holy spot sacred to Mahádeva, under the emblem of a pillar, the very sovereigns of the world whom his prowess had overcome ;—

" And thus having re-established this same pillar of victory, he acquired reputation. It is a pious act to raise up a worthy foe when he has been humbled."

' Parcere subjectis et debellare superbos' seems to be the sentiment here inculcated ; and it is probable that the allegory of overthrowing and restoring enemies, alludes to the taking down the pillar (which may have been done to cut the new inscription) and its restoration, by some rája who had penetrated thus far in a successful expedition.

The name of Mall occurs as a patronymic in more than one dynasty of Nipál. It is not impossible, therefore, that the name here written Anik Mall, may be the same as the Anya Mall of the *Neverit* race, who reigned in that valley about the year 1195 A. D. according to Kirkpatrick's Sketch. Anya, which is without meaning, should probably be written Ani'k.

IV.—*Sub-Himálayan Fossil Remains of the Dádupur Collection. By Lieuts.* W. E. Baker, *and* H. M. Durand, *Engineers.*

[We should be wanting both in candour and courtesy, were we not to point out to the reader, that the plates accompanying the present paper were furnished by our zealous contributors, and their esteemed commandant Col. Colvin. In despair of the difficulty and expence of executing so many plates in Calcutta, it occurred to us that the same pens and pencils which could produce such neat original drawings, could, if provided with the requisite materials, furnish engravings and lithographs ready executed for our Journal. We accordingly dispatched some yellow paper, and a copper plate, by dâk, to Dádupur ; and these are the first fruits. If not quite perfect, it should be remembered that the transfers had to travel 1,000 miles in the height of the rains ere they could be secured on the stone—and that the copper-plate, with its waxed and etched surface, had to be bitten by the acid after its arrival in Calcutta. The wonder is, that they should have turned out so well ! We anticipate much greater success hereafter.—Ed.]

RHINOCEROS.

The manner in which the organic remains of the Sub-Himálayas were at first deposited, and that in which they have been subsequently disinterred, have necessitated a system of search more favorable to the acquisition of specimens than to the accurate description of the localities in which they occurred. Hitherto the fossils were in general found widely scattered over the surface and throughout the ravines of the calcareous sandstone formation ; a dispersion which rendered gleaning from the hill surfaces preferable to excavation at any one place, affording the certainty of a larger number and greater variety of spe-

cimens than could be anticipated to result from any other mode of collection. Notwithstanding these circumstances, however, it was soon observed that the different parts of the head, the various fragments of one limb, picked up at considerable distances from each other, could with a little trouble be extracted from the heaps and assorted; the sharp edges and accurate junction of the fractured surfaces preventing any doubt or mistake. Such restorations proved that whole extremities, perhaps entire skeletons, must occasionally have been entombed in the sand, and that the upheavement of the strata causing the greater number of fossils to be traversed by cracks, divided them into a number of fragments, which, on the degradation of the strata, were swept away by the drainage water to various distances from their original sites. It became an object, if possible, to discover these sites; with this purpose in view, many of the abrupt cliffs and fresh slips, with which this tertiary formation abounds, were examined; but with such little success as to render it evident that the gradual wear of ages could alone have sufficed for the exposure and dissemination of so vast a quantity of these relics on the slopes and in the ravines of the hills. The scattered fragments were seldom found to give any clue to the original place of deposit: in fact it has but once occurred to us that a nearly entire extremity has been discovered in the calcareous sandstone. And in order to illustrate the foregoing remarks, we have appended a sketch of these remains*; the drawing represents them as they lay after the removal of the sand which at first concealed all but the lower fragment of the femur: pieces of tusk, bones, and the half of a lower jaw, were found in the immediate neighbourhood, and indicated that the other parts of the skeleton of this *mastodon elephantoides* had originally been deposited at no great distance from the posterior extremity which forms the subject of the sketch. The whole may be considered a fair example both of the mode of deposition and of the subsequent dispersion which lodged separate, sharp-edged fragments on the hill sides and amongst the sandstone boulders of the water-courses. The rare occurrence of specimens under such favorable circumstances rendering excavation a very uncertain and ill requited labour, forced the native collectors to be satisfied with the crop which time had exposed.

* We regret exceedingly that the drawing on transfer paper of the fossil *in situ* was spoiled in passing it on to the stone. This was the case also with Plate XIX. a very beautiful drawing by Col. J. Colvin: but the latter officer having taken the precaution of forwarding its original, a tolerable attempt has been made to supply its place by M. Tassin. The initials W. E. B. to this plate have been inserted by mistake.—Ed.

Hence, too, the localities of fossils thus collected at places remote from each other did not admit of being accurately specified; a circumstance of less importance so long as the species, sometimes even the genera, exhibited characters distinct from the fossil and existing species hitherto described; but the species about to be noticed being an approach to an existing type, we consider ourselves fortunate in having witnessed the exhumation of many of the specimens referred to in this paper, and are only sorry that the limited time at our disposal was insufficient to enable us to take a plan and accurate sections of the ground.

The following general description may, however, give some idea of a locality which furnishes an exception to other places whence fossils have been obtained; in this instance they have not been met with in solitary fragments, but found massed together; and excavation has been resorted to with advantage. Though but an imperfect description, what follows may suffice to point out the site in question, and it has therefore been introduced.

The deposit is situated about a mile and a half to the N. W. of *Maginund*, a village on the left bank of the easternmost affluent to the *Caggar*, (or Gagur of some maps), immediately at the debouche of the channel from the hills. On leaving the village, crossing over to the right bank, and skirting for a short distance in a westerly direction the base of the hills, the bed of a tributary is reached, which, on being traced up, leads to the deposit. The formation here consists alternately of strata of calcareous sandstone and of strata of a loamy texture, composed of a mixture of sand and clay; the proportions of these ingredients of course vary continually, but in general they are nearly equal; the clay colours the strata, giving a brownish red shade. The calcareous matter which enters into these loamy strata is usually in small quantity, and they are so little indurated that some of the blocks, although sheltered from the force of the rain itself, fall to pieces when exposed to the damp atmosphere of a rainy day. The fossils extracted from this matrix are more fragile than those imbedded in the calcareous sand, and much care is requisite in disengaging them.

A hasty or distant view of the sections which here, as elsewhere, abound, might lead to the conclusion that the loamy strata predominate; for being, as above described, but little indurated and easily acted upon by damp and rain, they tinge the calcareous sand strata beneath them by covering their exposed sectional surfaces with red or ochre-coloured particles. The consequent effect is very deceptive; but on closely examining many sections, we invariably found the sand

to predominate. The part of the hills here alluded to is barren of wood. The strata evidently suffer very rapid degradation, in consequence of the facility with which the clayey beds yield to the abrading force of the drainage water; by means of the loose stratum, the more enduring sandstone is as it were peeled off, and covers the hill slopes with its debris. The dip of the stratification has a general N. E. direction.

The circumscribed space, more immediately under consideration, consists of about one hundred feet of ravine along a stratum of loamy texture. Within this confined space specimens of all the genera, contained in the synopsis of our collection, have been found: that is to say, the same bed which yielded so many remains of the fossil unicorn rhinoceros, likewise produced the half of the upper and lower jaws of a young sivatherium; many bones of the extremities of adult animals of that genus, or of a ruminant of as large a skeleton as that of the sivatherium; the anterior half of the head of an animal which presents analogies both to the palæotherium and anoplotherium; and, in short, exemplars of all the genera excepting the hippopotamus. The remains of fish and tortoises must also be added to the list of classes not hitherto discovered in this deposit: exceptions, however, which are probably accidental, as the plates of saurian animals have been obtained from thence.

The osteological remains, although strangely amassed together, are frequently perfect; in many instances whole extremities have been disinterred; there are cases of the greater part of whole skeletons being dug out, but these are rare; whole craniums of large animals have not hitherto been met with; a circumstance which, considering the number of their bones, would be unaccountable, had we not grounds for taxing the carelessness of the excavators as in part answerable for the anomaly. Perfect craniums of the smaller animals are of frequent occurrence; in one block we counted *five* craniums of antelopes, close together; not all equally perfect, as one of them possessed even the core of the horns complete, but with the molars and greater part of the head present, so that all error is excluded. Animals of the same species are not always thus heaped together: on the contrary, the relics of very different species may be frequently observed in contact. One block of moderate dimensions presented the assemblage of remains of the sivatherium, rhinoceros, sus, crocodile, of a large feline and a small carnivorous animal, of antelope, and of an undistinguished ruminant. Another block gave the head of a species of gulo, accompanied by the plate of a saurian animal. To the rhinoceros femur and tibia, (Pl. A) we found attached the astragalus of

an elephant and metatarsal of a rhinoceros : it would however be useless to mention at greater length the juxta-position of specimens in this stratum ; suffice it to add, that sometimes, perhaps in general, the skulls and bones of the same species are found together ; at others, however, as above described, the remains of very different species occur together.

There is one remarkable fact deserving of mention ; which is, that by far the greater proportion of the craniums from this deposit are those of young animals ; the adult bear a small proportion to them.

From the above site the fossils selected to form the subject of this paper have been obtained, with the exception of the following.

The cranium, Pl. XV. which was found about three miles from the Maginnud deposit.

The separate teeth, fig. 5, 6, 7, 8, Pl. XIX. which were brought at different times and without any account of the places at which they were obtained.

The fine fragment from a lower jaw, fig. 6, 7, Pl. XVI. which is in the possession of Conductor Dawe, of the Canal Department, to whom it was brought from the vicinity of the *Haripur* pass.

Cranium. We shall commence with the fossil, which being the most perfect, affords the best means of instituting a comparison with the skulls of described species. It forms the subject of Pl. XV. in which three views are given, which were taken with a camera lucida—the instrument and the distance of the cranium were so adjusted, that the reflected image was exactly one-sixth the size of the original. We are indebted to Colonel Colvin for the delineations in this plate.

The fossil cranium is imperfect in the following parts. The extremity of the nasal and intermaxillary bones are broken off ; the zygomatic arches are both fractured ; the left occipital condyle is wanting ; the following molars have either dropped out prior to the envelopment of the head by the matrix, or have been broken off subsequently to its fossilization, viz. the fifth of the right, the first and seventh of the left maxillary. In addition to these losses the cranium has undergone, when in the stratum, the common fate of sub-Himálayan relics, and is cracked in several directions : the crush, however, which produced these cracks has not materially altered the form of the head ; the chief effect produced has been the forcing the left half palate at its anterior extremity a little above its proper level ; this the longitudinal crack passing through the left orbit enabled it to accomplish ; the displacement resulting may be best observed in the profile view of the skull, fig. 3. The transverse cracks are accompanied by a small hollow and a consequent neighbouring bulge, both so partial and

of such small relief, that in the profile their places can only be observed by paying attention to the jagged outline at the depression of the frontals. With the above exceptions the specimen is perfect.

A glance at Pl. XV. will be sufficient at once to determine the species with which this fossil rhinoceros must be compared. The depression of the frontals causing the deeply curved outline of the upper planes of the head; the slope of the occiput; the septum and its nasal arch—all separate this cranium from the existing and fossil bicorn species. The existing unicorn species is that, therefore, to which recourse must be had in order to establish a comparison.

In the unicorn rhinoceros of Java the height to which the crest of the occiput rises above the palatal plane, as also the thickness and prominence of the nasal arch supporting the horn, are less than in the Indian rhinoceros. A line drawn tangential to the crest of the occiput and the highest point of the nasal bones will, in the unicorn species of India, be more raised above the plane of the frontals than is the case in the Javanese rhinoceros. In the foregoing respects the fossil associates itself with the Indian, and differs from the Java species. The comparison may, therefore, in general be confined to the former.

With the view of bringing at once under the eye, the discordance which occurs between the relative values of analogous dimensions, the subjoined table is here inserted. The modulus chosen is the space occupied by the seven molars, because on this measurement the development of the bones of the head must, to a certain extent, be dependent. The measurements given in Cuvier's Os. Fos. have afforded the proportions of the existing species; and the table of dimensions which closes this paper has given the proportions of the fossil.

Measurement.	Cuvier's Ind. Rhin.	Fossil. Ind. Rhin.
Space occupied by the seven molars assumed equal to, ...	1·00	1·00
Height of occiput from lowest edge of occipital foramen to summit of crest of occiput, ...	1·02	0·80
Greatest breadth of occiput, ...	1·11	1·05
Least thickness of cranium across temporals, ...	0·45	0.38
Breadth across at post orbital apophysis of frontals, ...	0.83	0·78
Distance from anterior of orbit to auditory foramen,.....	1·02	1·00
Breadth across the occipital condyles, ...	0·47	0·60

Referring to the table of dimensions it will be observed, that the height of the occiput is in the fossil less by met. 0.021 than the corresponding measure of Cuvier's Indian rhinoceros; but the greatest breadth of the occiput is met. 0.036 in favor of the fossil: relatively to the space occupied by the seven molars, these two measurements attain a less development in the fossil than in the existing animal.

The difference in the occipital condyles amounting to met. 0.065 in excess of the Indian rhinoceros causes a marked discordance in the ratios of these dimensions; but, as the left condyle and the adjacent parts are wanting in the fossil, the measure was obtained by doubling what appeared to be the exact half dimension; this of course is not so satisfactory as if the condyles had been perfect; any inaccuracy consequent on this circumstance could not, however, amount to a quantity which would materially alter the deduced proportion. The occiput, figs. 8, 9, Pl. XVII. is fortunately very perfect; from its dimensions, which prove it to have belonged to a smaller animal than the cranium of Pl. XV. may also be concluded, that though inferior in size to Cuvier's specimen of the Indian rhinoceros, which in greatest breadth of occiput exceeds it by met. 0.039, yet the space occupied by the condyles is 0.010 in favor of the small fossil occiput. In both of the fossils the depressions near the summits of the occiputs on each side of the mesial projections are deeper than those of the existing species.

The zygomatic arches not being entire, and the matrix being uncleared from the portions which remain, no particular remarks can be passed on them.

The sutures cannot anywhere be traced; a circumstance which precludes the notice of particulars frequently of importance in the comparison of species.

The least thickness of the cranium is but met. 0.001 greater than that of the Indian rhinoceros; and therefore in proportion to the modulus, yields a less ratio than that species.

The breadth at the orbits is met. 0.024 greater than in the existing species; consequently the skull does not in this part present any material discordance of proportion.

The length between the auditory foramen and the anterior of the orbit is 0.043 met. greater in the fossil; this measurement affords a proportion only differing met. 0.002 from that obtained from the existing species.

The infra-orbitary foramen is situated similarly to that of the Indian rhinoceros.

The nasal arch is massive and much developed; the spring of this arch is perpendicularly over the anterior of the second molar; that is a little more retired than in the Java or Indian rhinoceros skulls, given in Cuvier's Pl. 4.

The breadth of the palate has not been given in the table of dimensions, because the first and seventh molars not being perfect on both sides, measurements corresponding to those of Cuvier's could

not be obtained. It is comparatively less than in the existing species, but the great breadth of the teeth compensates for this difference.

Having detailed the essential differences and the points of resemblance observable in the fossil Indian rhinoceros when compared with CUVIER's dimensions of the existing Indian rhinoceros; we must be permitted to add, that additional measurements from skulls of the latter species are requisite before anything certain can be pronounced as to the amount of difference or correspondence between the two species. We are induced to make this remark, in consequence of having been favored with the examination of two craniums which presented considerable variation of proportions when compared with CUVIER's and with each other.

It appears to us desirable, therefore, to ascertain the limits within which individual variations range before any thing positive can be asserted. The foregoing remarks will have shown a great general resemblance, accompanied by a departure of proportions in some corresponding parts: the latter may be sufficient for the establishment of a new species,—at least for the present, until more data are obtainable whence to determine the bounds by which the individuals of one species are limited in their variations; for the sake of distinction, therefore, and present convenience, at the same time keeping in view the type to which it is a near approach, we have termed the species under consideration the *R. Indicus fossilis*.

Teeth. The remark has been already passed, that the greater number of fossils obtained from the Maginnud deposit are the remains of young animals: with the rhinoceros this has been particularly the case. We accordingly find ourselves better able to illustrate the early stage of dentition than that more advanced.

Fig. 1, Pl. XIX. represents the right half of an upper jaw, the left half being in this instance omitted, as also in figs. 3 and 4, in order that the series may be brought under the eye in one plate. Fig. 1 contains the four milk molars of the left maxillary; the fourth being but just cut is unworn; but the palate being broken away from the base of the tooth, more of it is seen than would otherwise be the case; in the right half of the specimen, where the palate is whole, the fourth molar is more concealed. The first molar is also unworn, but the second and third have suffered detrition. The two rows of teeth have their internal base lines parallel to each other, and the lines which would circumscribe their exterior much curved, in consequence of the difference of breadth which exists amongst the teeth. The upper part of an unworn tooth, measured exteriorly, is much longer than the lower; for the anterior of each molar projects beyond the posterior

extremity of the one immediately in its front by the gradual enlargement of the external line of enamel from the base to the summit. As the molars wear down, this outer development is reduced, the internal sides of the teeth come more into use, and breadth is gained in compensation for the diminished length of surface in wear.

Fig. 2, Pl. XIX. is a fragment from a right maxillary, containing the 1st, 2nd, and 3rd milk teeth, more worn than the corresponding molars of fig. 1. The 1st teeth in these two specimens are dissimilar; but that of fig. 1 not having completely disengaged itself from the jaw-bone, a strict comparison cannot be made between the two. The detrition which the remaining teeth have undergone does not prevent the trace of their enamel from being found to agree with that of the analogous molars of fig. 1.

A still further advanced state of wear is figured in fig. 3, which is taken from a cranium to which the occiput and anterior of the nasal bones are wanting. The 5th molar is here on the point of appearance; the four first are much worn, particularly the first and second; but there is no difficulty in tracing the correspondence between the molars of this and of the preceding specimens.

The above three exemplars of the deciduous dentition we assign to the fossil Indian rhinoceros, from the circumstance of their having been found in company with bones the forms of which clearly pointed out the species which they must have resembled. The disposition of the molars also corresponds with that observable in the cranium Pl. XV. where the same parallelism, of internal base line and arched external bounding line, exists. To which may be added, that the frontals of the cranium to which the molars of fig. 3 belong, evince no sign of having borne a horn.

Between the worn state of the deciduous molars exemplified by fig. 3, and the worn state of the permanent molars figured in Pl. XV. we have no connecting links, excepting such as may be obtained from a few detached teeth which appear to have belonged to this species—these are,

Fig. 5, Pl. XIX. The sixth molar from a left maxillary. The spur, which occupies no inconsiderable part of the hollow between the anterior and posterior transverse hillocks, is here less curved than that of the Indian rhinoceros; and there is wanting altogether the small salient of enamel, which in the Indian rhinoceros occurs between the starting point of the above mentioned spur and the point of junction of the exterior and anterior main lines of enamel. It may also be mentioned, that the exterior and posterior lines of enamel being less thick than the corresponding parts of the sixth molar of the Indian

rhinoceros, there is a greater space between the two. Such modifications of form are however fortuitous, differences of equal amount being observable in the teeth of animals of the same existing species.

This fossil measures in length, in. 2.50 met. 0.0645
in breadth, ,, 2.62 ,, 0.0675

Fig. 6. The 5th molar, derived from a left maxillary. The outline of its enamel accords with that of the similar tooth of the Indian rhinoceros, the only difference being in the dimensions and in the enamellated edge of the short beading at the anterior side of the tooth.

It measures in length, in. 2.08 met. 0.053
in breadth, ,, 3.27 ,, 0.0835

Fig. 7, is the 7th molar, and from a right maxillary; the point of the small spur is broken, as also the anterior extremity of the external line of enamel; but the tooth is sufficiently perfect to show a close resemblance to the analogous molar of the Indian rhinoceros.

It measures in length, in. 2.88 met. 0.0735
in breadth, ,, 2.53 ,, 0.065

Fig. 8, is the 7th molar of a left maxillary; the difference observable between this and the foregoing specimen consists in the great development which the small anterior spur here attains; in the former it is scarcely observable; in fig. 8 it is very prominent. Variations to an equal amount may, however, be observed in the minor saliants, &c. of enamel in teeth appertaining to skulls of the same existing species. No weight can therefore be attached to such unimportant modifications.

This fossil measures in length, in. 2.95 met. 0.075
in breadth, ,, 2.55 ,, 0.065

Fig. 5, offers a good example of the difference of length at the upper and lower parts of the tooth; the greatest length, which is that taken near the top, is given above; the least external length taken at the base would have been in. 2.04, or nearly half an inch less than the top measurement.

The cranium Pl. XV. has its molar teeth so much worn down, that the configurations of the enamel cannot be traced; the table of dimensions gives the length and breadth of each tooth, and shows that although the lengths do not materially differ from those of the corresponding teeth of the existing species, the breadths exceed those of any hitherto described.

Without complete illustrations of the milk-teeth of existing species, it would be dangerous to attempt a comparison between them and the fossil Indian rhinoceros. We have therefore avoided the endeavour;

but we must be allowed to notice the upper jaw fig. 4, Pl. XIX. which offers peculiarities when compared with figs. 1, 2, and 3 (of the same plate) deserving of remark.

The right half of the specimen is figured in the plate, the left half having lost the 1st tooth. With respect to age, this jaw nearly corresponds with fig. 3, the fifth molar being in both on the point of appearance. The following departures from the tracing of enamel in figs. 1, 2, and 3, may, however, be observed. The second molar of fig. 4 has this peculiarity,—that instead of the anterior portion of the tooth being one continuous offset from the exterior line of enamel, it only assumes that appearance after considerable detrition, consisting at first of a short offset and an isolated pillar, as shown in the drawing. The two sides of the jaw have been very unequally worn, in consequence of which the opposite side to that delineated has the pillar and offset conjoined. The third molar also presents a marked difference, when placed in juxta-position with the corresponding teeth of the other three jaws; the two spurs which occupy the central hollow of the tooth are of a different shape from that which occurs in the other specimens. In other respects fig. 4 corresponds with them—its rows of molars are parallel to each other, and the dimensions offer but trifling variations. The modifications of form above alluded to, unless fortuitous, which is perhaps improbable, denote the existence of another species; a fact corroborated by the examination of the milk molars of the lower jaws in our possession. Upon the consideration of these we now enter, but are able to offer but few and unsatisfactory remarks.

Lower Jaws. With the exception of the fine fragment, fig. 6, Pl. XVI. submitted to our inspection by Conductor Dawe, and the fragment fig. 9, the specimens of lower jaws are all from the Maginnud deposit, and all the remains of young animals.

Fig. 1, Pl. XVI. represents a fossil which has lost the anterior of its symphysis, the second molar on the right, and the first molar on the left side of the jaw; as also both the rami, which are broken off. Four molars have appeared, the second and third of which are worn, but the first and fourth have their enamel intact; the sections of fracture expose germ teeth. The two lines of molars have a gentle convergence, which is effected, not by a curve in the rows of teeth, for these are set in a perfectly straight line, but by the gradual approach of the two rows, which make a small angle with the medial line of the jaw. The section shown by the break of the symphysis and the interval between the front molars, argues the existence of a prolonged symphysis. The fourth molar is characteristic, having an isolated point or low pillar in the centre of the chord of its posterior crescent.

Fig. 5 is a fragment containing two molars, apparently the third and fourth milk ones; the outer enamel of the latter is mutilated, but the interior is perfect, and presents the isolated pillar of the posterior crescent, noticed as remarkable in fig. 1.

Fig. 4 is the right half of the lower jaw of a young rhinoceros, but of one somewhat older than the animal to which fig. 1 belonged, for the fourth molar has in fig. 4 suffered detrition. Notwithstanding the difference of age being in the favor of this specimen, the space occupied by the four molars is less than that of the four in fig. 1. The fourth molar is here devoid of the low isolated pillar in the posterior crescent, and has the central enamel, or junction of the two crescents, larger than in fig. 1. There are no means of ascertaining whether or not the opposite rows of molars were parallel, but in position of symphysis and set of the teeth in a perfectly straight line, this specimen corresponds with the foregoing.

Fig. 3 is the exterior view of fig. 4.

Fig. 2 has its fourth molar just disclosed and rising into the line of molars: it is devoid of the isolated pillar; but in size corresponds with fig. 1, instead of fig. 3, to which latter it assimilates itself by the fourth and second molars.

It is difficult to ascertain the degree of importance to be attached to such points of difference: in no specimen from the jaw of an adult animal has any trace of the isolated pillar been hitherto found: occurring as this peculiarity does in a deciduous tooth, should nothing similar take place in the permanent tooth which replaces it, the only chance of determining the question will be the discovery of an entire head. We have noticed an upper jaw, fig. 4, Pl. XIX, which indicates the probability of the existence of two species. The examination of the above lower jaws rather confirms this supposition; but in the event of such slight modifications denoting specific distinctions, we are unable, in consequence of the paucity and incompleteness of specimens, to decide which are the milk-teeth of the fossil Indian rhinoceros. Nor are we fortunate with respect to the lower maxillary of the adult animal; figs. 6, 7, and figs. 8, 9, being all that we can bring forward. The sections of these two fragments differ in consequence of their being derived one from the posterior, the other from the anterior part of the jaw, which thickens as it approaches to the symphysis. These two specimens resemble the corresponding portions of the lower jaw of the Indian rhinoceros, but are too imperfect to afford any satisfactory measurements for grounds of comparison.

Anterior Extremity.

A scapula in our possession is not sufficiently perfect to give accu-

rate measurements, but it bears as great a general resemblance to that of the Indian rhinoceros as do the other parts of the skeleton.

The humerus, figs. 1, 2, Pl. XVII, having its radius and ulna attached, was discovered by ourselves very close to the place whence we excavated the femur and tibia forming the subject of Pl. XVIII. With the exception of the deltoid crest, this humerus is perfect, and has afforded the dimensions which enter into the first column of the table. For the purpose of comparison the following five columns are here added. The proportions of the Indian and Sumatra small species of rhinoceros are deduced from Cuvier's table ; those of the fossil specimens are of course from the table of dimensions. The length of the bone is assumed as the unit, and the measures of other parts referred to it in order to obtain their comparative values.

Measurements.	Cuvier's Ind. Rhin.	Cuvier's Sumatra Sl. Sp. Rhin.	Fig. 1, Pl. 17. fossil I. R.	Fig. 5, Pl. 17. fossil Ind. Rhin.	Fig. 6, Pl. 17. fossil Ind. Rhin.
Length of humerus from tuberosity to external condyle, ...	1·00	1·00	1·00	1·00	1·00
Ditto ditto ditto internal ditto, ...	1·03	0·95	0·91	0·94	..
Greatest anter. post. diameter at top,.....	0.44	0·30	..	0·44	0·43
Breadth across condyles, ...	0·36	0·31	0·35	0.37	..
Ditto of articulating pully, ...	0·25	0·19	0·22	0·22	0·25
Least diam. of the body of the humerus, ...	0·15	0·13	0·14	..	0·15
Length of radius, ...	0·79	0·75	0.76	..	..
Breadth at top, ...	0·26	0·20	0.23	..	..
Ditto at bottom, ...	0·25	0·18	0.23	..	..
Length from articulating head to bottom of internal condyle, ...	..	..	0.82	0·81	0·87

The Sumatra rhinoceros (small species) concurs with the fossil Indian rhinoceros in having the length taken to the external condyle longer than that taken to the internal. The Javanese and the larger Sumatra species also accord with the fossil in this respect, but not so nearly as the small Sumatra species, which has consequently been introduced into the above table.

The length of the fossil humerus, figs. 1, 2, Pl. XVII, exceeds that of any of the existing species : its thickness is, in proportion to the length of the bone, intermediate between the Sumatra and Indian species. The articulating pully also possesses a development intermediate in value to those of the two existing species. The breadth at the condyles is in the same proportion or nearly so as that of the Indian rhinoceros. The radius is in length, considered with reference to length of femur, a little less than in the Indian and somewhat in excess of the small Sumatra species ; the remaining two dimensions of this bone yield values intermediate to those of the two existing rhinoceroses. These remarks apply to the deductions for fig. 1 ; nor would it

be necessary much to alter them in speaking of fig. 5 ; but fig. 6 presents such a close approximation to the Indian rhinoceros, that it is much to be wished that the specimen had not been so broken as to prevent additional measurements from being derived from it. Excepting in the length from the articulating head to the bottom of the internal condyle, it does not much differ from fig. 5. The bone, however, being imperfect, must be omitted in drawing a comparison between the fossil and existing species.

Fig. 1, varies most from the Indian rhinoceros in the proportion of the length taken to the internal condyle ; an anomaly difficult of explanation. We must here repeat, that there exists a necessity for a greater number of tables of dimensions taken from the skeletons of the Indian rhinoceros : the anterior extremity of a rhinoceros, with the examination of which we have been favored, yielded proportions so nearly corresponding with those deduced from the fossil humerus, figs. 1, 2, as to prevent our drawing more positive conclusions than those expressed at the close of the remarks on the cranium, Pl. XV.

Posterior Extremity.

The femur and tibia, Pl. XVIII, were dug up in such close proximity to the humerus and radius, fig. 1, Pl. XVII, that little doubt could be entertained of their having belonged to the same animal. Being perfect,

Measurements.	Cuver's Ind. Rhin.	Fossil Pl. 18.	Fossil 3d in table of dimensions.	Fossil 5th in table of dimensions.
Length of femur from articulating head to bottom of internal condyle,	1·00	1·00	1·00	1·00
Breadth from head to most salient part of great trochanter,	0·38	0·43	..	..
Breadth across condyles,	0·29	0·28	0·26	..
Antero. post. diam. of internal condyle,	0·34	0·34	..	..
Ditto ditto ditto of external ditto,	0·27	0·26	..	..
Distance between bottom of 3rd trochanter and top of 1st,	0·59	0·61	..	..
Ditto ditto ditto small trochanter and top of head of femur,	0·46	0·41	0·46	0·42
Diam. of articulating head of femur,	0·18	0·19	0·16	0·17
From lower side 3rd trochanter to bottom of external condyle,	..	0·38	0·38	..
Length of femur from articulating head to bottom of 3rd trochanter,	..	0·72	0·71	0·64
Length of tibia from anter. tubero. to anter. edge of inferior articulating surface,	0·67	0·70	..	..
Greatest transverse diam. at top,	0·25	0·25	..	..
Antero. post. diam. from antero. post. tubero. to post. ext. of internal condyle,	0·29	0·31	..	..
Transverse diam. at bottom,	0·21	0·20	..	..
Diam. antero. post. of internal side,	0·14	0·13	..	..
Length of fibula,	0·62	0·65	..	..
Breadth at bottom,	0·10	0·10	..	..

except at the lower part of the great trochanter, the specimen affords ample means of comparison with the femur of the existing species.

On reverting to the table of dimensions it will be observed, that this fossil exceeds, as did also the humerus, any of those in Cuvier's table of existing species. The preceding columns show in what respects the proportions of the bone vary from those deduced from Cuvier's Indian rhinoceros. The length of the femur is here the modulus.

From a comparison of the two first columns in the above table there results, that the fossil has a greater development at its upper and a somewhat less development at its lower extremity than is the case in the Indian rhinoceros. The third trochanter is set lower down, and the inferior extremity of the small trochanter higher up than in the existing species; the articulating head is larger in proportion in the fossil than in the Indian rhinoceros. None of these modifications however are excessive; on the contrary, they are less than those which exist amongst the fossils themselves, which are all three undoubtedly of the same species.

From the manner in which the lower and exterior part of the great trochanter is broken, there is every probability that a descending point protruded from the fractured surface towards the third trochanter, the ascending point of which is very perfect.

The third trochanter, however, differs from that of the existing species as figured in Cuvier's *Oss. Foss.* in not possessing the double point; for it has a single well defined ascending process, without any sign of the bicuspid termination. The lower edge of this trochanter, instead of ascending with a gradual swell towards the point, as in the existing species, has a counter curvature to that of the upper edge. The chief dissimilarity between Cuvier's plate and the fossil occurs in this part of the bone, the third trochanter assuming a different shape, and offering a variation more distinctive than any other presented in either extremity. This circumstance, together with some of the proportions of the cranium, has led us for the present to distinguish these remains by appending the word fossil to the name of that species of which they are the prototype: but we dwell on the necessity of more extended research, and the collection of a greater series of tables of dimensions of the Indian rhinoceros, before any thing absolutely conclusive can be pronounced with regard to the fossil and existing species.

We have had no hesitation in ascribing the two limbs dug up in such close neighbourhood to the same animal; an additional confirmation of the correctness of the assumption may be derived from the proportion which exists between these two extremities, when compared with that which occurs in the Indian rhinoceros.

Ind. Rhin. femur and tibia, met. 0.960 humerus and radius, met. 0.868
Fossil Ind. Rhin. do. do. ,, 1.056 ditto do. ,, 0.947

In the first, the humerus and radius are to the femur and tibia in the ratio of 1 : 1·10; in the fossil the ratio is 1 : 1·11.

The analogy which exists between these fossil extremities and those of the Indian rhinoceros being no less striking than that which was observed between the cranium Pl. XV. and the skull of the existing species, we have considered such correspondence sufficient to prove, that the fossil anterior and posterior limbs appertained to an animal of the same species, and of about similar size to the one of which the cranium in question is a relic.

Even in the event of a much closer approximation of symmetrical proportions than that given in this paper being obtained, we are aware that identity of species could not be presumed. It could not be assumed that the skin, the external appearance of the animal, was precisely similar to that of the existing species. The fossil Indian rhinoceros must, however, have presented a figure bearing a strong general resemblance to the uncouth symmetry of its present representative.

Remarks on part of the specimens delineated in Plate XVII.

When describing the specimens of upper and lower jaws, the possibility of the existence of another species was noted. The fossil femur, of which figs. 3, 4 are representations, would be corroborative of the fact, were it not for a peculiarity which renders it somewhat doubtful whether or not it may be attributed to a species of rhinoceros. On comparing it with Pl. XVIII, the dissimilarity of the two bones will be at once apparent. The third trochanter is in fig. 3, placed about the centre of the femur, in which respect it resembles the unicorn of Java, thus described by Cuvier: "Le femur à son troisieme trochanter placé au milieu de son côte externe, large, recourbé en avant, ne remontant pas de sa pointe vers le grand trochanter lequel ne donne non plus aucune pointe pour venir à sa rencontre. L'echancrure entre eux n'est donc pas close en dehors; mais du reste elle est aussi grande que dans l'unicorne. La tête inferieure est plus enlargée en arriere." The latter remark, however, does not at all apply to the fossil, which has its inferior extremity much compressed instead of developed; so much so, indeed, that but for the other parts of the bone it could not for a moment be a matter of doubt whether or not it came from a rhinoceros.

Figs. 10, 11. Axis of a rhinoceros: the spinous process appears shorter and deeper than the one figured by Cuvier, and the main foramen more regularly circular.

Figs. 12, 13. A calcaneum which appears not to differ from that of the existing species.

Fig. 14. Tarsus and metatarsus. In this specimen the medial metatarsal bone is not so long as that of the Indian rhinoceros, but longer than that of any other species given by Cuvier. The general form corresponds with that in Cuvier's plate.

Fig. 15. Metacarpal bones: the medial one is rather longer than the same bone in the Cape rhinoceros, and considerably longer than in any other species.

Figs. 16, 17, are the external metacarpal of the left side.

Fig. 18. An astragal, which differs much from those figured by Cuvier, being higher, narrower, and more compressed.

Fig. 19. Tarsal and metatarsal bones of a rhinoceros, with the lower portion of tibia attached.

Table of Dimensions.

Measurements of the head.	Cranium. Pl. XV.		Occiput. Pl. XVII.	
	Met.	In.	Met.	In.
Height of occiput from lowest edge of occipital foramen to top of crest,	0·259	10·20	0·223	8·78
Greatest breadth of occiput, behind auditory foramen,	0·341	13·44	0·266	10·50
Least thickness of cranium at temporal bones,	0·126	4·95	..	..
Breadth between post orbital apophysis of frontals,	0·254	10·00	..	..
Distance from anterior of orbit to auditory foramen,	0·325	12·80	..	..
Space occupied by the seven molares,	0·324	12·75	..	..
Breadth across occipital condyles,	0·195	7·70	0·140	5·51
Ditto of occipital foramen,	..	..	0·0575	2·25
Height of ditto ditto,	..	..	0·049	1·90
Distance between internal extremities of glenoid facets of temporal,	..	..	0·0735	2·88
Ditto from lower edge of occipital foramen to medial post. extremity of palate,	0·368	14·50	..	..
Ditto from post. of right occipital condyle to spring of nasal arch,	0·539	21·22	..	..
Ditto ditto ditto to anterior of orbit,	0·449	17·71	..	..
Depth from edge of maxillary at 5th molar to upper surface of frontals,	0·239	9·42	..	..
Greatest transverse width of nasals at horn site,	0·174	6·86	..	..
Ditto external breadth at 6th molar,	0·246	9·72	..	..
Thickness of cranium over the medial post. extremity of palate,	0·204	8·06	..	..
Height of highest point of nasal arch above anterior of palate,	0·238	9·38	..	..
Perpendicular from a line tangential to the summit of crest and vertex of nasal arch to the depression of frontals,	0·099	3·91	..	..

Measurements of Upper Molars.		Cranium. Pl. XV.		Cranium. Fig. 3 Pl. XIX.		Fig. 1. Pl. XIX.		Fig. 2. Pl. XIX		Fig. 4. Pl. XIX.	
		Met.	In.	Met.	In.	Met.	In.	Met.	In.	Met.	In.
Greatest length											
Molar,	1	..	..	.030	1.19	.0295	1.14	.030	1.20	..	..
	2	.035	1.36	.034	1.335	.038	1.49	.0395	1.53	.039	1.49
	3	.045	1.75	.0475	1.85	.053	2.07	.056	2.17	.045	1.74
	4	.049	1.92	.058	2.26	.061	2.39	..	..	.056	2.20
	5	.044	1.69	.061	2.37	..	..	..	..	..	..
	6	.0495	1.95	..	..	..	..	..	..	..	..
	7	.0755	2.96	..	..	..	..	..	..	..	..
Greatest breadth											
Molar,	1	..	..	.024	0.95	.024	0.95	.0285	1.09	..	..
	2	.059	2.31	.0385	1.5	.036	1.40	.041	1.58	.037	1.45
	3	.080	3.15	.049	1.9	.045	1.88	.053	2.05	.051	2.007
	4	.083	3.36	.0575	2.25	..	..	..	..	.059	2.30
	5	.081	3.19	..	..	..	..	..	..	..	..
	6	.089	3.48	..	..	..	..	..	..	..	..
	7	.083	3.25	..	..	..	..	..	..	..	..

Measurements of Lower Molars.		Fig. 1. Pl. XVI.		Fig. 2. Pl. XVI.		Fig. 3. Pl. XVI.	
		Met.	In.	Met.	In.	Met.	In.
Greatest length of Molar, ...	1	.016	0.61	..	..	.017	0.67
	2	.037	1.44	.0335	1.30	.033	1.29
	3	.053	2.09	.050	1.98	.0425	1.67
	4	.047	1.82	.056	2.18	.046	1.79
	5	..	..	..	..	..	..
	6	..	..	..	..	..	..
	7	..	..	..	..	..	..
Greatest breadth of Molar, ...	1	..	..	..	..	.0115	0.46
	2	.020	0.77	.021	0.81	.018	0.70
	3	.026	1.01	.027	1.05	.025	0.98
	4	.029	1.12	.029	1.10	.030	1.19
	5	..	..	..	..	..	..
	6	..	..	..	..	..	..
	7	..	..	..	..	..	..

Measurements of Anterior Extremity.	Fig. 1. Pl. XVII.		Fig. 5. Pl. XVII.		Fig. 6. Pl. XVII.		Fossil humerus not drawn.		Fossil humerus not dwn.	
	Mt.	In.	Mt.	In.	Mt.	In.	Mt.	In.	Mt.	In.
Length of humerus from tub. to external condyle,.....	.538	21.20	.488	19.22	.482	19.0	..	..	..	..
Do. do. do. internal do.....	.492	19.38	.461	18.15	..	..	..	..	..	..
Greatest anter. post. diam. at top,.....	..	..	.218	8.60	.208	8.20	.200	7.90	..	..
Breadth across condyles, ...	.193	7.60	.183	7.22	..	..	..	..	.176	6.94
Breadth of the articulating pully,...	.119	4.70	.111	4.40	.121	4.80	.104	4.10	.109	4.30
Least diam. of the body of the humerus, ...	.078	3.07	..	..	.073	2.90	.071	2.82	.069	2.75
Length of the radius,.....	.409	16.10	..	..	..	..	..	..	..	..
Breadth at top,.....	.124	4.90	..	..	..	..	..	..	..	..
Ditto at bottom, ...	.124	4.90	..	..	..	..	..	..	..	..
Length of humerus from art. head to internal condyle, ..	.441	17.40	.393	15.51	.420	16.55	.389	15.35	.398	1570

Measurements of Posterior Extremity.	Femur&c. Pl.XVIII		Fossil femur not drawn.		Fossil femur not drawn.		Figs. 3 and 4 Pl.XVII.		Fossil femur not drawn.		Fossil femur not drawn.	
	Mt.	In.	Mt.	In.	Mt.	In.	Mt.	In.	Mt.	In.	Mt.	In.
Length of femur from ant. head to bottom of 3rd trochanter,	.449	17.70	..	..	.383	15.10	..	..	.328	12.94	.369	14.56
Length of femur from ant. head to bottom of internal condyle,	.621	24.45	..	..	.539	21.25	..	..	.510	20.10	..	..
Breadth from head to most salient part of great trochanter,	.269	10.60	..	..	..	..	..	..	..	..	..	..
Breadth across condyles, ...	.173	6.82	..	..	.143	5.63	.146	5.75	..	..	..	..
Antero. post. diam. of internal condyle, ..	.214	8.45	.221	8.70	..	..	.166	6.55	..	..	..	..
Ditto do. do. external condyle, ...	.161	6.35	.162	6.40	..	..	.139	5.48	..	..	..	..
Distance between bottom of 3rd trochanter and top of first, ...	.383	15.10	..	..	..	..	..	..	..	..	..	..
Distance between bottom of small trochanter and top of head of femur, ...	.259	10.20	..	..	.249	9.80	..	..	.215	8.50	.231	9.10
Diam. of articul. head of femur, ...	.118	4.65	..	..	.086	3.40	..	..	.089	3.50	.083	3.30
From lower side 3rd trochanter to bottom of external condyle, ...	.242	9.53	.177	7.00	.208	8.20	.266	10.50	..	..	..	..
Length of tibia from anter. tubero. to anter. edge of infer. articu. surface, ..	.435	17.15	..	..	..	..	..	..	..	..	..	..
Greatest transverse diam. at top, ...	.156	6.15	..	..	..	..	..	..	..	..	..	..
Antero. post. diam. from anter. tub. to post. ext. of internal condyle, ...	.195	7.70	..	..	..	..	..	..	..	..	..	..
Transverse diam. at bottom, ...	.128	5.05	..	..	..	..	..	..	..	..	..	..
Diam. of antero. post. internal side,.....	.086	3.40	..	..	..	..	..	..	..	..	..	..
Length of fibula, ...	.405	15.95	..	..	..	..	..	..	..	..	..	..
Breadth at bottom, ..	.064	2.54	..	..	..	..	..	..	..	..	..	..

Index to the Plates referred to in this paper ; shewing also their orders of succession.

Pl. XV. Three views of fossil cranium, (on lithographed paper.)

Pl. XIX. Views of connected and detached molars upper jaw, (copper plate.)

Pl. XVI. Ditto fragments from lower jaws, (lithographed paper.)

Pl. XVIII. Three views of femur and tibia.

Pl. XVII. A folding plate on lithographed paper, sundry bones of the extremities.

[The letters appended to the plates for convenience of reference in the MS. ; namely, A, B, C, D, E, F, have been changed in printing into Nos. XVIII, XVII, XV, XIX, and XVI. Plate F was, as before stated, spoiled in transferring it to the stone. By mistake the dimensions in Pl. XV, have been marked *one-fourth* in lieu of *one-sixth* : a material error, which it is as well to notice thus prominently.—Ed.]

Fig. 2

Fossil remains from the Sub Himalayas Rhinoceros

Fig. 1

¼ Nat. Size

Fig. 3

M.E.B.

Fig. 3

Fig 4

Fig 7

Fig. 8

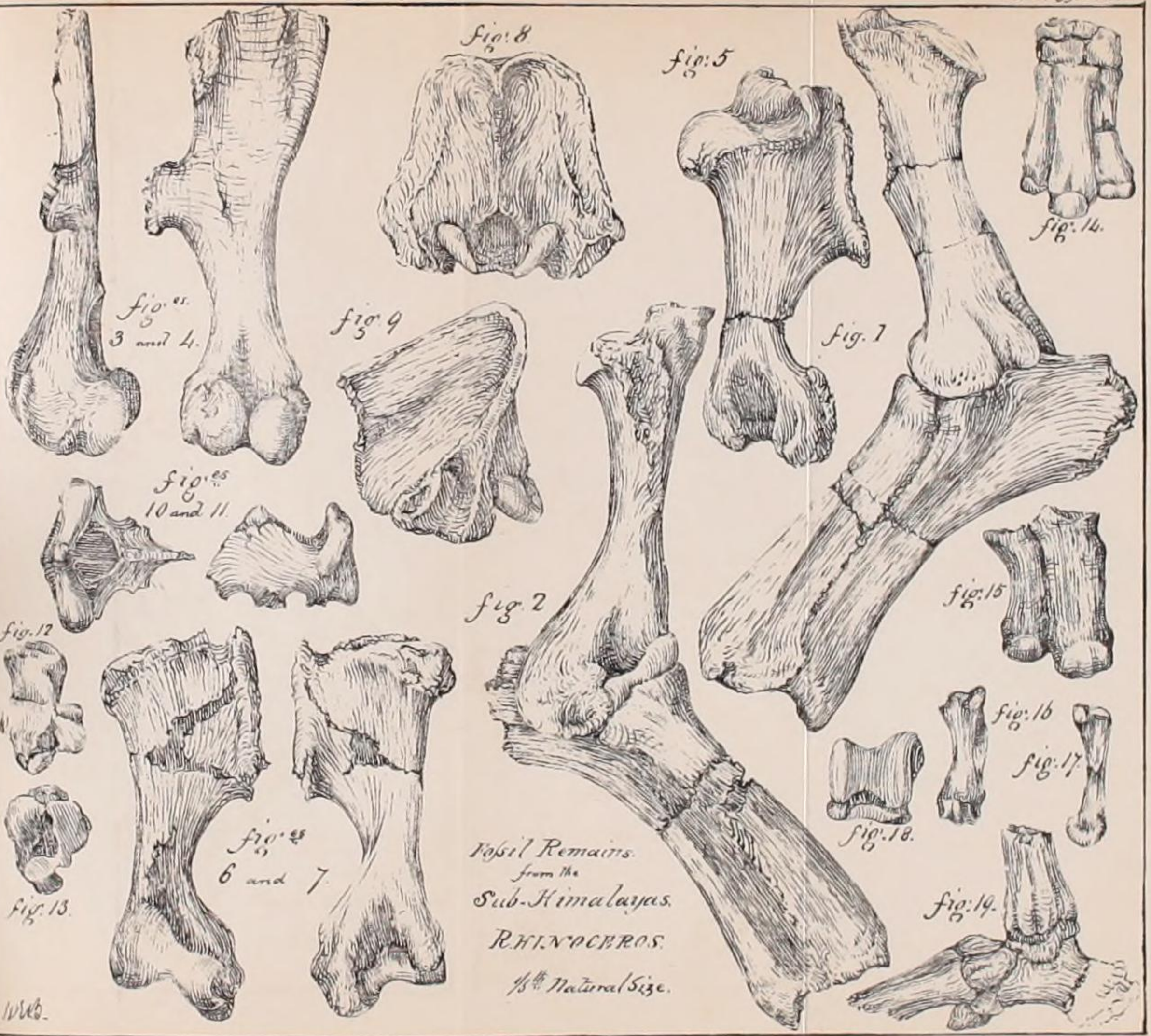
Fig. 1

Fig. 5

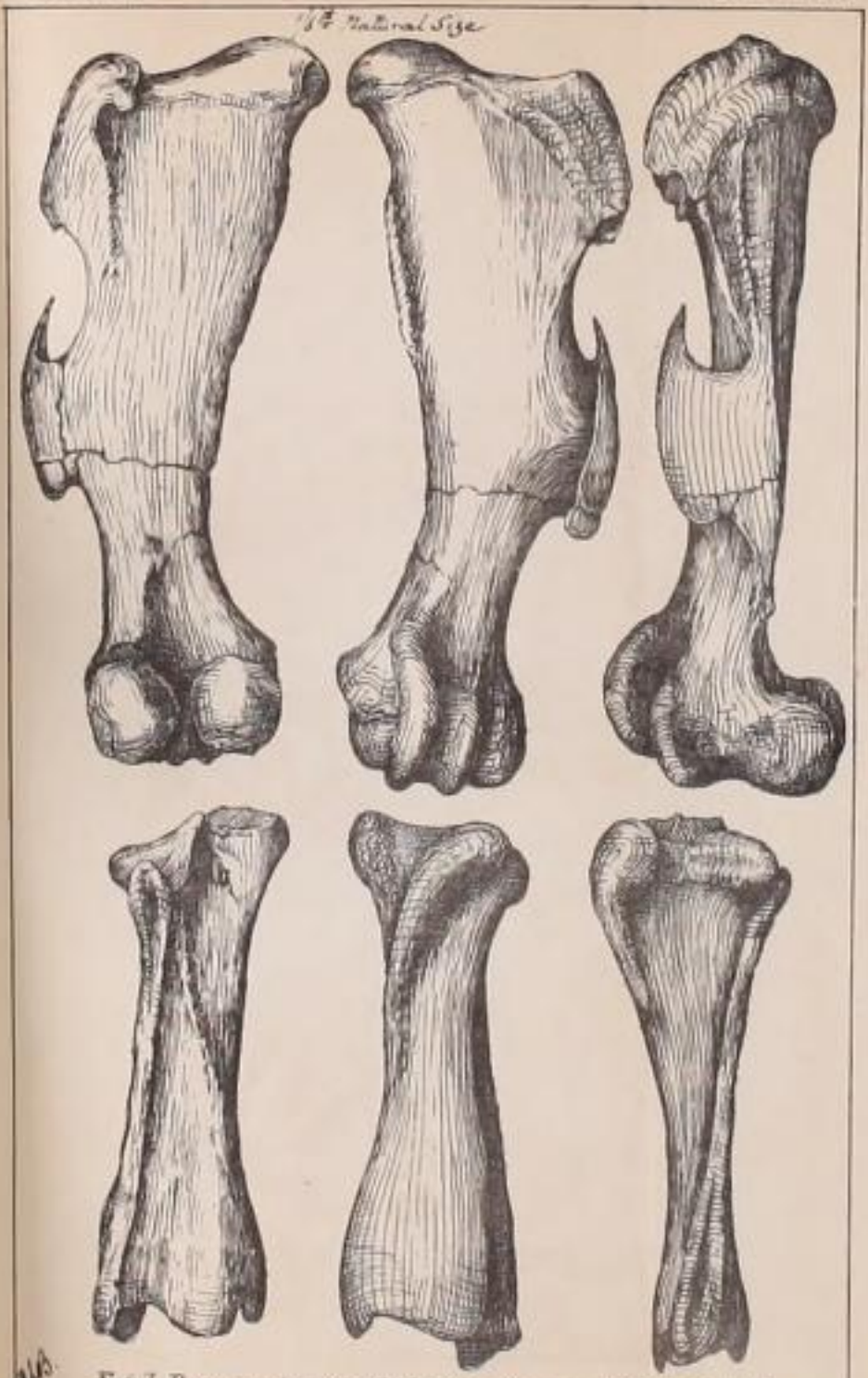
Fig. 6

Fig. 2

Fossil Remains from the Sub Himalayas RHINOCEROS. 1/3rd Nat. size.



J. B. Tawney's Lith: Press - Calcutta.



Fossil Remains from the Sub-Himalayas. RHINOCEROS

Fossil Rhinoceros of the Sub-Himalayas