khan, the 2d, rented the Pergunnahs of Juttoe and Mudwala and others surrounding, from Mirza Khan, Nazim of Dera Gházee Khan, and brought them into cultivation.

In the year 1200 H. (A. D. 1785,) Tymoor Shah came down upon Buhawulpoor. Mohummud Buhawul Khan leaving his country, went into the desert, and the fort of Duráwur fell into the hands of the Shah. To the charge of this fort, and the Nizamut of Dera Gházee Khan, Shah Mohummud Khan of Mooltan was appointed, through the interest of Abdool Ghufár Khan. Mouladád, a Goojur, rented from the Badshah the Kinjoor district in the territory of Dera Gházee Khan, and the southern districts of Kutchee, which had been in the hands of the Buhawulpoor Government. In the meantime, Mohummud Moobarik Khan, eldest son of Mohummud Buhawul Khan, presented himself before the Badshah, and obtained favor. The Badshah moved towards Cabul. Buhawul Khan came back from the desert to Buhawulpoor. Shah Mohummed Khan and the other Afghans of Mooltan, having, on the capture of Durawur

fort, imprisoned and punished the Dáoodpootras who were inside, the Khan, now collecting a great number of boats at the ferry of Oochh, crossed to Seetpoor and captured the families of Shah Mohummed Khan and other Mooltanee Afghans in charge of Duráwur fort. He then brought them to the outside of the fort of Duráwur, and left them there. On this, Shah Mohummud Khan and the other Afghans, beholding the disgrace of their families, made a truce, quitted the fort, and went with their families towards Dera Gházee Khan. Thus the Khan came again into the possession of his country.

In 1222 H. (A. D. 1807,) Nuwab Moozuffur Khan went on a pilgrimage to Mecca, and his eldest son, Mohummud Sirafráz Khan, remained in Mooltan in his father's stead. As a mark of friendship he rented to Buhawul Khan the villages of Adumwahu, Khanpoor, Sheergurh, and Kháee, on that side of the river—and the Khan brought these districts into fine cultivation.

In 1225 H. (A. D. 1810,) Ahmed Khan Mooltanee and Dhoomun Singh, jemadars in the Buhawulpoor army, having rebelled against the Khan (Mohummud Sadik Khan), crossed to the Khan's rented lands on the other side of the river, and committed havoc upon them ; Nuwab Sirafráz Khan, notwithstanding his father's injunctions, doing nothing to prevent this proceeding of the jemadars. The Khan's army with the Dáoodpcotra chiefs crossed and fought with them. On both sides many were killed, Ahmed Khan among the number, and his comrades fled. The Khan sent 12,000 rupees to the heirs of Ahmcd Khan. The Khan, in consequence of Sirafráz Khan's not having hindered the jemadars from raising this disturbance, reckoning also upon the feebleness of the Cabul government since 1213, discontinued making any payments for the districts he held on that side of the water.

In 1230 H. (A. D. 1814) the army of Maharaja Runjeet Singh arrived in the neighbourhood of Déra Gházee Khan, and along with the army of Mohummud Sadik Khan (of Buhawulpoor), seized the Déra, and its whole district from the hands of Mohummud Zeman Shah. At the Khan's desire, the Déra and its district were conferred by the Maharaja on him, on an annual rental of 4 lakhs of rupees.

In 1248 H. (A. D. 1831) Déra Gházee Khan, and all the lands on that side of the river cultivated by the Buhawulpoor government, whether rentcd or rceeived in free gift, were taken by Maharaja Runjeet Singh into his own hands.

List of Soobahdars of Mooltan.

A. H. 1135, (A. D. 1722).—Hyát oollah Khan, (Shah-nuwáz Khan,) son of Zukureeah Khan,* was appointed by Wuzeer Kumur-ood-deen Khan. In 1152, accompanied Nadir Shah to Sindh, and received the title of Shah-nuwáz Khan.

In 1159, having thrown off his allegiance to the Wuzeer, Maharaja Koura Mull was appointed. The Nuwab was killed outside of Mooltan.

A. H. 1159, (A. D. 1746).—Koura Mull (Maharaja) (Khutree, Tribe Zóod).—Obtained the appointment through Moćen-ood-dowlah, son of Wuzeer Kumur-ood-deen.

The Maharaja generally lived at Lahore. Was killed in battle with Ahmed Shah Badshah.

A. H. 1160, (A. D. 1767).—Ali Mohummud Khan, Khákwánee—(Nuwab.)—Appointed by Ahmed Shah. He ill-treated Shooja Khan Suddozye, and the Badshah, on his return from Hindoostan, hearing the circumstances, put to death him and his son.

A. H. 1182 (A. D. 1768).—Shooja Khan, Suddozye—(Nuwab.)—Was displaced, having displeased Tymoor Shah.

A. H. 1186, (A. D. 1772).—Hajee Shereef Khan, Suddozye—(Nuwab.)—Removed after six months.

A. H. 1186, (A. D. 1772).—Mirza Shereef Beg Moghul, (Názim,) and Dhurm Dás.—They disagreed and Dhurm Dás was killed. Mirza Shereef secretly invited Chundra Singh and Gunda Singh, and the Sikhs came into power.

A. H. 1187, (A. D. 1773).—Sirdars Chunda Singh and Gunda Singh—(Malik)—were expelled by Timor Shah, who appointed Nuwab Moozuffur Khan to be Soobahdar.

A. H. 1193, (A. D. 1779).—Nuwab Mozuffur Khan—(Nuwab.)—Maharaja Runjeet Singh attacked Mooltan. The Nuwab was killed, and Lala Sookh Dyal appointed.

A. H. 1232, and A. H. 1873 V. (A. D. 1816).—Sookh Dyal—(Soobahdar.)—Deficient in his remittances. Was imprisoned and displaced.

A. H. 1876 V. (A. D. 1819).—Sham Singh, Kashmeeree—(Kardar.)—Imprisoned and deposed after six months.

* Zukureeah Khan, governor of Lahore at the time of Nadir Shah's invasion.

A. H. 1876 V. (A. D. 1819).—Budun, Huzáree—(Kardar.)—Failed in his accounts. Confined and removed.

A. H. 1878 V. (A. D. 1821).—Dewán Sawun Mull—(Nazim.)—Ruled well from the day of his appointment. Was shot by a robber in the month Kartik 1901, and was succeeded by his son Deewan Moolráj.

A. H. 1901 V. (A. D. 1844) Dewan Moolráj—(Nazim.)

Miscellaneous.

Extract of a letter from Dr. Campbell, *to the Hon'ble the* President, *Asiatic Society.*

I am sure that the members of the Asiatic Society will be greatly interested to learn something of the travels and proceedings in the Eastern Himalaya of our distinguished Honorary Member Dr. J. D. Hooker.

He started from Darjeeling on the 27th of last month, fully equipped and attended, for a trip to the Kanglachema pass of the snowy range: and with the purpose of returning by the western shoulder of Kunchinginga and Jongei to Darjeeling.

Circumstances prevented his commencing his journey through Sikim, the direct route. He was therefore very fortunate in being able to go through the Nipal territory, and is now journeying in a portion of that kingdom which has never before been trodden by any European traveller.

For the first week he was subjected to much annoyance from the quarrels and desertions of his Bhotia coolies, and other numerous mishaps inseparable from new venturers in new lands; but a light heart and enthusiastic spirit are matches for all the ills that travelling flesh is heir to, and so it has been with him. On the 4th, but after making seven journeys of a distance that might have been got over in 3, but for the above disasters, he was on the top of Nangbi—say 14 miles W. of Darjeeling, at an elevation of 10,000 feet above the sea, and the temperature at daylight down to 21° of Faht. This was a trial for his followers, which the lightly-clothed and chicken-hearted portion of them could not stand against: and after relieving him of some of his stores about a dozen of them left him to his fate without their assistance.

This compelled him to make more exertion for the purpose of getting into the road from Harngachy to Walloongchoong, and on the 9th he was at Sakiagong, on a tributary of the Konke river, and ready to move northwards for the snowy range.

He was therefore at that date in a fair way to attain his object, for he says:—"I got a glorious round of angles yesterday, Phughloot, Nangbi, &c. which will do well to fix my position. This is a lovely country, and I am enjoying myself vastly, have a few new plants, lots of observations, and we go north to-morrow."

I shall not fail to report progress as I get it. This is a most important and interesting expedition, worthy of Dr. Hooker's powers, and of it. It will give materials for maps, climatology, botany, &c. &c. for a portion of the Himalaya altogether unexplored and unknown.

Addendum on the Anatomy of Ailurus, by B. H. Hodgson, *Esq.*

I had scarcely despatched to you my description of the anatomy of Ailurus, deduced from two junior specimens, when my shooters killed a mature specimen in my own immediate vicinity, at an elevation of about 7300 feet. It proved to be a female, mature, but only just so, and was killed in a lofty tree. As this type is the sole representative of a family, and is one of the most anomalous of quadrupeds, I shall make no apology for troubling you with a few additional remarks on its anatomy, not however needlessly reiterating what has been already noted, and is free from doubt.

Ailurus fulvens? A female mature but not at all aged, $20\frac{1}{2}$ inches from snout to vent. Has the deep ochreous red of the superior surface of the body, tipt largely with aureous; whence, and from the presently to be noted anatomical differences, I conjecture it may be fulvens and not ochraceus. Teats 8. No anal glands or pores. Lungs with 3 main divisions, about equal, and each composed of one large and one small lobe, 6 lobes in all. Liver also with a primary triple division; its right lobe largest and almost equally bifid; its left lobe next in size and also bifid, but less equally; its central lobe, smallest of all and trifid. Consequently 7 lobes in all. Gall-bladder empty, collapsed, a long ellipse, $1\frac{3}{8}$ inch long by $\frac{3}{4}$ inch wide, very freely suspended in the cleft of the central lobe of the liver. Its duct, large and distinct, 2

inches long, enters the intestine about that distance below the accessory stomach. Pancreas 2 inches by 1, parallelogramic, with the angles rounded off, its lower margin closely attached to the intestine, and throwing off a small short duct which discharges the pancreatic juice into the gut about $\frac{1}{2}$ inch above the opening of biliary duct. Spleen 5 inches by less 1, shaped like a manis' tongue. Kidneys $1\frac{1}{4}$ inch by $\frac{3}{4}$, and *not* lobulated internally as in the juniors. Uterus with very long horns, each $2\frac{1}{4}$ inch in length, and small round dark ovaries, each $\frac{3}{4}$ inch in diameter. Bladder $2\frac{1}{4}$ inch, empty and collapsed. Intestines $8\frac{1}{2}$ feet long, wide, gradually lessening in width from above downwards from plus $\frac{7}{8}$ inch to minus $\frac{5}{8}$ inch, excepting the last half foot which is 1 inch wide. This last named portion of the intestines has its coats remarkably thickened and furnished internally with longitudinal bands. Elsewhere the intestinal canal shows no trace of bands or other processes. Stomach empty and collapsed, $8\frac{1}{2}$ inches along its greater, and $2\frac{1}{2}$ along its lesser, arch, exclusive of the accessory stomach, which is 3 inches long and $1\frac{1}{8}$ inch wide. The true stomach is a hemisphere in shape and is membranous, with thin equable coats and no internal bands or folds. The accessory stomach is very thick and firm coated, elastic, between muscle and gland, and has its inner surface marked with strong longitudinal bands. The orifices of the true stomach are quite terminal, and the false stomach commences at the pyloric or lower end of the true one.

Teeth $\frac{6}{6}\cdot\frac{1\cdot1}{1\cdot1}\cdot\frac{5\cdot5}{6\cdot6}$, the deciduous premolars of the lower jaw being forthcoming. Crowns of the molars *not* flattened, *nor* showing any crusta petrosa, as was the case in the two very perfect but older specimens from which my original description was taken. The crowns in this sample are covered with enamel and furnished with numerous conic tubercles, sufficiently salient but blunt. Cervical vertebræ 7, dorsal 14, lumbar 6, sacral 3, caudal 18, all very satisfactorily ascertained, and again compared with the skeleton of the juniors which shows beyond a doubt 15 dorsals and 5 lumbars. Ribs 14, whereof 8 are true and 6 false. Sternal bones 7, cylindric. Forward process of the keel of the scapula not cylindric as in the juniors, but flattened and having a subordinate process arising from its base. These may be the acromion and coracoid. At all events there are no other processes answering thereto. Considering the very free action of the arm in Ailurus it is

remarkable that the former process infringes considerably on the field of rotation of the humerus. There is not the least trace of a clavicle or pseudo clavicle. This I have very carefully ascertained. Lastly, it should be noted that the ribs are not much bulged, contrary to what was remarked in the juniors; and that the ossa pubis and the sacral vertibræ are, each of them, osseously united, as usual, the opposite characters of the precedent skeletons thus proving (as anticipated) the effects of nonage merely.

In comparing the above details with those priorly given one cannot but note with surprise the remarkable disparities of the teeth and of the spinal vertebræ. My former description of the teeth was taken from two very fine skulls which showed no signs of decay, though it would now appear that they must have belonged to aged subjects, the crowns of whose molars had been worn down greatly by use. *That very use, however, must have been a grinding or triturant one;* and, singularly as the character of the molars is now altered, the sheer fact of wearing in such mode and degree seems to demonstrate that extreme lateral action of the jaws for which I contended, but with which it is not so easy to reconcile the style of the dentition exhibited in the present subject.* What is the normal state of the teeth? and how can we be justified in regarding that state of them as *ab*normal which is found in lusty and vigorous specimens of the animal? The intestinal canal of the present sample is 5 lengths, as before, not so remarkable, however, for width, but more so for the very singular and almost identical modification it undergoes at either extremity. It would seem as if both these peculiarly structured parts of the intestines should be regarded as quasi stomachs, and their effect in harmonising the alimentary canal with the dentition (whatever its normal character) must be material. The variation in the number of the dorsal and lumbar vertebræ is another remarkable peculiarity of Ailurus, as to which however I will only add that the fact is unquestionable, having been carefully and repeatedly seen to. As already hinted, it may be a mark of species.

* The salient processes of the crowns of the molars are more marked than in Ursus: yet the relative narrowness of the lower jaw continues as noticeable as in prior specimens, so that any efficient action of the teeth must be by movements of the jaw, essentially lateral, notwithstanding the deep cylindric hinging!

Letter from Dr. Campbell, *on the Elevation of Peaks in the Himalaya, &c.*

To the Secretaries Asiatic Society, Calcutta.

Gentlemen,—I am enabled, by the kindness of Colonel Waugh, the Surveyor General of India, to furnish the Society with the following results of the operations of the Great Trigonometrical Survey in this part of the Himalaya in 1847.

I have also the pleasure to forward a small and beautifully executed Chart of a portion of the Survey, received from Colonel Waugh some months ago.

It was sent to me after the publication in the Society's Journal of my Itinerary to Phari, to illustrate Colonel Waugh's views regarding the position of the celebrated "Chumalari" and of the "Chola" mountain of that Itinerary. When Colonel Waugh left this place in November last, after having satisfied himself in the course of his previous operations of the position of "Chumalari," by observations from Tonglo and Sinchal, I took some Lepchas and Bhotiahs who had travelled into Thibet by the Phari route, with me to the top of Sinchal, to point out Chumalari to them; as they were positive in stating their belief that it was not visible from any part of this neighbourhood, when I said "there is Chumalari," the whole party exclaimed—"No, it is Chola, and not Chumalari." I took pains to ascertain the reasons of their dissent, and afterwards wrote an epitome of them to Colonel Waugh, who thanked me for doing so, said he would file my note with the other documents, and while adhering to his former opinion said, as far as I recollect—"but you may rely upon it that I shall not finally decide the point until you are satisfied that I am right." Thus the matter rested until Colonel Waugh got a copy of my Itinerary to Phari, from the Journal for April last, when he informed me that the delay with respect to the results of the Darjeeling Trigonometrical operations, although greater than he had anticipated, could not then be considered a matter of regret, as it had put him in possession of evidence to prove the identity of his mountain with the great Chumalari of Thibet. "The evidence alluded to," he said, "is contained in your paper published in the Asiatic Society's Journal for April 1848. This valuable contribution to conjectural Geography, has arrived in good time

to be of service to precise Geography, and I am exceedingly obliged to you for the information it contains." He then very clearly and fully argued the whole question, and concluded by saying that the well-timed publication of the Phari Itinerary had enabled him to substantiate that the Peak seen from Sinchal is Chumalari, at the same time he satisfied himself that the "Chola" of that Itinerary is the "Chumanko" of his Survey. On these two points I am alike satisfied, and am very glad indeed that in communicating the dissent of my hill people from the conclusions of Colonel Waugh, I was the means of so soon shewing the triumphs of accurate science over the obstinacy of local ignorance. This is the history of the Chart now forwarded: and I doubt not that the Society will be glad to possess so correct a delineation of these exquisitively accurate observations, pending Colonel Waugh's own publication of the results of his important operations in this quarter. I have arranged the results of the Survey which most interest me under three heads.

1*st.*—*Elevations at and near Darjeeling.*

Darjeeling Hill above the sea,	7165
Jilla Pahar—highest point,	7452
Rockville,	7134
Birch Hill,	6880.8
Dr. Campbell's House,	6966
Bryn Gwyn (Major Crommelin's),	6734.9
Lebong, (Mr. Grant's house),	6039.3
Sinchal—highest point,	8606.7

2*nd.*—*Elevations in Sikim—Sub-Himalaya.*

Tendong—called Ararat,	8662.8
Tougloo,	10079.4
Singalela,	12329.2

3*rd.*—*Elevations of Peaks in the Himalayan Range, seen from Darjeeling.*

1 Kunchinginga, West Peak,*	28,176.6

* This is, I believe, the highest spot on the surface of the globe. Distance from Darjeeling 45 miles. Elevation of the stations on the plains in the Chaet:—"Bundurjoola, 246 feet. Thakoogunj (summit of tower) 267.3; Doom Dangi (Do.) 312.8. These three stations are in the district of Purneah.

A. Campbell.

2	Ditto, East Peak, ...	27,825.9
3	Junnoo, ...	25,311.5
4	Kabroo, ...	24,004.5
5	Powhunry, ...	23,175.5
6	D. 2, ...	22,581.9
7	Pundeem, ...	22,015
8	D. 3, ...	19,242.10
9	Black Rock, ...	17,556.9
10	Nursing, ...	19,139.2
11	Chola, ...	17,319.5
12	Gipmoochi, ...	14,509.2

Thibetan Mountain.

Chumalari, ...		23,929.2

Your's truly,

A. Campbell, *M. D.*

Darjeeling, Nov. 23rd, 1848.

Extract of a letter from Lieut. R. Strachey, Engineers, (communicated by the Hon'ble Mr. Thomason.)

I just write a few words to let you know that we have come back from Tibet. We returned here yesterday, having got along without any difficulty any where. We left this on the 2nd, as I before wrote to you, and got over all the passes on the 7th into the "table-land." We halted the 8th, and on the 9th got to the Sutlej, some miles below Kyunghing. Thence we returned back towards the southern edge of Rakas Tal, reaching Gyanima, or Nimakhan, on the 12th. On the 14th we got within sight of Rakas Tal,and encamped near its southern shore. On the 15th we went on towards Manasarowar, which we reached on the 16th, encamping about a mile or so below Tu-Gamba, the monastery at the effluent from the Lake; we went up to look at the outlet, which was quite unmistakable. The opening is in an elevated beach, and might perhaps be overlooked when the lake was low. The beach of which I talk is rather curious, being evidently the effect of the waves of the lake, and raised perhaps 6 or 8 feet above the level of the water on one side, and of the low ground outside the beach on the other. These beaches are common to both lakes, and are, I suppose, the result of the

frightful winds that blow there, of whieh we had most freezing examples. I never felt any thing like the wind (exeepting at sea) either for cold or intensity; it was absolutely frightful. On the 17th we returned from Manasarowar; on the 19th, we crossed over into the valley of the Karnali, up whieh we came, passing Lama Choktan on the 23rd, and arrived at the foot of the passes at Chirehun on the 24th. The next day we came over the passes, three in number, of whieh Unta Dhura is the lowest. The highest ridge erossed will probably be upwards of 18,500 feet above the sea.

From the accident to my barometer, I ean't give even any approximation to heights yet—i. e. until I make comparisons with the barometers left here, which I hope to do in a day or so.

The main results of our visit to Tibet are to see that the plains are very evidently produced by Lakes or Sea. The great mass of them being perfect gravel to a depth of 800 or 1000 feet, to whieh extent the great ravines eut into them.

The part of the eountry towards the long lake of Gyanima, seems to have been much more reeently under water than the other, and in faet appears to be in many places even now imperfectly drained and subjeet to flood. The whole of the eountry from the lake of Gyanima to Rakas Tal, and along almost the whole of the southern edge of the latter, is a great eruption of volcanie roek, and the bar between the lakes is probably also eaused by this trap eruption, as it consists of gravel (exaetly such as now exists *in* the lakes) to a height of 6 or 800 feet above the present level of the water.

With some difficulty I got an observation of the elevations of Kylas and Gurla, from which I hope to get a decent approximation to their height. The dreadful wind almost stopped me altogether—blew away both ends of the tape used for measuring a base for me to work upon, and prevented any thing like real accuracy.

The valley of the Karnálá, Pruang, &e. is also eertainly part of the same great deposit of gravel as the rest of the plain to the westward.

The eountry generally is more hilly than I had anticipated. The plain more flat, in fact perfeetly so, with hills rising abruptly from it. The plain seems to run along the northern foot of the Himalaya, the Sutlej apparently having hills along its southern bank all down its course as far as we saw.

We found none of the recent fossils of large animals, of which I have got indifferent specimens from Bhotias which I had hoped to see. They seem to come from more to the westward. An almost unlimited supply of fossil shells may however be got on the passes into Tibet, and some specimens I have got from 18,000 feet at least, probably higher up.

In the latter part of our trip the thermometer has been as low as 15 or 16° at sunrise—but it became rapidly colder at last, and we before suffered more from the violence of the sun than from cold.

Tibetan Type of Mankind.

To the Secretaries of the Asiatic Society of Bengal.

Gentlemen,—The accompanying remarks upon a series of human skulls, collected by me in the valley of Nepál, and forming part of the general osteological* collection made in the sub-Himalayas and deposited in the British Museum, are from the pen of the celebrated author of the Physical History of Mankind. The novelty and the importance of accurate ethnological research in India, together with the eminent qualifications of the commentator on these materials, will, I fancy, readily induce the Society to give a place in its Journal to Dr. Prichard's observations, hereto subjoined. Symbhúnáth and Sankmúl are places of interment or cremation in the valley of Nepál, and there the skulls were procured: Dr. Prichard rightly conceived that the skull No. 8 is a typical Tibetan, and the skull No. 4, a normal Néwár, one; and it is very satisfactory to me to find this gentleman's estimate of the physical character of these races as deduced from the crania so perfectly correspondent with that deduced by myself from the living subjects.

I am, Gentlemen, &c.

B. H. Hodgson.

Darjeeling, November, 1848.

* A recent letter from Mr. Gray, the Curator of the British Museum, acquaints me that this collection, the first of the sort ever deposited there, has proved the nucleus of an osteological collection in the great national Institute of England, which already rivals that of any Museum in the world, save the French one, in the single department of Fishes.

Extract of a letter from Dr. Prichard,

dated, London, August 11th, 1848.

"I am much interested in your researches, and as you requested, I went on the first favourable opportunity to the British Museum and carefully examined your skulls; I enclose the description of them. The impression I derived for the examination is that the Tibetans have the heads of the Chinese, Tartar or Mongolian type, but that the type is not quite constant among them—some of the Bhotia* skulls have very little characteristic difference from Europeans. I suppose No. 8, may be considered as typical, and the rest as deviating from it. No. 8 is a strongly marked Tartar or Turánian head.

The Néwárs† appear to have this type very much softened down, in every particular approximating to the European type. I take No. 4 to be typical of the Néwárs. It is the most unlike an European, and the most like the Bhotia No. 8, but in every respect less barbarian and less like a Mongol.

The collection is a very valuable one."

Skull marked No. 8, ticketed as that of a Hillman, probably a Cachár Bhotia, procured at Symbhúnáth.

Description.—Skull large, apparently that of a tall and large man, not particularly heavy. Vertex high.—General aspect like that of a Chinese skull.

Front view.—Face broad and flat, particularly in the plane of the cheek bones. Zygomatic arches large and prominent forwards and outwards. Outer corner not rounded off as in the skulls of Esquimaux, but angular. Nasal bones flat—hence the breadth and flatness of the face.

Mouth rather prominent, the upper jaw being prognathous, and the lower jaw large. Supra-orbital ridges rather strongly marked. The outer part of the upper orbital edge, above outer angle of the eye, thick and prominent.

* Bhotia is equivalent to Tibetan; Bhót being the Hindu, and Tibet the Moslem, name of the country. My skulls belonged mostly to Cisnivean or Kachár Bhotias.

† The Néwárs are the people of Nepal proper, or the great Valley.—B. H. H.

Vertical view.—Head oval (seen above) : oval figure rather long, viz. the longitudinal diameter is long in proportion to the transverse. The oval figure narrower in the anterior than in the posterior part. Occiput protuberant (not truncated as Retzius thinks it is in the Tartar races), vertical ridge or crest, strongly marked.

Basis of the Skull.—Basis broad (as the basis of the Esquimaux skull in the plate of 4 basis in my Researches into Physical History, vol. 1.)

Zygomatic areas (meaning the nearly oval spaces in the view of basis cranii, which are enclosed externally by the Zygomatic arches) large and open as in the figure of the Esquimaux skull above mentioned, but not so oval in shape, the anterior part being more square and angular. Foramen occipitale small.

No. 10, Cachár Bhotia—Symbhúnáth.—Skull a good deal like No. 8, but not so flat-faced. Maxilla superior, prognathous.—Alveolar process round, not so square as in No. 8. Nasal bones not so flat, but face broad in the plane of the cheek bones.—Margins of the orbits thick and prominent, both above and below the orbital cavity.

Basis.—Zygomatic areas large, open, square and angular *anteriorly*. This is the most characteristic trait, and gives rise to the breadth of the face.

No. 2.—Hillman—Bhotia—Symbhúnáth.—Vertical section of the head (vertical figure) of an oval form. Face not broad or flat. Nasal bones prominent. Orbits square. Forehead high and well formed, having the prominences which Gall calls *organs of comparison* well developed. Whole form of skull approaching the European type, and wanting all Chinese and Mongolian characters, except one, viz., the cheek bones are square and angular, and the zygomatic areas in the basis cranii, large and square anteriorly.

No. 4.—Hillman, probably Néwár, procured at Sankmol.

Head large, nearly of the same size as No. 8, and in general shape resembling it, only with all its peculiarities softened.

Cheek bones rounder, not so square and angular. Zygomatic arches not nearly so large. Zygomatic areas viewed in the basis cranii, not nearly so large and open.

Nasal bones much more prominent. Face not nearly so wide and flat. Upper jaw equally prognathous, but the alveolar process not so

square, straight, or broad, anteriorly—more rounded. Head oval—Occiput prominent. Scarcely any vertical ridge or crest.

N. B. All the characters seem to be much softened and approaching the European type, as compared with the Bhotia heads.

No. 7.—Hillman, probably Néwár, procured at Sankmol.

Face not so broad and flat as the Bhotia No. 8, more rounded and prominent in the profile. Head rounded with longitudinal diameter shorter.

Differences from European type as follows—Cheek bones a little more prominent laterally.

Zygomatic areas, seen in the basis cranii, much larger and more open than in an European, and square anteriorly like those of the Bhotia No. 8.

Upper maxilla somewhat prognathous.

No. 16.—Man of the Néwár tribe and Bandya division. Like No. 4 but more European. Face not flat. Cheek bones not laterally projecting—Alveolar process of the upper jaw prominent—Vertical ridge strongly marked, Zygomatic areas and orbital cavities like European.

Lower jaw small.

No. 15.—Another Néwár Bandya.

Head round, oval, with longitudinal diameter short.

Face rather broad and flat, but not so much so as in the Bhotia No. 8. Nasal bones more elevated.

N. B. The chief characters different from the European type are in the shape and size of the zygomatic arches viewed in the basis cranii. Areas more open and their anterior edge angular and square.

No. 20.—Skull from the plains, near the Ganges. Head nearly European; a bad European head.

(Signed) J. C. Prichard.

Notes on the Eastern Desert of Egypt, from Gebel Afrit, by the ancient Porphyry quarries of Gebel Dukhan, near to the old station of Gebel Gir ; with a brief account of the ruins at Gebel Dukhan, by Hekekyan Bey.—*(Communicated by Capt.* Newbold.)

These rough but interesting notes, on a part of Egypt so seldom visited by travellers as its Eastern Desert, were written by my friend, the Bey, in English ; and I have adhered as closely as possible to the original, with but trifling alteration. The notes would have been more valuable had a map been laid down of the route, with a list of bearings and distanees, and more detailed observations on the general nature of the country traversed. The porphyry quarries of *Gebel Dukhán*, (Mons Porphyritis) are probably eoeval with the celebrated breceia quarries of *Wádi Keneh*, and worked in the time of the first Osirtasen, the supposed Pharoah, who ruled over Egypt in the time of Joseph. The beautifully coloured porphyries, green, purple, and red, and much of the basalt used in aneient Egyptian seulpture, were derived in great measure from *Gebel Dukhán*, and its vieinity ; whenee they were probably conveyed to Coptos on the Nile, and thenee easily distributed to various parts of Egypt. The *Wádi* from *Gebel Dukhán* to *Keneh*, the aneient Koinipolis, a little N. of Coptos, is to this day ealled the *Sikket el Arabíyeh*, the high-road of the Carts.

It is not very elear why the Arabs should give the name *Dukhán* دخان, which literally signifies smoke, to this mountain. We have no evidenee of any voleanie eruptive aetivity within the historic period. It has probably got the name from its colour, partieularly when viewed from a distance under a deep blue sky, or from the smoke of the town and huts of the workmen.

The remains of the inscription eopied by the Bey from the frieze of the temple near *Gebel Dukhán*, bear the name of the emperor Adrian, with the surname of Trajan, whose son by adoption he was. The temple is dedieated to Sarapis the great, [with his titles of Pluto and the Sun, ΔΙΙ ΗΛΙΩΙ ΜΕΓΑΛΩΙ ΣΑΡΑΠΙΔΙ] and to the other gods in the same temple. Small temples to Sarapis are very common in the vieinity of mines and quarries. As Pluto he is supposed to preside over demons and the evil genii, who the orientals imagine, watch over the treasures of

the earth. *Gebel Dukhán* lies in about latitude N. 27° 16′ and longitude E. 33°. There is an ancient road leading from it to Myos Hormus, an old port on the Red Sea, from which it is distant about 32 miles as the crow flies.

Hekekyan Bey's Journal.

April 17th, 1844.—Sandstone is the prevalent rock for the first half hour, succeeded by granite, gneiss, black and red basalt, to *Wádi Keneh*.

April 18th.—Granite and porphyry were the prevalent rocks during this, and the two following days' march.

April 21st.—Granite and basalt. The road from *Dukhán* to Keneh is called the *Sikket el Arabíyeh* (the road of the chariots) to this day. There are the foundations of a station at *Wádi Billi*.

April 22nd.—Up Wádi úm Yesúr, granite and basalt.

April 23rd.—Fort of *Gebel Dukhán*. Here is a temple of white-spotted granite with four Ionic columns; the altar still standing in its original place. On the frieze is a Greek inscription of which the following is a copy :—

ΥΠΕΡ ΣΩΤΗΡΙΑΣ ΚΑΙ ΑΙΩΝΙΟΥ ΝΙΚΗΣ ΤΟΥ ΚΥΡΙΟΥ ΗΜΩΝ ΑΥΤΟΚΡΑΤΟΡΟΣ ΚΑΙΣΑΡΟΣ ΤΡΑΙΑΝΟΥ ΣΕΒΑΣΤΟΥ ΚΑΙ ΤΟΥ ΠΑΝΤΟΣ ΑΥΤΟΥ ΟΙΚΟΥ ΔΙΙ ΗΛΙΩΙ ΜΕΓΑΛΩΙ ΣΑΡΑΠΙΔΙ ΚΑΙ ΤΟΙΣ ΣΥΝΝΑΟΙΣ ΘΕΟΙΣ ΤΟΝ ΝΑΟΝ ΙΚΑΙ ΤΑ ΠΕΡΙ ΤΟΝ ΝΑΟΝ ΕΠΑ ΡΟΙΤΟΣ ΚΑΙΣΑΡΟΣ ΕΓΗΡΙΑΝΟΣ ΕΠΙΡΑΝΝΙΩ ΜΑΡΤΙΑΛΙ ΕΠΑΡΧΩ ΑΕΥΙΡΤΟΥ ΜΑΡΚΟΥ ΟΥΛΠΙΟΥ ΧΡΗΣΙΜΟΥ ΕΠΙΤΡΟΠΕΥΟΝΤΟΣ ΤΩΝ ΜΕΤΑΛΛΩΝ ΕΠΙ Π ΠΡΟΚΟΥΛΗΙΑΝΟΥ.

Above the *Nakúbah*, on the left side of the valley, is a *Tellaah*, up which there is a well of sweet water, probably a spring. The *Tellaah* contains green plants. The *Nakúbah* below it is composed of some ten tortuously branched spreading trees, giving an agreeable shade. There is a well close by them, and ruins adjoining, whose remains indicate the site of a regularly laid out plan of buildings, and show that water must formerly have abounded here, and that gardens were kept up.

The *Wádi* here expands into an amphitheatre. The clear purple cross of Gebel Dukhán (W. by N. W.) under a dark blue sky, crown the more sombre and gloomy mountains of porphyry, amidst which the *Wádi* serpentines. Tufted shrubs and plants of every shade of

* αιγυπτου ?

green, each with its blossom of varied colours, grow among the masses of purple, green, red, and black porphyries, under shady archways formed by the bending branches, and foliage of the *Nebkh*,* whose fruit was as yet green.

We took water of the *Maitha*, and, debouching out of the valley, struck down into *Wádi Billi*, and ascended it as far as the *Silloa*, when we halted. This part of Wádi Billi is full of Persica and Seyaleh, (Acacia seyaleh), and numerous kinds of plants; the Arabs say that the lower part of the Wádi contains *forests* of *Seyaleh*. The inferior granites here are more friable, and whiter; they have rounded surfaces and summits,† and are free from dykes of felspar. The upper granites on the contrary are more rugged and perpendicular as the height increases.

There are in Wádi Billi signal-posts, mile-stones, guard-houses, forts, wells and stations. Near *Ain Abu Markhah* are quarries, and traces of buildings, *Sakiyas*,‡gardens, a citadel, magazines, brothels, sacred groves, temples, priest's residence, baths, forum, villages, grottos, pottery, green sarcophagus, troughs, blocks of green, purple porphyry, and of black grey-veined breccia. Many Tarantulas (Abu *Shebbath)*.§

Wádi Guttar runs in the direction of the crags of *Gebel Dukhán*, but after passing the well in the middle of the *Wádi* it sweeps southerly towards *Gebel Altarásh*, runs into *Wádi Keneh*, receiving along its course *Wádi's Altarásh*, *Gerzoo*, *Kohel*, and others.

The well station in the middle of *Wádi Guttar* below the *Mazra*, is 150 feet square; it contains the remains of buildings, with strong walls, and there are the remains of buildings, stables and out-houses outside. A dyke with walls 6 feet thick runs across the *Wádi*, probably to retain the water for cultivation.

April 26th.—Left for Keneh, and reached *Tellaat el Um Gesher*, on the summit of which we found rain-water. Here is a Roman station of unburnt brick, with an area of a fort with towers at the angles (bears S. S. W. by S. from *Gebel Dúkhán*.) A large gateway in the centre opens upon the valley. The enclosure, which is about 300 feet long by 200 feet, contains a saki, and a cistern of cement 20 feet by 15, now both filled with sand. Outside, towards the N. and close

* Nebkh, Rhamnus nabeca. T. N.

† Probably felspathic gneiss. T. N.

‡ A watering place, a canal. T. N.

§ *Lit.* Father of the Spiders. T. N.

to the cistern, are the traces of an extensive village, apparently regularly laid out. This and the body of the place, and its interior buildings, are of blocks of dark green felspar, serpentine, &c. from the neigh, bouring mountains. Fragments of silicified nummulitic limestone, porphyries, granite, and pottery are scattered about.

April 27th.—In $\frac{3}{4}$th of an hour we emerged from the *Múkhayeneh*, and left the granite behind. We now crossed a vast *Farsh*,* even and hard as if Macadamized. We were four hours in crossing it to Gebel *Gír*. The *Farsh* is called *Gaá*† *Tiúr*. The old station of *Gebel Gír* stands on a hill. Here are the remains of a reservoir and a lake 300 feet in diameter and 20 feet deep. They are now filled up almost, and plants grow at the bottom. There are the remains also of several cisterns and three aqueducts all dry. Attached to the station in the valley are the traces of regularly laid out stables and lodgings built of limestone, and two excavations; the smaller of which is near the N. of the outer station: the excavated matter is thrown out in the form of a dyke.

The formation is of argillaceous sandstone, in alternate layers, with carboniferous plastic clays; under which are the ferruginous clays and sandstones.

Immediately over them is the silicious limestone, capped by nummulitic limestone. The argillaceous sandstone contains layers of shales, bivalves, &c.

* Fersh فرش, signifies a wide field or plain, also a bed, spread out. T. N.

† قاع طيور more properly the G of Gáa should be the guttural káf. T. N.

PROCEEDINGS

OF THE

ASIATIC SOCIETY OF BENGAL,

FOR NOVEMBER, 1848.

The usual monthly meeting of the Society was held on the evening of Wednesday, the 1st Nov. 1848.

The Hon'ble Mr. Justice COLVILE, President, in the chair.

The accounts and vouchers for September and October were presented.

The following gentlemen having been duly proposed and seconded at the September meeting, were ballotted for and elected members of the Society :—

Capt. Pakenham, Body Guard.

Capt. Powel, Steamer 'Precursor.'

Capt. Banks, Assistant Sec'y to Govt. of India, Mily. Department.

Lieut. Stubbs, Bengal Artillery.

T. A. Anstruther, Esq. Madras C. S. was named as a candidate for ballot at next meeting, proposed by Walter Elliott, Esq. seconded by J. W. Laidlay, Esq.

The *Rev. J. Richards,* Chaplain, Madras Establishment, proposed by Rev. J. Long, seconded by Rev. Mr. Keane.

Notes were received from the following members, requesting their names to be withdrawn :—

W. Storm, Esq. Calcutta.

W. Thornhill, Esq. Nainee Tál.

Read letters—

From G. A. Bushby, Esq. Sec'y. to Government of India, forwarding for deposit in the Society's Museum, 30 pieces of ancient sculpture collected by Capt. Kittoe.

From the Hon'ble Mr. Thomason, enclosing extract of a letter from Lieut. R. Strachey, Engineers, announcing his return from the lake Manasarowar.

From the Academy of Natural Sciences, Philadelphia, returning thanks for the Society's gift of 28 volumes of Oriental works, published by the Society.

From Lieut. Col. Goodwyn, Engineers, communicating a paper, with plates, on Taper Chain Suspension Bridges.

From Col. Low, giving cover to copy of inscription, and announcing despatch of a further portion of the Singapore rock inscription.

From Rev. Mr. Mason, sending a notice and drawing of a Tenasserim Pine.

From Captain Hutton, a second article on the nidification of Indian Birds.

From Captain Newbold, forwarding notes by His Highness Hekekyan Bey, Honorary Member of the Asiatic Society, on his visit to the Porphyry quarries of Gebel Dukhan.

From Dr. Hooker, Honorary Member of the Asiatic Society, (communicated by the President,) a narrative of his visit to Parusnath, Rotas and the table-land of Behar.

From H. M. Smith, Esq. communicated by Capt. Sanders, giving an account of the supposed efficacy of the leaves of Aristolochia Indica in the treatment of a case of snake bite.

From the Editor of the "Revue des deux Mondes," Paris, soliciting contributions of papers for that Journal.

Resolved, that the Society subscribe for a copy of the *Revue.*

From the Librarian, proposing a reduction in the scale of prices of the Oriental publications of the Society.

Referred to Oriental Section.

From H. M. Elliot, Esq. presenting for the Library a copy of la Mezeraye's History of France, and for the Museum an Egyptian vase taken from a Mummy case.

Dr. O'Shaughnessy presented a copy of Mr. Laidlay's version of, and Notes on the Pilgrimage of Fa Hian, and proposed the following resolution, which was seconded by Mr. Heatley, and unanimously adopted:—

That Mr. Laidlay's version of the travels of Fa Hian be forwarded to the Oriental Section for their examination and report, and with the suggestion that it appears highly deserving of adoption by the Society.

An apology was read from Mr. Piddington, for his absence on ac-

count of illness, and Mr. Blyth made his usual monthly report on the Zoological Department.

Library.

The following books have been added to the Library since the last meeting.

Presented.

Histoire de France, par François de Mezeraye. Paris, 1643; 3 volumes folio.—By H. M. Elliot, Esq.

Prosodie des langues de l'Orient Musulman, specialement de l'Arabic, du Persan, du Turc et de l'Hindustani; par M. Garcin de Tassy, Paris, 1848, 8vo.—By the Author.

The Report of the British Association for the advancement of Science, for 1847, London, 1848, 8vo.—By the Association.

The Journal of the Indian Archipelago, for Augt. and Sept. 1848, (two copies.)—By the Bengal Government.

Ditto ditto for Sept. 1848.—By the Editor.

The whole works of the most Rev. James Usher, D. D., Vol. XV.—By the Board and Fellows of Trinity College, Dublin.

The Journal of the Royal Geographical Society of London, Vol. XVIII. part I.—By the Society.

The Calcutta Christian Observer, for Oct. 1848.—By the Editors.

The Oriental Christian Spectator, Vol. IX. No. 9.—By the Editor.

The Oriental Baptist, Nos. 22, 23.—By the Editor.

Meteorological Rigister kept at the Surveyor General's Office, Calcutta, for the months of Augt. and Sept. 1848.—By the Deputy Surveyor General.

Statistics of Sugar produced within the Presidencies of Bengal, Fort St. George, and Bombay. Calcutta, 1848. (Pamphlet).—By the Government of Bengal.

Plans of the Captured Sikh Trophies, Folio.—By the Military Board.

Inscriptions on the Captured Sikh Trophies, 4to.—By the Same.

Proceedings of the Twenty-fifth Anniversary Meeting of the Royal Asiatic Society, (Pamphlet).—By the Society.

Upadeshaka, Nos. 21, 22, 23.—By the Editor.

Tatwabodhiní Patricá, Nos. 62, 63.—By the Tatwabodhini Sobha.

Exchanged.

Journal Asiatique, No. 54.

Journal of the Agricultural and Horticultural Society, Vol. VI. Part III.

Jameson's Journal, No. 89.

The Athenæum, Nos. 1082—5.

Purchased.

Alison's History of Europe, Vols. XVIII. XIX. and XX.

Atlas to the above, 16 Nos.

The Kalpa Sútra, and Nava Tatwa: two works illustrative of the Jain Religion and Philosophy, translated from the Magadhi, by the Rev. J. Stevenson, London, 1848, 8vo.

The Edinburgh Review, No. 177.

The North British Review, No. 18.

The Annals and Ma gazine of Natural History, Nos. 7, 8.

The London, Edinburgh and Dublin Philosophical Magazine, No. 219.

Journal des Savants; April and July, 1848.

Comptes Rendu Hebdomadaires des Seances de l'Academie des Sciences, Nos. 21 and 25, Vol. XXVI. and Nos. 1 to 4, Vol. XXVII.

The Calcutta Review, No. XIX.

(A correct Report) W. B. O'Shaughnessy, *Secry.*

Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of Nov., 1848.

Lat. 22° 33′ 28″. 33 N. Long. 88° 23′ 42″. 84 East. Mag. Variation 2° 28′ 36″ East. Mag. Dip. 27° 45′.

Days of the Month.	Observations made at sunrise.						Maximum Pressure observed at 9h. 50m.						Observations made at apparent noon.						Observations made at 2h. 40m. p. m.						Minimum Pressure observed at 4 p. m.						Observations made at sunset.						Maximum and Minimum Thermometer.			Maximum Thermometer in sun's rays.	Rain Gauges. Elevations.		Moon's phases.	Days of the month.
	Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of Wet Bulb.	Wind. Direction at sunrise.	Aspect of the Sky.	Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of Wet Bulb.	Wind. Direction at 9h. 50m.	Aspect of the Sky.	Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of Wet Bulb.	Wind. Direction at noon.	Aspect of the Sky.	Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of Wet Bulb.	Wind. Direction at 2h. 40m. p. m.	Aspect of the Sky.	Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of Wet Bulb.	Wind. Direction at 4 p. m.	Aspect of the Sky.	Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of Wet Bulb.	Wind. Direction at sunset.	Aspect of the Sky.	Maximum.	Mean.	Minimum.	Maximum.	Feet. 40 Upper.	Feet. 4 Lower.		
	Inches	°	°	°			Inches	°	°	°			Inches	°	°	°			Inches	°	°	°			Inches	°	°	°			Inches	°	°	°			°	°	°	°	Inch.	Inch.		
1	29.976	74.8	75.4	72.5	N.N.W.	Cloudy.	30.014	79.3	79.4	75.4	N.N.W.	Cloudy.	29.961	83.9	82.5	76.6	N.N.W.	Cloudy.	29.911	84.5	83.9	74.3	N. N.W.	Cldy. Cir. cum.	29.893	84.0	83.3	75.2	N. N.W.	Cirro cumuli.	29.909	82.0	81.2	74.9	N. N.W.	Cirro cumuli.	85.0	80.1	75.2	105.8	..	..		1
2	.961	71.6	72.0	69.0	N. N. E.	Cirro cumuli.	.020	83.0	82.9	74.0	N. E.	Clear.	.974	87.4	86.4	74.7	N. E.	Cirro cumuli.	.913	89.0	87.2	73.3	N. N.W.	Cirri.	.912	88.0	85.7	72.6	N. N.W.	Clear.	.929	83.5	82 8	73.7	N. N.W.	Ditto.	89.3	80.7	72.0	112.6	..	..		2
3	.999	70.5	71.2	69.9	N. N.W.	Clear.	.033	83.8	83.2	73.0	E. S. E.	Ditto.	.987	88.0	86.5	73.8	N. E.	Clear.	.914	88.3	87.4	73.0	N. N. E.	Clear.	.907	87.3	85.5	72.3	N. N.W.	Ditto.	.920	83.3	82.1	71.9	N.	Clear.	89.7	80.4	71.0	113.4	..	..		3
4	.964	71.3	72.0	71.0	N.N.W.	Clear.	.007	83.4	83.0	72.6	N. W.	Ditto.	.955	86.3	85.5	73.2	N. .W.	Cumulo strati.	.891	86.8	85.4	73.0	N. N.W.	Cirro cumuli.	.889	84.8	82.2	72.8	N. W.	Cirro cumuli.	.891	82.4	82.2	72.8	N. N.W.	Cirro cumuli.	88.7	80.1	71.4	109.8	..	..	D	4
5S	.934	69.4	69.9	67.0	N. N. E.	Ditto.	29.982	82.0	81.9	70.4	N. N. E.	Ditto.	.942	85.3	84.4	70.9	N. N. W.	Clear.	.879	86.3	85.8	71.8	N. N.W.	Clear.	.878	85.3	83.7	70.1	N. N.W.	Clear.	.892	81.7	81.2	69.8	N. N.W.	Clear.	87.2	78.6	70.0	105.8	..	..		5
6	.964	70.3	70.8	67.0	N. N. E.	Ditto.	30.016	80.4	80.3	70.8	N.	Ditto.	.960	84.4	83.9	72.8	N.	Ditto.	.898	85.3	84.4	71.9	N. W.	Ditto.	.886	85.0	83.3	70.8	N. N.W.	Ditto.	.892	81.6	80.8	70.9	N. N.W.	Ditto.	86.8	78.8	70.8	105.9	..	..		6
7	.976	70.0	70.3	66.8	N.N.W.	Ditto.	.021	78.4	78.3	71.5	N. W.	Ditto.	.951	84.4	83.2	73 0	N. W.	Ditto.	.878	85.1	84.5	73.0	N. W.	Ditto.	.870	84.7	83.2	71.3	N. W.	Ditto.	.883	81.2	80.4	71.3	N. W.	Ditto.	86.2	78.2	70.2	106.0	..	..		7
8	.954	69.9	70.0	67.3	N.N.W.	Ditto.	.010	79.3	79.7	70.7	N.	Ditto.	.945	83.7	83.0	72.8	N. W.N	Ditto.	.857	86.2	85.3	72.7	N.	Ditto.	.847	84.2	82.8	70.5	N. W.	Ditto.	.858	80.9	80.0	70.9	N. W.	Ditto.	87.0	78.5	70.0	110.0	..	..		8
9	.930	66.4	66.8	65.4	N. W.	Ditto.	29.978	78.7	78.3	70.7	N. W.	Ditto.	.921	82.5	81.5	67.8	N. W.	Ditto.	.853	84.4	83.7	70.0	N.	Ditto.	.837	83.4	81.7	67.0	N.N.W.	Ditto.	.858	79.3	78.5	67.0	N.N.W.	Ditto.	85.3	76.2	66.9	103.6	..	..		9
10	.922	65.3	65.7	64.3	N. W.	Ditto.	.951	78.4	77.8	68.4	N.N.W.	Ditto.	.903	81.9	80.7	65.4	N. W.	Ditto.	.845	83.4	81.8	66.7	N.N.W.	Ditto.	.835	82.8	80.8	65.9	N.N.W.	Ditto.	.850	78.7	77.3	65.8	N.N.W.	Ditto.	84.7	75.4	66.0	107.8	..	..		10
11	.944	63.5	63.4	61.3	N. W.	Ditto.	.996	77.3	76.9	67.8	N. W.	Ditto.	.952	82.3	81.3	66.7	N.	Ditto.	.900	83.7	82.7	68.3	N. W.	Ditto.	.895	82.3	80.7	67.2	N. N.W.	Ditto.	.904	78.3	77.5	66.4	N.N.W.	Ditto.	84.8	74.3	63.8	106.7	..	..	○	11
12S	.934	63.9	65.0	63.4	N.N.W.	Ditto.	.974	76.4	76.4	68.8	N.N. W.	Ditto.	.929	81.3	80.8	68.7	N. N.W.	Ditto.	.854	83.1	82.5	68.7	N. W.	Ditto.	.846	82.6	80.3	67.0	N. N.W.	Ditto.	.860	79.0	77.8	66.8	N.	Ditto.	84.0	84.5	64.9	108.0	..	..		12
13	.935	64.8	65.0	63.2	N.N.W.	Cirro strati.	.999	77.3	77.0	69.4	N.N. W.	Cirri.	.946	82,2	80.4	68.8	N. N.W.	Cumuli.	.900	83.2	82,4	69.4	N.N.W.	Cumuli,	.879	82.6	80.7	68.8	N.N.W.	Cirro strati.	.903	78.4	77.3	68.3	N.N.W.	Cirri.	84.0	74.7	65.3	104.9	..	..		13
14	..	..	..	..	....	....	..	..	..	..	..	....	..	..	..	..	..	....	..	..	..	..	....	....	..	..	..	..	....	....	..	..	..	..	....	....	..	..	..	..	..	..		14
15	..	..	..	..	....	....	..	..	..	..	..	....	..	..	..	..	..	....	..	..	..	..	....	....	..	..	..	..	....	....	..	..	..	..	....	....	..	..	..	..	0.13	0.20		15
16	.946	73.8	74.4	73.7	N. N. E.	Drizzly.	.997	75.5	75.3	73.4	N. E.	Cloudy.	.934	79.0	78.0	74.2	N. E.	Cloudy.	.866	80,3	80,0	74.9	N. N. E.	Cloudy.	.871	79,3	78.9	74.4	N. N. E.	Cloudy.	.879	77.5	76.8	73.8	N. E.	Cloudy.	81.3	78,0	74.6	93.7	..	..		16
17	.936	73.4	73.9	69.7	N. N. E.	Cloudy.	.987	76.0	75.7	70.3	E.	Drizzly.	.949	75.7	74.4	69.6	N. E.	Ditto.	.907	77.6	77.2	71.0	N. E.	Ditto.	.910	78.5	76.8	72.0	N. E.	Ditto.	.927	76.3	75.2	71.3	S.	Ditto.	78.8	76.3	73.7	98.9	..	..		17
18	30.049	72.4	73.3	71.5	S. W.	Cloudy.	30.122	77.8	77.3	69.9	N.	Cloudy.	30.074	82.9	82.0	71.2	N. W.	Cirro cumuli.	30.019	83.7	83.5	71.2	N. N.W.	Cirro cumuli.	30.016	84.3	82.9	70.9	N.N.W.	Cirro cumuli.	30.021	81.0	79.0	70.6	N.N.W.	Clear.	85.4	78.2	71.0	109.7	..	..	☾	18
19S	.110	67.4	68.0	63.5	N. N. E.	Clear.	.162	78.3	78.0	69.0	N.N. E.	Clear.	.092	82.8	81.4	69.0	N. N. E.	Clear.	.019	84.2	83.4	71.2	N. W.	Clear.	.014	83.2	81.8	68.7	N. W.	Clear.	.031	79.3	78.4	69.0	N. W.	Ditto.	85.2	76.6	67.9	107.0	..	..		19
20	.088	64.3	64.9	62.9	N. W.	Ditto.	.140	75.3	75.4	68.3	N. W.	Ditto.	.075	81.0	80.1	68.9	N. W.	Ditto.	.017	83.4	82,0	68.3	W.N.W.	Cumuli.	.014	82.6	80.7	67.4	N.N.W.	Cumuli.	.022	78.9	77.3	68.0	N. W.	Ditto.	84.2	74.6	65.0	106.6	..	..		20
21	.065	66.3	67.0	65.2	N.N. W.	Ditto.	.107	75.8	75.7	70.3	N. W.	Cumuli.	.038	81.2	79.8	69.7	N. W.	Cumuli.	29.981	83.5	82,9	69.4	N. N.W.	Ditto.	29.981	82,6	80.9	68.2	N.N.W.	Clear.	..	..	..	..	....	....	84.5	75.8	67.0	106.7	..	..		21
22	.077	65.2	65.9	64.1	N. N. E.	Cirro strati.	.133	77.9	78.3	69.5	N.N. W.	Cirri	.069	83.6	81.2	69.3	N. E.	Cumulo strati.	30.011	83.6	82,3	69.4	N. W.	Cumulo strati.	30.008	83,2	81.3	69.4	N. W.	Cumuli.	.020	79.0	77.0	69.0	N. W.	Ditto.	84,2	75.1	66.0	108.0	..	..		22
23	.091	66.2	66,3	64.6	W.N.W.	Cumuli.	.142	77.8	78.0	70.8	N. W.	Clear.	.077	82.3	81.3	70.8	N. W.	Cumuli.	.017	84.0	82.7	68.4	N. W.	Cumuli.	.010	83.3	81.8	68.3	N. W.	Ditto.	.019	79.8	78.5	68.2	N.	Ditto.	84,5	75.5	66.5	104.3	..	..		23
24	.041	67.3	67.5	64.7	N.N. W.	Ditto	.139	76.3	76.9	69.0	N.N. W.	Cumuli.	.074	82.7	82,2	70.3	N.N.W.	Cumulo strati.	.008	82,9	82,2	67.3	N. W.	Ditto.	29.999	82,4	80.8	66.4	N. W.	Ditto.	.014	78.3	77.3	68,2	N. W.	Cirro cumuli.	83,8	75.7	67.6	104.0	..	..		24
25	.075	67.2	67.9	64.0	N.N. W.	Cloudy.	.124	75.6	75.4	66.4	N.	Ditto.	.053	82,0	81.2	69.0	N. W.	Cumuli.	29,975	83.4	82,0	68.7	N. W.	Cumulo strati.	.967	82.6	80.6	68 0	N. W.	Ditto.	29.970	78.5	77.0	68,2	N. W.	Clear.	84.3	76.0	67.6	105.7	..	..		25
26S	.031	65.8	66,3	62.3	N.N. W.	Cirro cumuli.	.084	76.7	76.6	66,0	N. W.	Clear.	.032	81.8	81,0	67.0	N.	Cirri.	.975	82.6	81.8	67.9	N. W.	Cirri.	.972	82.0	79.8	66.0	N. W.	Cirro cumuli.	.980	78.0	76,0	67.0	N. W.	Ditto.	83.6	75.0	66.4	104.2	..	..	◑	26
27	.069	66.2	66.4	63.5	N. W.	Cumuli.	.133	75.6	75.3	66.4	N.	Cirro cumuli.	.075	81.3	81,0	67.9	N.	Clear.	30,012	83,2	81.6	67.4	N. W.	Cumuli.	30,012	81.7	79.8	66,8	W.N.W.	Clear.	30,022	77.7	75 4	66.7	N. W.	Ditto.	84,4	75.4	66.4	107.0	..	..		27
28	.142	64.2	64.8	61.0	N.N. W.	Cirri.	.215	76.0	76.2	66.6	N.	Clear.	.166	81.7	79.8	68.7	N.N.W.	Cumuli.	.106	82,0	81,0	68,5	N. W.	Ditto.	.105	81.0	79.2	67.6	N. W.	Ditto.	.110	76.9	75,8	67.0	N.	Cirri.	83,3	74,0	64.7	105.8	..	..		28
29	.160	65.7	65.8	62,8	N.N.W.	Cirro strati.	.211	75.9	76.0	69.0	N.	Cirri.	.158	83.0	81.3	69.3	N. N. E.	Cumulo strati.	.090	82,3	81,3	69,3	N.N.W.	Ditto.	.088	81.5	80.2	68.4	N. W.	Cumulo strati.	.101	78.5	76.9	69.0	N.N.W.	Cumuli.	83,9	75,0	66.0	107.0	..	..		29
3	.165	63.3	64.2	63.3	Calm.	Foggy.	.202	75.5	76.0	70.1	N. E.	Clear.	.148	82.5	80.3	68.7	N. E	Cumuli.	.072	82.3	81.3	69.4	N. W.	Clear.	.065	81.2	79.5	67.4	N. W.	Clear.	.070	77.8	76,5	68.0	N. W.	Clear.	83.5	73.6	63.7	106.7	..	..		30
Mean	30.016	67.9	68.4	65.9			30.068	78.0	77.9	69.9			30.012	82.8	81.6	70.3			29,949	83.9	82.9	70.3			29,943	83.1	81.8	69.3			29,953	79.5	78.4	69.4			84,9	76.6	68.3	106.4	0.13	0.20		
Mean of the Corresponding month of last year	29.955	67.2	67.8	66.5			30,008	77.6	77.5	70.5			29,962	81.0	80.4	70.1			29,902	82,2	81.6	70.9			29.892	81.5	80,1	69.2			29,900	78.5	77.5	69.0			83.4	..	..	..	5.40	5.59		

These Observations have been made for the most part, with a supply of new and first rate Instruments received into the Observatory, by orders of the Bengal Government; a brief description of the Instruments seems necessary.

1st.—The Barometer is a standard Instrument by Newman, diameter of the tube 0.504 Inches. The following is the comparative shewing of this Instrument and those Barometers which were in use at the Observatory prior to 1st of June, 1844.

Ditto „ „ „ „ 0.514 Ditto.

Barometer by Troughton used prior to the 1st of June, 1844. Observations reduced to 32° Fahrenheit. 29.493
Ditto.. Ditto Col. Everest used from 1st of June to 31st of August, 1844. .... Ditto .....Ditto 29.637
No. 52 Standard Barometer by Newman used from 1st of September, 1844..... Ditto .....Ditto 29.654
No. 86.... Ditto.... Ditto ..... Ditto.....from 3d of April, 1847. .... Ditto .....Ditto 29.667

2nd.—The Thermometer is a Standard Instrument by Newman, on metal Scale and graduated to ½ of a degree.

3rd.—Wet Bulb Hygrometer by Newman, graduated to single degree divisions, the difference between Standard Thermometer and dry Thermometer of this Instrument is + 0.2, the Temperature of the dry Bulb is taken from the Standard Thermometer, and in the event of the quantity moisture, dew point, or dryness, being required, it is necessary the difference advered to, be taken into calculation.

4th.—Maximum and Minimum Thermometer by Newman. The difference between these instruments, and the Standard Thermometer is + 0.7 for the former and 0,23 for the latter.

5th.—The Temperature shewn in Column 41 of a Thermometer, in sun's rays, is acquired by means of a Newman's Maximum Thermometer having a black bulb.—The above Instruments, excepting the Thermometer placed in the sun's rays, are fixed at above 4½ feet from the ground, to a post, in a thickly choppered house, and are freely exposed to the air and sheltered from any influence of Solar reflection.

The height of the Surface of the Mercury in the Cistern of the Standard Barometer in the Observatory attached to the Surveyor General's Office above the Mean Level of the Sea, having been deduced from a Series of Tide Observations taken from a Register kept at Kyd's Dock Yard, the result is recorded for general information.

	Feet.
Lowest Monthly Average of Mean Tides in the Months of February and March, above the Zero of Gauge at Kyd's Dock Yard, Calcutta, ...	8.38
Difference of Level between the Zero of Tide Gauge at Kyd's Dock Yard, and the Standard Barometer at the Observatory, ...	26.59
Height of Standard Barometer above the Level of the Sea, ...	18.21

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