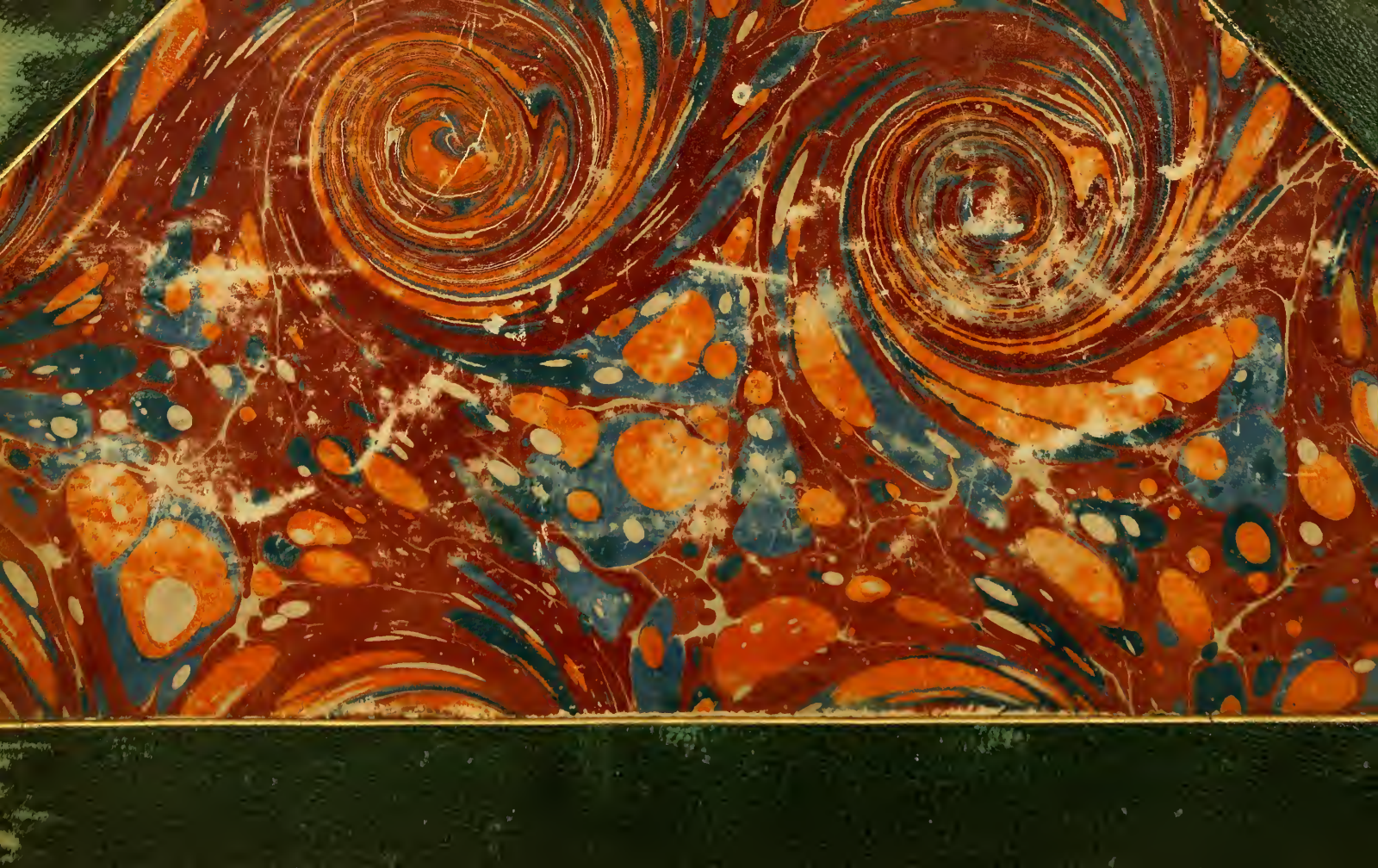

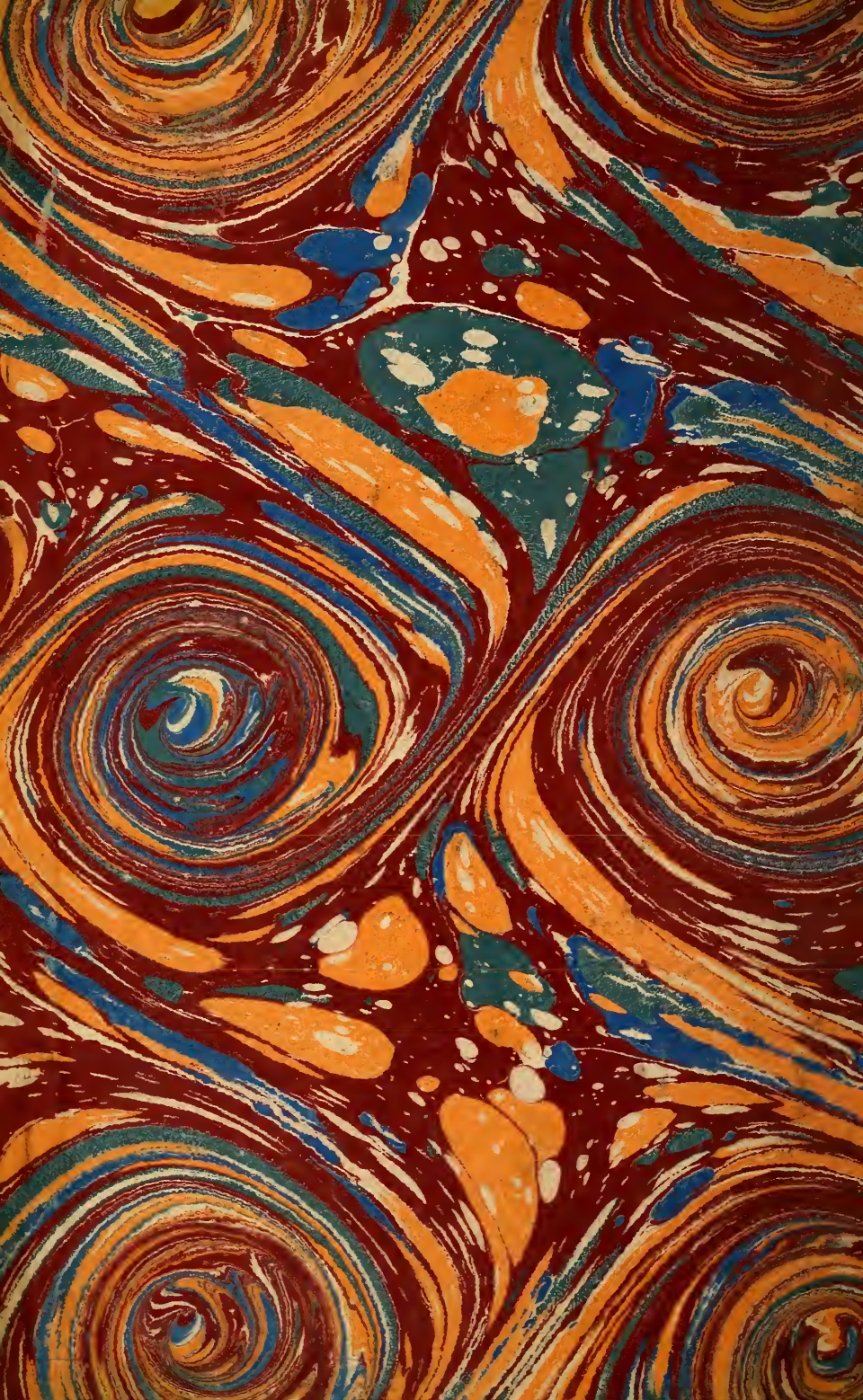

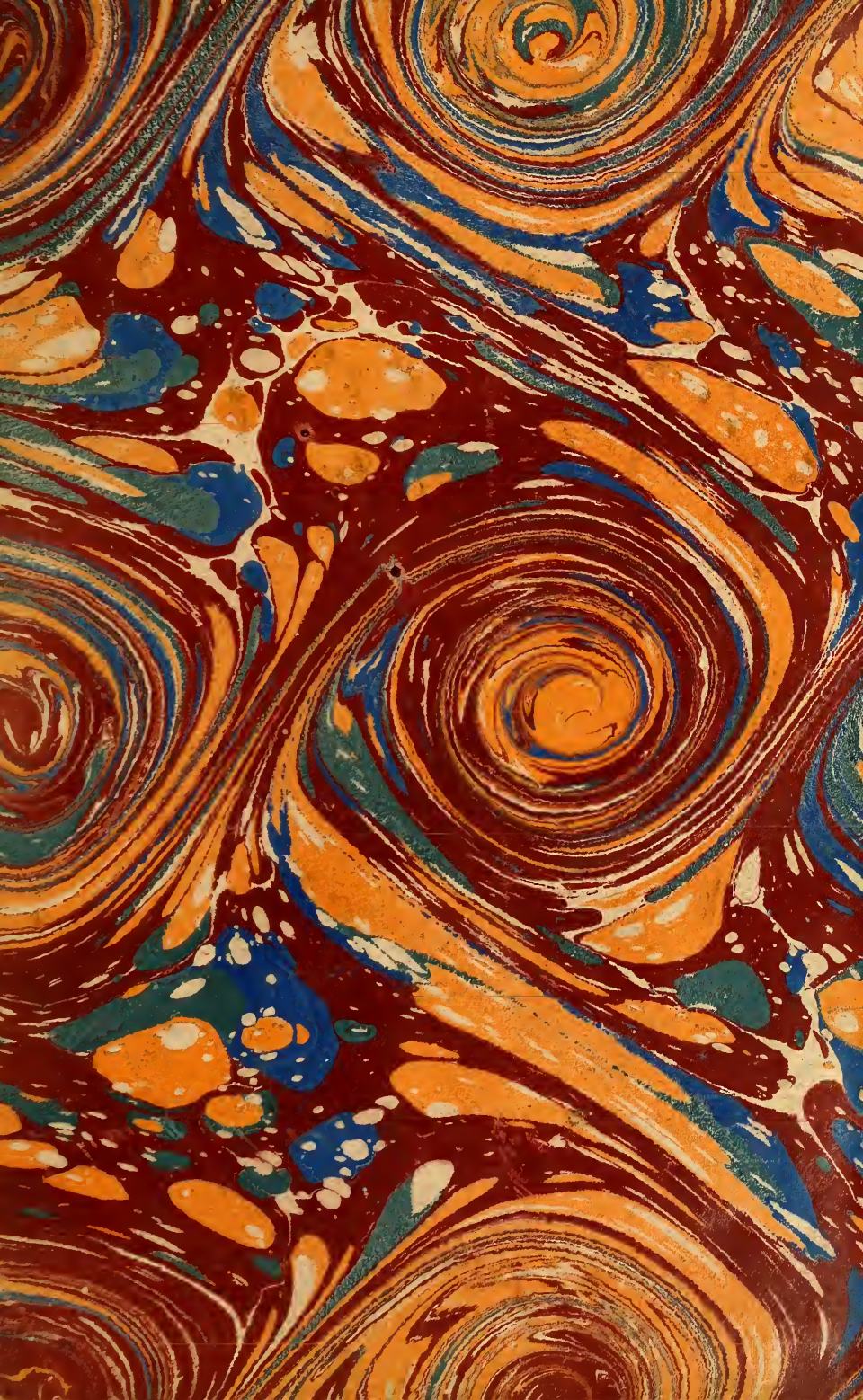

FAUNA ANTIQUA SIVALENSIS,

BEING THE

FOSSIL ZOOLOGY OF THE SEWALIK HILLS,

IN THE NORTH OF INDIA.

BY

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FAUNA ANTIQUA SIVALENSIS.

The plan which we have laid down for our guidance in the conduct of this work, is in the first place, to determine the remains of the extinct genera and species, and, on the conclusion of the systematic and descriptive details, to investigate the general results to which they lead. The advantages of this method are so obvious that it is unnecessary to insist upon them: for general conclusions in science are of little value, if the facts upon which they are founded be not in the first instance rigidly and accurately ascertained. The order to be observed in describing the different families, will depend more on the state of preparation and convenience of the materials, than upon any strict principle of zoological arrangement. This, which might be deemed objectionable in a general systematic work, is of little consequence in the case of a particular Fossil Fauna, provided that the forms in each family and genus are taken in sequence. The great palæontological work of Cuvier, opens with the Pachydermata, the Proboscidea being the first in the order of description. Following our illustrious guide in extinct zoology, we shall commence with the Elephant group, in which is most signally displayed the numerical richness of forms which characterizes the Fossil Fauna of India.

I.—PACHYDERMATA.

CHAP. I. PROBOSCIDEA.—ELEPHANT AND MASTODON.

§ 1.—General Remarks.

The fossil remains of the Proboscidean Pachydermata have in all ages attracted more attention, both from the learned and from the unlearned, than perhaps those of any other family of extinct animals. Until a comparatively late period in Europe, and at the present time in all countries where the light of anatomy cannot be brought to bear in solving the mystery of their indications, the enormous bones of this tribe, when disinterred from the earth, have been regarded as demonstrative evidence of the former existence of Titans, Giants, and other fabulous beings handed down to us in the records of superstition and mythology. Like the Greeks and Romans of old, the people of India even now, usually refer such remains to the *Rakshas* or Titans, who hold so prominent a place in the ancient writings of that country. The severe investigations of modern science, have expelled these fictions from the belief of civilized mankind; and reconstructed the true forms of the animals which appear in many instances to have given rise to them. Palæontology made, as it were, its first great advance in the exact determination by Cuvier of the Mammoth of Siberia, and the Mastodon of North America. Since that time several new forms have been discovered, and most of the great points connected with the structure of the Proboscidea, fossil and recent, have been ascertained. But, notwithstanding the vast amount of observation on the subject during late years, a great difference of opinion has prevailed among Comparative Anatomists and palæontologists, down even to the period when we now write, in regard to the degree of affinity and generic relations of the different species of Mastodon and Elephant. The majority of late authorities, including Cuvier and Owen, have regarded them as constituting two distinct and well marked, although closely-allied

genera; others have gone the length of breaking up Mastodon into two genera; while M. de Blainville has reverted to the opinion of some of the earlier observers, that the so-called Mastodons and Elephants are but modifications of one common type, differing so little from each other that all the species may, with propriety, be included within the limits of a single genus. A still greater, and vastly more important difference of opinion has prevailed, regarding the number and characters of the species: for, while the conflicting views respecting the generic distinctions concern little more than the principles of systematic classification, the accurate determination of the fossil species affects the value of facts, which implicate the accuracy of some of the most weighty arguments in the geology of the later tertiary strata, more especially such as relate to the changes of climate which are supposed to have accompanied their deposition, and the extension of the species through a wide range of time and space. Cuvier considered all the Elephant remains which have been found in Europe, the north of Asia, and America, whether occurring in the superficial drift of Siberia, or in the tertiary beds of the Val d'Arno, to belong strictly to a single species, *Elephas primigenius*. Professor Owen, with all the lights, and wielding every arm of an advanced science, holds the same opinion. M. de Blainville does not think that there are sufficient characters, even for separating the Mammoth from the existing Indian Elephant, both of which he appears to regard as varieties of the same species.[1] On the other hand Nesti, after a careful study of the Elephant remains of Italy, during a period of nearly twenty years, upon an ample collection of the best materials in the form of crania, jaws, and teeth, insists upon the specific distinctness of the Tuscan fossil Elephant, *E. meridionalis*, from the true Mammoth of Siberia. Other palæontologists have gone so far as to construct ten species out of the single species of Cuvier, founding the distinctive characters upon the differences presented by the molar teeth. A like range of conflicting opinions has prevailed in regard to the Mastodons. Cuvier, Owen, and de Blainville,

[1] De Blainville, Ostéographie; Elephants, p. 222.

concur in restricting the narrow-toothed Mastodons of Europe to a single species, the geographical range of which Cuvier extended even to South America: while Croizet and Jobert, Kaup, Von Meyer and others, divide them into two, *M. longirostris*, and *M. angustidens*. No less than two genera, and at least ten nominal species have been founded upon teeth which Owen, de Blainville, and most other authorities, attribute merely to different ages and sexes of a single species, the *M. Ohioticus* of North America. In short, the ascertained fossil species,—exclusive of those of India—according to some, are limited to one Elephant, and four or five Mastodons; while others would raise the number of the former to ten, and of the latter to upwards of twenty.

This great diversity of opinion, almost unequalled in regard to any other section of mammalian palæontology, has in a great measure arisen from the isolated and often defective nature of the materials relating to this tribe, as they ordinarily come before the palæontologist. From the peculiar mode of succession of the molar teeth, which yield the principal distinctive characters in Mastodon and Elephant, by repeated renewals from back to front, at different stages of the animal's growth, as the worn and exhausted grinders drop out, a limited number only of the whole series can be met with in any one fossil specimen, even under the most favourable conditions. It is this peculiarity which has so long retarded the attainment of an accurate knowledge of the dentition of the living species. The difficulty applies with double weight to the fossil species,[1] for the teeth are rarely met with in connexion with perfect crania and jaws: they most frequently occur detached, or connected with mutilated fragments. It is only, therefore, from the comparison of an extensive series of specimens,

[1] In illustration, it may be mentioned, that Eichwald (Nova Act. Acad. Nat. Curios. 1834, vol. xvii. p. 735, tab. liii. fig. 2), in a memoir descriptive of fossil remains of Elephas, Mastodon, and Dinotherium, &c., found in Poland, figures and describes what appears to be a fragment of the symphysis of the *lower jaw* of *Dinotherium giganteum*, as a portion of the *upper jaw* of a new species of Mastodon, which he names *Mastodon Podolicus*. Other equally remarkable cases of the same kind might be adduced, so unsafe is it to draw conclusions regarding the fossil Proboscidea from imperfect materials.

embracing every period of life and the range of individual and sexual varieties through which the species runs, that any safe conclusions can be drawn regarding the distinctive characters of any one form. In consequence, although palæontologists are agreed on the great points relating to the construction of the head, trunk, and extremities, hardly any two concur respecting the number, form, and succession of the teeth in the different species of Mastodon and Elephant.

The surprising number of forms belonging to this family, embraced in the Fossil Fauna of India, and the immense abundance in which their remains have been met with, have placed us perhaps, with respect to the quantity and perfect condition of the materials, in more favourable circumstances for the determination of the Sewalik species, than has ordinarily happened to the palæontologist in the case of most of the other fossil Proboscidea. Of five of the species to be described in the sequel, we possess nearly perfect crania of each, and, in most of the instances, crania with teeth of all ages, from the very young up to the adult animal, in addition to a vast collection of the detached teeth and lower jaws, so as to furnish us with the whole of the essential evidence requisite for the specific determination of each of these forms. The distinctive characters are so broadly marked, that there is hardly room for a doubt being entertained in regard to them. In the course of the investigation we have been led to examine the conclusions which have been arrived at by writers who have preceded us upon this family. The Indian species, and those previously described, fossil and recent, have mutually reflected light on each other, and ranged themselves into natural and allied groups. Instead, therefore, of restricting ourselves merely to a description of the Sewalik fossil forms, we shall endeavour, in what follows, to trace the affinities, and institute an arrangement of all the well-determined species in the family.

The results to which we have been conducted, lead us to differ on certain points from the opinions most commonly entertained at the present day; for while, on the one hand, it would appear that the fossil species of both Elephant and Mastodon have been unne-

cessarily multiplied by authors both in Europe and America, on the other, we are compelled to think that Cuvier, and others, have run into the opposite extreme of caution, and in more than one instance included distinct forms under the same nominal species. Further, in regard to the views which have been at different times advanced respecting the differential characters of Elephant and Mastodon, in the succession and development of the series of molar teeth, our conclusions are, in some measure, at variance with those of most other palæontologists who have preceded us upon this family.

Before entering upon the description of the species, we shall examine, at some length, the general characters presented by the teeth; but in order to comprehend the present state of knowledge on this branch of the subject, it will in the first instance be necessary to pass briefly under review the leading opinions which have been entertained by palæontologists regarding the relations of Mastodon and Elephant to each other, and to notice the successive steps in the discovery of new forms, which have led to the modifications of these opinions.

It is beside our object to give anything like a historical account of the labours of the earlier writers. Those who are desirous of the information, will find it detailed in the great work of Cuvier, down to the period at which he wrote: and for subsequent opinions, they may consult the 'Ostéographie' of de Blainville, now in course of publication, and the writings of Professor Owen, Bronn, von Meyer, Kaup, and other palæontological authors.

Notwithstanding the earlier contributions of Daubenton, Pallas, Merck, and the elder Camper, hardly anything was known regarding the succession of the teeth in the Elephant, except that they are repeated oftener than once during life, by protrusion in the jaws from behind forward, till the appearance of the memoir by Corse,[1] in the Philosophical Transactions of 1799. This excellent and careful observer had resided many years in India, in charge of a Government stud of Elephants in Bengal. By captures of herds of the wild animal he had an opportunity of watching the

[1] Corse, Phil. Trans. 1799, vol. 89, p. 205.

successive fall and renewal of the teeth, from the youngest age up to the adult, the periods of which he carefully recorded; and casualties supplied him with a series of upwards of thirty crania of all ages, upon which he studied the form, size, and the number of plates which enter into the composition of the grinders at different stages of the animal's life. The observations embodied in this memoir are the most valuable which have been made on the teeth of either of the living species. Corse first showed that the Indian Elephant has 'milk' tusks (incisors) which cut the gum when the calf is about six months old, but are extremely caducous, as they drop out between the first and second year. He detected the position of the capsule of the permanent tusks, which protrude about two months after the milk incisors are shed, and go on increasing in size during the rest of the Elephant's life. He has described the variations in size, form, and direction which the tusks present in the different sexes and castes of the Indian species, the general character of which castes he has accurately recorded; but the most valuable part of his observations is comprised in what relates to the molar teeth. He showed that they are reproduced several times during life, and that the number of plates entering into the composition of each molar goes on increasing as the teeth are successively renewed. This succession he has carefully traced up to the fourth grinder; the first cuts the gum eight or ten days after birth, is well out at six weeks, and is composed of four plates; the second is completely in use at two years, and consists of eight or nine plates; the third serves the period between the second and sixth year, and has twelve or thirteen plates; the fourth is in use between the sixth and tenth year, and consists, according to Corse, of about fifteen plates. Puzzled, probably, by the irregularity in the number of plates and the size of the rest of the molars in different individuals, this faithful observer stops short at the point where his observations ceased to be conclusive, and does not attempt to define the number of plates in those which follow after the fourth. He states, generally, that the plates go on increasing successively up to the 'seventh or eighth set,' when each grinder consists of twenty-two or twenty-three plates

being the greatest number which he had observed.[1] These observations were of especial value in furnishing a standard of comparison for the teeth of the fossil species; and by establishing the existence of milk incisors, they proved that part at least of the dental system of the Elephant agreed with that of the ordinary Pachydermata. But Corse was at fault in the conjecture that eight molar teeth are successively developed in an antero-posterior series in this animal; for if this were the case, the Elephant would form an exception to a general law in the Pachydermata and allied orders, among which the normal number of milk molars does not exceed four, that of the true molars being invariably three.

Notwithstanding this objection, Corse's numerical statement was adopted by Cuvier and by all other authors prior to 1844, when it was, for the first time, challenged by M. de Blainville in the part of his 'Ostéographie' devoted to the Elephants. Bronn,[2] in his 'Lethæa,' gives eight molars on each side of both jaws to the genus Elephas; and Dr. Grant,[3] in his memoir upon the Proboscidea, puts forward different dental formulæ in the molars, as points of generic distinction between Elephant and Mastodon, attributing eight molars in each side to the former, and only six to the latter.

Cuvier, except in what regards his hypothetical explanation of the formation of the dental tissues, has described with admirable clearness, and in great detail, the structure and mode of growth of the teeth in the Elephant. But he had assuredly arrived at no accurate idea of the true division of the molar series into milk and permanent grinders. He makes no attempt to show where the deciduous series terminates and the true molars begin, although so particular upon this point in his descriptions of the dental system in the ordinary Pachydermata and Ruminantia. In fact, the term 'dent de lait' is but rarely applied in his Elephant descriptions; and in these instances, it has evidently reference more to the immature age of the animal, than in the ordinary sense of a deciduous tooth which is expelled by a vertical successor. Having

[1] Corse, *loc. cit.* p. 224.

[2] Bronn, Lethæa Geognostica, 1838, p. 1240.

[3] Grant, Geolog. Proceedings, 1842, vol. iii. p. 771.

adopted the excessive numerical formula of Corse, this great anatomist was led to believe that the successional premolars, instead of being suppressed, are developed behind the milk teeth. The language in which this remarkable opinion is expressed is clear and explicit :—" L'on pourroit dire que les dents de remplacement de l'Eléphant viennent derrière ses dents de lait, au lieu de venir dessus ou dessous, comme dans les autres animaux."[1]

The discovery of the entire set of molars in *Mastodon Ohioticus* by Dr. Hays,[2] in 1834, and in *M. longirostris*, by Dr. Kaup,[3] in 1835, had clearly established that the antero-posterior series in these species does not exceed six, and paved the way for an accurate knowledge of the dentition of the Elephant, when M. de Blainville published, in 1844, the osteographical memoir upon this genus, contained in his great work. This distinguished Anatomist, in his remarks upon the dentition of the Dugongs, first states that the Elephants (in which he includes the Mastodons) have neither milk teeth nor vertical successional teeth.[4] His words are—" Ainsi l'on peut dire que chez les Dugongs et chez les autres Lamantins, ainsi que chez les Eléphants, il n'y a ni dents de lait ni dents de remplacement, comme chez la plupart des autres mammifères ; celles-ci poussant, pour ainsi dire, celles-là de bas en haut, et formant ainsi deux rangées superposées ; mais que toutes les dents que doit avoir l'animal dans le cours de sa vie entière forment une seule ligne, un seul rang, un sort de boyau cylindrique, qui se développe d'arrière en avant dans le canal dentaire, dont l'enorme diamètre est en partie dû à cette particularité. C'est quelque chose de semblable à ce qui existe dans les Eléphants." This statement is subsequently modified in the portion of the work devoted to the Elephants. M. de Blainville there prefers a claim to having first indicated the normal number, the mode of succession, and the true signification of the molar teeth in this genus.[5] He

[1] Cuvier, Oss. Fossil. tom. i. p. 39, 4to edit. 1821.

[2] Hays, Amer. Phil. Trans. vol. iv. p. 320, 1834.

[3] Kaup, Oss. Fossil. pt. iv. p. 65-89, 1835.

[4] De Blainville, Ostéographie, 'Manatus,' p. 75.

[5] *Loc. cit.* p. 58. "Aussi dans aucune ouvrage le nombre normal, le mode de succession des dents molaires de l'Eléphant, et leur signification réelle, n'ont pas été deter-

admits, on the evidence of Corse, milk and permanent incisors, but sees no occasion to apply a similar division of 'milk' and 'permanent' to the molar series. He follows their succession from first to last, and vindicates the first part of his claim, by showing that in the existing species, and probably in the Mammoth, the number of developed grinders is neither more nor less than six. But in regard to their signification, viewed as a series, we cannot, with every respect for this eminent Anatomist, admit that he has been equally successful. He divides the six molars into three sets, each consisting of two teeth; the first includes the two anterior molars, which are characterized by being worn out in the part of the jaw where they first protrude; the second set is characterized by being formed in the posterior part of the jaw, and at last pushed out in front; and the third set, formed behind like the two preceding teeth, is characterized chiefly by serving the adult stage of the animal's life, and by the greater space which the teeth have to traverse in progressing forwards. This, however, is at best but an ætal division, and cannot be received as a philosophical interpretation of the theoretical signification of the molar series: for the second of these sets groups together the last milk and the first permanent molar. Further, M. de Blainville expresses, by a numerical formula,[1] his view of the dental system of the Elephant, which, if interpreted according to the exposition of his peculiar method of symbols, laid down in the first part of the Ostéographie, would imply that the Elephant has three premolars and three back molars, the milk series being suppressed: whereas, in the three species of which the dentition is known, it is in reality, the three milk molars that are invariably developed, while the three premolars are constantly suppressed.

Professor Owen, down to the close of 1844, appears to have held with Cuvier the opinion that the developed molars in the

minês, ce que nous croyons pouvoir faire aujourd'hui d'une manière positive, en nous aidant, il est vrai, des dents fossiles que possèdent nos collections en plus grand nombre peut-être que des dents récentes."

[1] *Loc. cit.* p. 75. The formula given is $\frac{1}{0} + \frac{0}{0} + \frac{3}{3} + \frac{1}{1} + \frac{2}{2}$. The signification of these figures, indicated in the opening memoir "Sur les Mammifères en general," p. 34, is $\frac{1}{1}$ in. + $\frac{0}{0}$ can. + $\frac{3}{3}$ avant mol. + $\frac{1}{1}$ princip. + $\frac{2}{2}$ arrière mol.

Asiatic Elephant amounted to seven or eight. This number, adopted on the authority of Corse, is stated in his 'British Fossil Mammalia.'[1] But it was not likely that the true numerical formula would escape the sagacity of this eminent Comparative Anatomist when directed to the teeth of the Elephant in connection with those of the ordinary Pachydermata. Accordingly, in the last part of his Odontography, while he agrees with M. de Blainville in attributing six molars on each side of the jaws to this genus,[2] he has made a considerable step in advance of the latter Anatomist in regard to their signification. The occurrence of a vertical successional premolar in the upper jaw of one or more species of Mastodon had previously established that the two anterior grinding teeth in that genus are displaced, like the milk teeth in the ordinary Pachydermata, by a vertical successor. Professor Owen follows up this indication to its legitimate conclusion, and infers that the third molar in the series of antero-posterior succession in the Mastodon, is the last milk molar, the vertical successional tooth by which it ought, normally, to be pushed out, usually remaining undeveloped. He then extends this view to the dentition of the Elephant, and states that 'it is probable that the three preceding teeth' (namely the three first developed molars) 'are analogous to the true deciduous molars of the ordinary Pachyderms.'[3] The correctness of this opinion is susceptible of demonstration by the dentition of an Indian fossil species which we have named *Elephas planifrons*, to be described in this work. The determination of the point was of great zoological interest, by explaining the apparent anomaly which had hitherto divided the teeth of the Elephant from those of the allied families in the order.

Next, in regard to the establishment of the species.—The fossil remains of the Mammoth had, during ages, attracted more or less attention in every country in Europe, having been found in England and in all parts of the Continent, from Italy to Siberia. But it was only towards the close of the last century that definite

[1] Owen, Brit. Foss. Mammal. part v. p. 225.

[2] *Idem*, Odontography, 1845, p. 626, and note p. 635.

[3] *Id. loc. cit.* p. 634.

notions as to the species, were arrived at. Pallas, who had better opportunities for determining the point than any of his cotemporaries, upon the perfect remains so commonly met with in Russia, erroneously considered the fossil teeth to be identical with those of the Indian species. A great advance was made in the inquiry through the discovery, by Peter Camper, of the specific difference between the teeth of the Asiatic and African Elephants,[1] when Blumenbach and Cuvier almost simultaneously entered upon the investigation, and arrived at the same result, viz., that the Mammoth was an extinct form, differing from both of the existing species. Struck with the length of the cranium, and of the incisive sheaths in the Mammoth, as represented in the figures of Messerschmidt's specimen attached to Breyne's excellent remarks in the Philosophical Transactions,[2] and connecting these peculiarities with the great width of the crown, and the narrowness and number of the plates in the fossil grinders, Cuvier was conducted to his first happy conclusion. The probability of a similar difference characterizing the species in other fossil genera, flashed across his mind, and opened to him new views respecting the theory of the earth. Great and important were the results; and after they had been achieved, the illustrious Anatomist reverted, in terms of the liveliest acknowledgment, to the long neglected figures of Messerschmidt, which had helped him to the first idea.[3]

After determining the specific independence of the Mammoth, the next point to ascertain was, whether the remains occurring in very different deposits, and in localities widely contrasted in climate and in geographical position, belonged to the same or to different species. Notwithstanding that the fossil teeth from the southern parts of Europe commonly presented wider and fewer plates, with thicker enamel, than those of the typical form of Mammoth found in Siberia, Cuvier attached minor importance to these differences, as the teeth agreed in certain other respects; and he ranged the whole under the single species of *Elephas primigenius*.

[1] P. Camper, Déscript. Anatom. d'un Eléphant male, p. 16.

[2] Phil. Trans. vol. xl. 1738, p. 124.

[3] Cuvier, Oss. Fossil. tom. i. p 178.

This opinion has been very generally adopted by subsequent authors, among others, by M. de Blainville, and by Professor Owen, who has entered at considerable length upon the question, in his 'British Fossil Mammalia,' and decided in favour of the specific unity of the European forms. But notwithstanding this array of authority, we cannot help thinking that Cuvier was premature in his conclusion, and that the identity of the forms has rather been assumed against the evidence, than proved by it. Had the differences in the teeth been less considerable than they are known to be, it would have been requisite to show that the crania at least agreed, before this identity could be considered to have been satisfactorily established. But there were not sufficient materials for making such a comparison when Cuvier wrote. The cranium of the Siberian Mammoth was known to him only through figures of five specimens, not one of which was drawn in any exact projection; and his acquaintance with the Italian fossil Elephant, exclusive of teeth, was limited, in regard to the head, to a single mutilated fragment, not extending above the orbits and maxillary bones. There is little doubt, also, that like other writers, he was partly swayed by the extraneous consideration of the geographic range of the two existing Elephants, the continents of Asia and Africa having each but a single species. We have the less hesitation in advancing these doubts, as conclusive proof will be adduced in the sequel that, in the similar instance of the *Mastodon angustidens*, Cuvier and others have included under that name two forms which are so distinct that, in our view, they do not even belong to the same section of the genus; while the Sewalik fossil remains show that there were formerly several species of Elephant at one time in the same Fauna in India.

Soon after the publication of Cuvier's Memoir, Nesti, in 1808, proposed an addition to the European fossil species, founded on remains from the Val d'Arno.[1] He put forward two new species: the first, resting on a lower jaw without teeth, was characterized by a peculiar spout-shaped prolongation of the symphysial apophysis; the second, which he named *E. mini-*

[1] Nesti, Annale del Museo de Firenze, tom. i.

mus, also resting upon a lower jaw, was distinguished by its supposed small size, by the absence of the beak apophysis, and by the rhomboid section presented by the plates of the grinders. Cuvier refused to admit either of Nesti's species. The lower jaw of the first he pronounced to belong rather to *Mastodon angustidens* than to an Elephant; and the second to be nothing more than the lower jaw of a young individual.[1] Nesti, after a long silence, reverted to the subject in 1825, in a memoir which embodied the results of extensive observations carefully made during seventeen years.[2] He tacitly admits the justness of Cuvier's criticism in regard to the second species, by abandoning *E. minimus;* but in confirmation of his first species he adduces a great mass of evidence derived from numerous crania of all ages, from the fœtus up to the adult; and from lower jaws in the Florence and other Tuscan musea,—all of which, he affirms, show the peculiar beak elongation of the symphysis in connection with Elephant's teeth. The result of the whole was to remove every doubt or hesitation from his mind regarding the distinctness of the Tuscan species, for which he proposes the specific name of *E. meridionalis*.

The value of the evidence regarding this species will be more fully considered in the sequel. Nesti's opinion, however, has met with little favour among palæontologists. Croizet and Jobert have adopted it for some of the elephant remains found in Auvergne,[3] and the name finds a place in the enumeration of species given in von Meyer's 'Palæologica.'[4] But it is not admitted by Bronn,[5] de Blainville,[6] or Pictet;[7] and it would appear from certain passages in the 'British Fossil Mammalia,' that the great weight of Professor Owen's authority is against it.[8]

[1] Cuvier, Oss. Fossiles, tom. i. p. 186.
[2] Nesti, Nuovo Giornale de Letterat. Pisa, 1825, tom. xi. p. 119.
[3] Croizet et Jobert, Oss. Foss. du Puy-de-Dôme, 1828, p. 123.
[4] Von Meyer, Palæologica, 1832, p. 69.
[5] Bronn, Lethæa Geognostica, 1838, p. 1245.
[6] De Blainville, Ostéographie; Elephants, p. 220.
[7] Pictet, Palæontologie, 1844, tom. i. p. 243.
[8] Owen, Brit. Foss. Mamm. p. 239.

In 1821 Dr. Goldfuss[1] described a fossil grinder found in a collection at Cologne, which resembles very much that of the African Elephant, in the characteristic peculiarities of the rhomboid form and reduced number of the grinding plates. He states that the specimen, although the precise locality was unknown, has the cement and ivory as much decomposed as in the fossil grinders from Siberia. In a second memoir[2] he figures and describes other teeth presenting the same characters, from the banks of the Rühr, in Westphalia, and concludes from them that the valley of the Rhine had formerly an Elephant, which was more closely allied to the African, than the Mammoth was to the existing Indian species. He proposed naming it provisionally *Elephas priscus*.

Cuvier threw very strong doubts upon the authenticity of these specimens as veritable fossils, in consequence of the ambiguous circumstances under which they were found. He considered them to be nothing more than disguised remains of African elephants of modern origin.[3] But according to Bronn, fossil teeth of the same description have since been found, under circumstances fully to be depended upon, throughout nearly the whole of Central Europe, from the Rhine to the heart of Russia.[4] Some of them have been described by Wagner;[5] and undoubted fossil teeth, presenting similar characters, have been met with in the 'brick earth' beds of the valley of the Thames, at a considerable depth below the surface. These will be noticed afterwards in connexion with the dental series of one of the Indian fossil species.

Fischer de Waldheim, in 1829, proposed the separation from the Mammoth of no less than five fossil species of Elephant, founded upon remains occurring in Russia. These he has severally named—*E. proboletes*, *E. campylotes*, *E. Kamenskii*, *E. Panicus*, and *E. pygmæus*.[6] Dr. Eichwald went still further, and added a sixth species, from Poland, under the name of *E. odontotyran-*

[1] Goldfuss, Nov. Act. Acad. Leop. Carol. Natur. Curios. vol. x. p. 485.

[2] *Idem, loc. cit.* vol. xi. p. 485.

[3] Cuvier, Oss. Fossiles, tom. ii. (8vo edit.) p. 184.

[4] Bronn, Lethæa Geog., p. 1244.

[5] Wagner, Karsten's Archiv. xvi. p. 21.

[6] Fischer de Waldheim, Bullet. de la Soc. de Moscou, 1829, tom. i. p. 275; Mémoires de la Soc. de Moscou, tom. i. p. 285.

nus.[1] But the almost universal consent of palæontologists is against these so-called species; which are considered to be nothing more than varieties in the teeth, dependent upon age and sex in individuals of the Mammoth.

M. Morren, under the name of *Elephas macrorhynchus*, has lately proposed a new species for some of the fossil remains found in Belgium; but the grounds upon which it rests do not appear to be more valid than in the case of the Russian and Polish species.[2]

Mastodon.—In regard to Mastodon: the first determined species of this genus was the *M. Ohioticus*[3] of North America. The abundant remains found nearly all over the temperate parts of the United States had, as in the instance of the Mammoth of Europe, attracted the notice of observant travellers to this great extinct animal, upwards of a century ago. But, till the time of Daubenton, hardly any progress had been made towards a definite idea of its nature. This celebrated naturalist, in 1762, ascertained the close resemblance of the femur and tusks to those of the Elephant: but the molars appeared to him to present a nearer approach to the teeth of the Hippopotamus, and he was puzzled whether to ascribe the fossils to one or to two distinct animals.[4] Buffon participated in these doubts, but inferred that a part of the remains indicated the former existence of a terrestrial animal which had become extinct, larger than the Elephant.[5] Peter Collinson, in the *Philo-*

[1] Eichwald, Nova Acta Acad. Cæs. Leop. Car. Natur. Curios. 1834, vol. xvii. p. 723, tab. 63, figs. 1 and 2.

[2] Morren, Bulletin de la Soc. Géol. de France, tom. ii. p. 231.

[3] As in the case of the Mammoth (*E. primigenius*, Blum.) the specific name given by Blumenbach to the North American Mastodon, *M. Ohioticus* is here adopted instead either of *M. giganteum* or *M. maximus*, the names applied by Cuvier at different times. Blumenbach, in his 'Handbuch der Naturgeschichte,' had characterized the extinct animal by the form of the teeth, and called it *Mammut Ohioticum*, as a species of a peculiar genus, before the appearance of Cuvier's memoir (Annal. du Mus. tom. vi. p. 260, 1805), in which the designation of *M. giganteum* is first applied. This latter was abandoned (Oss. Foss. 4to edit. of 1824), for *M. maximus*. If the law of priority left a choice, *M. Ohioticus* would still be preferable to either of the names given by Cuvier, as the species is by no means the giant of the family.

[4] Daubenton, Actes de l'Académie des Sciences, 1762; and Histoire Natur. de Buffon, tom. xi.

[5] Buffon, Histoire Natur. tom. xi. p. 86.

sophical Transactions for 1768, gave some good figures of the back grinders, and shrewdly observed that the form of their crown was adapted for crushing boughs, twigs, and leaves, betokening the animal to have been of herbivorous habits.[1] William Hunter, struck with the great contrast between the salient enamel ridges of these teeth and the narrow plated flat surface in the grinders of the Elephant, inferred the American fossil to have been a gigantic carnivorous animal, which he proposed naming *Pseudelephant*.[2] The great reputation so justly attaching to the name of Hunter gave undue weight and a wide currency to this very erroneous opinion, and further led to the Mammoth of Siberia being commonly confounded under the same carnivorous notion with the Mastodon of North America.

Peter Camper, in the first instance, made a considerable step towards an accurate knowledge of the extinct animal, by the inference that its molar teeth had a greater analogy with those of the Elephant than of the Hippopotamus; and that, like the former, it was probably invested with a trunk and with tusks:[3] but he afterwards expressed doubts which compromised the value of his original observations, having been led to adopt the opinion of Michaëlis, that the animal belonged to the order *Bruta* of Linnæus; that it had no tusks, and differed greatly from the Elephant.[4] This error, as has been explained by Cuvier, arose from the inspection of a detached palate with grinders, the posterior part of which was mistaken, both by Michaëlis and by Camper, for the anterior.[5]

Pennant first ventured, in 1793, to designate the American fossil animal in a systematic work as a species of Elephant, by the name of *E. Americanus;* and Blumenbach, in 1797, erected it into a kind of genus, under the name of *Mammut Ohioticum*, which he briefly characterized by the form of the teeth. Cuvier in his earliest memoir on the Elephant, described it also as a

[1] Collinson, Phil. Trans. 1768, vol. lvii. p. 469.
[2] W. Hunter, Phil. Trans. vol. lviii. p. 38.
[3] Camper, Acta Petropolit. tom. i. part 11, p. 219.
[4] *Idem, loc. cit.* tom. ii. p. 259. [5] Oss. Foss. tom. i. p. 212.

species of this genus under the specific designation applied by Pennant of *E. Americanus*,[1] for which Adrian Camper, entertaining the same opinion of its generic relations, proposed the substitution of *E. macrocephalus*.[2] But in his second extended and elaborate memoir, published in 1805, which formed the groundwork of what he has written on the subject in the 'Ossemens Fossiles,' Cuvier separated the Elephants with mammillated molars from the ordinary forms with lamelliform molars, and united the former into a genus which he designated *Mastodon*, taking the North American species, under the name of *M. giganteum*, as the type.[3] In the interval between these two memoirs, Peale made the important discovery of two skeletons of the Ohio Fossil, near the banks of the Hudson River, in the State of New York, one of which was brought to Europe in 1802, and furnished nearly complete materials, for instituting a detailed comparison between the osseous frame of the Mastodon and of the existing Elephants.[4] Cuvier pointed out the entire correspondence between them in the tusks, trunk, and the whole of the skeleton, except the molar teeth. He admitted, even in regard to the latter, that the difference between the transverse mammillated ridges of the Mastodon, and the thin plates of the Elephants, is merely one of proportion; but insisted that there is an essential distinction in the circumstance that the spaces between the enamel ridges are filled with 'cement' in the teeth of the Elephant, which is wanting in those of the Mastodon. In addition to this supposed difference, he found corresponding modifications in the form of the cranium, which confirmed him in his view of a well-marked generic distinction between *Mastodon* and *Elephas*.[5] In the same memoir, Cuvier characterized four

[1] 'E. Americanus, molaribus multicuspidibus lamellis post detritionem quadrilobatis." Cuvier, Memoir. de l'Institut. Ann. vii. (1798.) 'Sur les espèces d'Eléph. viv. et foss,' p. 21.

A Camper, 'Descript. Anatom. d'un Eléphant Male,' Avant Prop. Note, p. 10.

[3] Annales du Muséum d'Histoire Naturelle, tom. viii. 'Sur le grand Mastodonte.'

[4] R. Peale, 'Account of the Skeleton of the Mammoth,' &c.; and 'Historic. Disquisit.' 1802 and 1803.

[5] Oss. Foss. tom. i. p. 221.

other species of his new genus, viz., *M. angustidens*, in which he included all the narrow Mastodon molars found in Europe, together with some from America; two species from South America, *M. Andium* and *M. Humboldtii;* and a small European species which he named *M. minutus*. To these were subsequently added, in the 'Ossemens Fossiles,' a sixth species, under the name of *M. Tapiroides*.

In regard to the number and succession of the teeth, while he admitted eight molars on each side of both jaws to the Elephant, this great Anatomist, not hazarding a conjecture beyond the materials which had come under his eye, was not aware of more than four on each side in the Mastodon, or sixteen in all. He was also without the knowledge of the occasional presence of tusks in the lower jaw; but he first made the important observation, that in the *Mastodon angustidens* a part of the anterior series of molars in the upper jaw is replaced by a vertical successional tooth, or true premolar, thus bringing them under the normal law of the order of Pachydermata, by showing a division into a milk and permanent set. The Dax specimen, figured in the 'Ossemens Fossiles' (Divers Mast. Pl. 3. Fig. 2), clearly establishes this point; and the signification of the structure is distinctly, although guardedly, explained by Cuvier in the descriptive part of the work (tom. i. p. 256). But he was less happy in the definition of his species. Under the name of *Mastodon angustidens*, he has included two very distinct forms, characterized by a different numerical formula in the crown ridges, viz. *M. angustidens* and *M. longirostris;* and the South American teeth which he distributed among three nominal species, *M. angustidens*, *M. Andium*, and *M. Humboldtii*, appear to be all referable to a single form, *M. Andium* of M. de Blainville. We agree also with the latter authority, in considering the tooth upon which *M. minutus* is founded to be nothing more than an anterior molar of a young *M. angustidens*.

Cuvier's opinion was first called in question by Tilesius, in 1815, in his memoir upon the skeleton of the frozen Mammoth, disco-

vered by Mr. Adams in Siberia.[1] He repudiates the validity of the grounds for separating Mastodon from Elephas, in terms of such strong dissent as to have excited the indignation of the French philosopher:[2] "Cuvierus in tractatu suo de hac specie (M. giganteus) quam injuste ab Elephantorum genere separavit quamquam non solum dentes molares, in quibus male genericam diversitam[3] quæsivit lamellosæ sunt structuræ, ut omnes reliqui Elephantorum molares sunt, sed etiam totum animal characteribus genericis Elephantorum respondeat ejusdem opinionis est." Cuvier's division, however, has been adopted by every subsequent writer except M. de Blainville, who coincides with the view taken by Tilesius.

A still more important oversight was made by the founder of the genus, in regard to the statement which he advanced of the entire absence of 'crusta petrosa,' or 'cortical' from the molars of Mastodon. It is true that this substance is not present in an appreciable quantity in *M. Ohioticus;* and that it is also but very sparingly developed in *M. angustidens* and *M. longirostris;* but in *M. Andium*, a typical form of the genus, this substance exists in a layer of considerable thickness, which we have observed in almost all the teeth of the species, contained in the museum of the Jardin des Plantes, including the specimens brought by Dombey, Humboldt, and Gay, from Chili and Peru, and also in the rich series of specimens from Buenos Ayres, lately acquired by the British Museum. The great weight of Cuvier's authority has given an undue influence to his statement upon this point, which has biassed the observations of some later writers directed to the subject.

No other additions were made to the species of *Mastodon* from the second edition of the 'Ossemens Fossiles' until 1826, when an important discovery was made, of fossil bones, along the banks of the Irawaddi River, in the Burmese Empire, by Mr. Crawfurd. These remains have been figured and described in the Geological Transactions, by Mr. Clift, who has made a valuable contribution

[1] Tilesius, Memoir. de l'Acad. Imperial des Sciences de St. Petersburg, tom. v. p. 452. [2] Oss. Foss. tom. i. pp. 11 and 225. [3] Sic in orig.

to palæontology by proving the existence of two Indian fossil species, which, through the form and number of the coronal divisions of the molars, establish connecting links between *Elephas* and *Mastodon*. These he has named *M. Elephantoides* and *M. latidens*, and from their examination, he was led, with prescient sagacity, to anticipate the discovery of other forms which should constitute a complete transitional series between the two genera.[1] But Mr. Clift, like Cuvier, overlooked the presence of a coat of 'cement,' which is developed in such thickness in one of the species (*M. Elephantoides*) as to be of functional importance; and his two nominal species include teeth which appear to belong to several distinct forms.

The next accession to the species of Mastodon was made in 1828, by Croizet and Jobert, who described certain fossil teeth and jaws from Auvergne, under the name of *M. Arvernensis*.[2] The specimens were chiefly jaw fragments, derived from very young animals, and the species was characterized by these palæontologists, as distinguished from the true *M. angustidens* of Cuvier, by the presence of a well-developed front and back 'talon' in each of the molars, and by the greater complexity in the composition of the crown ridges, which are irregularly subdivided into aggregations of small warty cones.

The observations of Croizet and Jobert were correct, so far as they went, and to them assuredly belongs the merit of having first recognised the distinctness of this much-disputed species, which is most frequently met with in authors under the name applied to it by Kaup of *M. longirostris*. But the most essential distinctive character escaped their notice. In the year following the publication of their work, Hermann von Meyer described under the same name a fragment of the upper jaw of a young Mastodon, from the celebrated deposit of Eppelsheim, containing the three first molars *in situ*.[3] After considering the characters

[1] Clift, Geol. Trans. 2nd Ser. vol. ii. p. 369.

[2] Croizet et Jobert, 'Recherch. sur les Oss. Foss. du Depart du Puy-de-Dôme,' 1828 p. 133.

[3] Hermann von Meyer, 'Uëber Mastodon Arvernensis bei Eppelsheim.' Nov. Act. Acad. Leop. Carol. Natur. Curios. 1829. Vol. xv. p. 113.

indicated by Croizet and Jobert, he states that *M. Arvernensis* is distinguished from *M. maximus* (M. Ohioticus), *M. angustidens*, and all the other species then known, by the circumstance that the third molar in the order of antero-posterior succession has the crown divided into *four* ridges, while the same tooth in the other species presents only *three* ridges. In a subsequent memoir, on the fossil remains of Georgensmünd,[1] von Meyer figured and described several Mastodontine grinders, which he referred to the true *M. angustidens* of Cuvier, and which confirmed the constancy of the differential character between that species and *M. Arvernensis*, in the numerical division and form of the crown ridges, as pointed out by him in his previous memoir. This was the first step towards a satisfactory determination of the species, as distinct from *M. angustidens;* and a great mass of additional materials, confirming the same inference, was soon afterwards brought to light by Dr. Kaup; but, in the interim, new observations, of great interest, were made upon the Mastodon of North America, which gave an entirely different character to the investigation from this date.

No suspicion appears to have been entertained before this time, that any of the Mastodons, more than the existing Elephants, possessed tusks in the lower jaw. Cuvier expressly affirms their absence,[2] although, as has been observed by Professor Owen,[3] he figured in the original memoir in the 'Annales du Muséum,' and in the first edition of the 'Ossemens Fossiles,' a lower jaw of an adult *Mastodon*, showing what appears to be the alveolus of a persistent inferior tusk. Early in 1830, a memoir by Dr. Godman was read to the American Philosophical Society,[4] upon a Mastodontoid lower jaw, with two small tusks, which he described as characterizing a distinct Proboscidean genus, under the name of *Tetracaulodon*. This jaw belonged to a young animal, and showed four molars on each side, the anterior two of which Godman considered

[1] Museum Senckenbergianum. Die fossilen Zähne und Knochen von Georgensmünd, 1834, p. 33, Tab. 1 and 3.

[2] Oss. Foss. tom. i. p. 233.

[3] Owen, 'Odontography,' p. 619.

[4] Godman, 'Americ. Phil. Trans.' New Ser. vol. iii. p. 478. 'Tetracaulodon Mastodontoïdeum.'

to belong to the 'milk,' and the rest to the permanent series. These teeth resembled, in every respect, molars of the same size, in other specimens of the lower jaw, which exhibited no vestige of a tusk, and which were usually considered to belong to *M. Ohioticus*. Mr. W. Cooper, in consequence, immediately questioned the accuracy of Godman's inference, and insisted that the inferior tusks indicated merely differences dependent on age and probably sex; that they were possessed by the young animals, but were shed during the increase of age, the period of their fall varying with the individual.[1] Mr. Titian Peale suggested that these inferior tusks might be a distinctive mark of young males.[2] Dr. Harlan adopted the same view,[3] and referred to the corneous appendages in several genera of the Ruminantia as analogous distinctive characters between males and females. Notwithstanding the force of these objections, Dr. Isaac Hays, in 1831, not merely maintained the correctness of Dr. Godman's opinion regarding the distinctness of *Tetracaulodon*, but attempted to distinguish two additional species of this nominal genus under the titles of *T. Collinsii* and *T. Godmani*, besides two new North American species of *Mastodon*.[4] The memoir in which these opinions were advanced, is illustrated by an excellent and copious series of figures, exhibiting the dentition of *M. Ohioticus*, from a very early to the adult stage; and although Dr. Hays has entirely failed in sustaining the genus *Tetracaulodon*, or the species which he proposed, his memoir has served as an important contribution to palæontology, by showing that the number of molars developed during life, in *M. Ohioticus*, successively from behind, amounts to six. These he has traced, from the first to the last with great care, in the lower jaw, and established the position and characters of each by the comparison of a large number of specimens.

[1] W. Cooper, 'Lyceum of Nat. History of New York,' April 1830; 'Silliman's Journ.' vol. xix. p. 159; and Featherstonhaugh's 'Monthly Americ. Journ. of Geol.' vol. i. p. 158.

[2] Titian R. Peale, quoted in Dr. Hay's Memoir Amer. Phil. Trans. New Ser. vol. iv. p. 318.

[3] Harlan, 'Med. and Phys. Research.' p. 254.

[4] Hays, *loc. cit.* p. 317-337.

Whilst this discussion was taking place in America, the discovery was made of a similar structure in a European species of *Mastodon*, by Dr. Kaup. This distinguished palæontologist first proved the existence of two deflected and recurved tusks of large size, in the lower jaw of his colossal genus *Dinotherium*, the teeth of which had been referred by Cuvier to a gigantic kind of Tapir. Soon afterwards, at Eppelsheim, in the same arenaceous deposit which had yielded the Dinotherian remains, he discovered an adult lower jaw of a species of *Mastodon*, which presented a remarkable semi-cylindrical and beak-shaped elongation of the symphisis, forming the sheaths of two inferior tusks, while the molar teeth exhibited the characters attributed by Cuvier to a portion of the specimens included by him under the names of *M. angustidens*. Kaup, after recognising the structure, at first adopted Godman's genus for the reception of his species, which he named *T. longirostris*;[1] but, subsequently, in his great work upon the Eppelsheim fossils,[2] he admitted the force of the objections raised by the American naturalists against the generic importance of the inferior tusks in *Tetracaulodon*, and referred the Eppelsheim fossil to the genus *Mastodon*, retaining the same specific name. He extended the observations made by von Meyer on *M. Arvernensis*, which he considered to be the young of *M. longirostris*. He traced the dental succession from the earliest to the adult stage, confirming the observations made by Hays on *M. Ohioticus*, by showing that six molars are developed in the European species during life, in antero-posterior succession. Kaup also detected the presence of an upper premolar, situated as a germ, above the second deciduous grinder, in a young specimen of *M. longirostris*, corroborating the inference drawn by Cuvier from the Dax specimen of *M. angustidens*; but he considered this tooth as the normal successor of the first milk molar, the second of the series being the tooth which it specially replaces. Dr. Kaup, in the first instance, took a peculiar view of the affinities and systematic relations of his most remarkable genus *Dinotherium*; but he has since come

[1] Isis, 1832, p. 623.

[2] Ossemens Fossiles de Darmstadt, 1835, Part iv. p. 65-89.

round to the opinion advanced by other observers, that it was a true Pachydermatous form,[1] closely allied to *Mastodon*.

The discussion respecting *Tetracaulodon*, which had been suspended in America, was renewed in England on the occasion of Koch's public exhibition of the entire skeleton, and other remains of the North American *Mastodon*, in London, during 1841. The ingenious exhibitor contrived a fanciful reconstruction of the skeleton inconsistent with the principles of animal mechanics. The huge tusks, instead of being placed with their points directed upwards, as in the Elephant, or downwards, as had been formerly suggested by Mr. Rembrandt Peale,[2] were spread out horizontally with diverging curves, so as to resemble two great sickles. Other corresponding extravagancies were exhibited in the apposition of the limbs, and for the grotesque form so constructed, Mr. Koch proposed a distinct generic place, under the designation of *Missourium*.[3] Professor Owen, on this occasion, reviewed the whole of the evidence respecting *Tetracaulodon*, and, in a masterly communication to the Geological Society, extended the objections urged by the American naturalists, by numerous and forcible analogies drawn from the dentition of the Dugong and Narwahl, besides some of the ordinary Pachydermata.[4] He arrived at the conclusion, that the Mastodontoid animals of North America are all strictly referable to a single species, which "has two lower tusks originally in both sexes, and retains the right lower tusk only in the adult male." Dr. Grant entered upon an elaborate investigation of the same subject soon afterwards, and was led to very different results.[5] He divides the Proboscidean Pachydermata

[1] Akten der Urwelt, 1841. [2] Cuv. Oss. Foss. tom. i. p. 239.

[3] Koch has lately published a separate memoir, in which the *Missourium* is figured and perpetuated with all its original exaggeration. He has given it the appropriate specific name of *M. theristocaulodon*, the tusks being invested with the functions of a sort of scythe.—A. C. Koch, 'Die Riesenthiere der Urwelt oder das neu entdeckte Missourium theristocaulodon, und die Mastodonten im Allgemeinen und Besondern.' Berlin, 1845.

[4] Owen, 'Proceedings of the Geol. Soc.' Feb. 1842, vol. iii. p. 659; 'Report on the Missourium.'

[5] Grant, *loc. cit.* June 1842, p. 770, 'On the Structure and History of the Mastodontoid Animals of North America.'

into four genera, *Elephas*, *Mastodon*, *Tetracaulodon*, and *Dinotherium*, to each of which he attributes a different dental formula. He admits thirteen species of *Mastodon*, and discriminates six species of *Tetracaulodon* among the *Mastodontoid* animals of North America. Mr. A. Nasmyth adopted similar views, from a minute microscopical examination of the structure of the tusks in these extinct animals ;[1] but the importance of the differential marks indicated by Dr. Grant and Mr. Nasmyth, has not been admitted by subsequent observers, as characterizing more than individual and sexual varieties in different animals of the same species. The generally received opinion at present is, that *M. Ohioticus* is the only Mastodontoid form hitherto met with in North America.

In the additions to the last edition of the 'Ossemens Fossiles,' Cuvier has recorded the discovery of fossil grinders of Mastodon, in the Lignite beds of Kœpfnach and Ellg in Switzerland, which he has referred to his 'Mastodonte à dents étroites.'[2] Some of these remains have been described by Schinz as indicating a distinct species for which he has proposed the name of *M. Turicensis*.[3] M. de Blainville refers them to *M. Tapiroides*, as defined in the 'Ostéographie.'

Two species of Mastodon have been proposed by Eichwald, from remains found in Poland, under the names of *M. Podolicus*[4] and *M. intermedius* ;[5] the former of which appears to be founded on a disguised fragment of the lower jaw of *Dinotherium giganteum*, and the evidence adduced in support of the latter is insufficient as yet to establish its specific independence. M. de Blainville refers it to *M. Tapiroides*.[6]

One of the authors has described some of the remains of a typical species of Mastodon, from the tertiary deposits of India,

[1] Nasmyth, *loc. cit.* June 1842, p. 775, 'On the Minute Structure of the Tusks of Extinct Mastodontoid Animals.' [2] Oss. Foss. 8vo. edit. 1834, tom. ii. p. 366.

[3] Schinz, quoted in von Meyer's 'Palæologica,' 1832, p. 72, and in Bronn's 'Jahrbuch' of 1839, p. 2; mentioned in Jameson's Edin. New Phil. Jour. vol. v. 1828, p. 273, as a communication to the Helvetic Society of Nat. Hist. in August 1837.

[4] Vide *supra*, note, p. 4.

[5] Eichwald, 'Zoologia Special.' 1831, vol. iii. p. 361.

[6] Ostéographie, 'Des Eléphants,' p. 259.

under the name of *M. Sivalensis*,[1] a detailed account of which will be given in this work.

Professor Owen has proposed the provisional name of *M. Australis*,[2] for a form which rests upon a solitary specimen, brought from Australia. We shall have occasion to refer to this specimen in the sequel.

The grounds upon which Cuvier technically rested his generic distinction between *Mastodon* and *Elephas* having been invalidated by the discovery of the species named *M. Elephantoides* by Clift, it became necessary for systematic authors either to unite them under a single generic name, or to devise other diagnostic characters for their separation. Bronn, in his 'Lethæa,' gives an elaborate definition of the two genera founded upon the observations of his countrymen, Kaup and von Meyer, on the European species, and of the American naturalists upon *M. Ohioticus*. He characterizes *Mastodon*[3] by inferior tusks; by the presence simultaneously of a greater number of grinders in each jaw; and by the expulsion of the anterior tooth in the young animal by a vertically succeeding premolar. The distinctive characters of *Elephas* he defines to be, the absence of inferior tusks; a less number of more complex grinders at one time in the jaws; and the uniform antero-posterior succession of the whole series of molars without a vertical premolar. M. de Blainville, in his great work,[4] has given the most full and detailed account of the species of both genera, that has appeared since the publication of the 'Ossemens Fossiles,' and endeavoured, by original observation and by the collation of information drawn from every accessible source, to make his memoir a monograph of the subject, brought up to the state of our knowledge at the present day. Having satisfactorily proved that the number of molar teeth, developed in antero-posterior succession, in the Elephant, does not differ from that of the Mastodon, as had been previously supposed, he insists

[1] Journ. Asiat. Soc. of Beng. vol. v. p. 294.
[2] Ann. of Nat. Hist. xiv. 1844, p. 296.
[3] Lethæa Geognostica, 1838, Band ii. p. 1233-1240.
[4] Ostéographie, 'Des Eléphants,' Fascic. xvi.

that the characters presented by the number as well as by the form of all the parts of the skeleton are alike in both; that the separate bones are so precisely similar that, when met with detached, it is exceedingly difficult to decide whether they belong to Mastodon or to Elephant; that, as regards the structure of the teeth, there is a series of intermediate gradations forming a passage from the one genus into the other; and that the observed differences in these organs are systematically of no greater signification than as indicative of the kind of vegetable food upon which the several species subsisted.[1] Guided by these views, M. de Blainville has abandoned Cuvier's genus of Mastodon, and, like the earlier observers, he has united it with the Elephant, under the common generic name of *Elephas*, of which he forms two sections, *Lamellidontes* and *Mastodontes*. The former includes the Elephants proper, viz., the two existing species, with *E. primigenius* doubtfully admitted as a distinct form, and *E. latidens*, under which name he unites the two species *M. Elephantoides* and *M. latidens*, described by Clift. Of the second section, comprising the typical Mastodons, M. de Blainville admits only four species, viz., *E.* (M.) *Ohioticus*, *E. angustidens*, *E. Andium*, and *E. Tapiroides*, together with *M. Sivalensis* as a doubtfully established species. M. de Blainville's work is illustrated with an admirable series of representations of the osteology and dentition of the different species, and he has made a valuable contribution to the palæontology of the Proboscidea, by defining the character of *M. Andium*, which was distributed among several nominal species by Cuvier. He has also thrown considerable light on *M. Tapiroides*, by means of the materials collected by M. Lartet, in the south of France, which he has combined under this specific name, with remains derived from different parts of Europe. But there are weighty objections to the rest of the details of this portion of the 'Ostéographie.' Although the consideration of the teeth is of paramount importance in every question connected with zoological arrangement, it is to be remarked, that M. de Blainville has nowhere adverted to the occurrence of premolars in the upper jaw of

[1] *Loc. cit.* p. 2.

certain species of Mastodon, the presence of which—first observed by Cuvier in *M. angustidens*—has been clearly established by Kaup in the young of *M. longirostris*. The author of the 'Ostéographie' describes them as equally wanting in the Mastodons and in the true Elephants. With respect to the species, while M. de Blainville has judiciously rejected a great many of the nominal forms which have been proposed on slender grounds, he appears in other cases to have pushed this numerical reduction too far, and to have mixed up under the same name species which are essentially distinct. This remark applies especially to the Indian fossil forms, three or four of which are combined under *E. latidens;* and to the European *M. angustidens*, which, as defined and illustrated in the 'Ostéographie,' includes two separate species.

Professor Owen has been engaged upon the same subject, contemporaneously with M. de Blainville. In addition to the memoir upon the North American Mastodon previously referred to, our eminent countryman has discussed the systematic relations of *Elephas* and *Mastodon*, in his 'British Fossil Mammalia,' and in his very valuable work upon the teeth, lately published. On the latter occasion, he showed, for the first time, that the molar teeth of the Elephants and Mastodon, while they agree with each other, form no exception from the normal division into sets, presented by the ordinary Pachydermata (supra p. 11), and that the apparent anomaly in the order of their succession, arises from the partial or total suppression of the successional series of premolars. In the former work, after describing the differences in the form of the teeth of the two genera, he adds :—

"A more important difference presents itself when the teeth of the typical species of Mastodon are compared with those of the Elephants, in reference to their structure. The dentine, or principal substance of the crown of the tooth, is covered by a very thick coat of dense and brittle enamel; a thin coat of cement is continued from the fangs upon the crown of the tooth, but this third substance does not fill up the interspaces of the divisions of the crown, as in the Elephant. Such, at least, is the character of the molar teeth of the first discovered species of Mastodon, which

Cuvier has termed *Mastodon giganteus* and *Mastodon angustidens*. Fossil remains of Proboscidians have subsequently been discovered, principally in the tertiary deposits of Asia, in which the number and depth of the clefts of the crown of the molar teeth, and the thickness of the intervening cement are so much increased, as to establish transitional characters between the lamello-tuberculate teeth of Elephants, and the mammillated molars of the typical Mastodons; showing that the characters deducible from the molar teeth are rather the distinguishing marks of species than of genera, in the gigantic proboscidian family of mammalian quadrupeds.

"Two dental characters, however, exist, though hitherto, I believe, unnoticed as such, which distinguish, in a well-marked and unequivocal manner, the genus *Mastodon*, from the genus *Elephas*. The first is the presence of two tusks in the lower jaw of both sexes of the *Mastodon*, one or both of which are retained in the male, and acquire a sufficiently conspicuous size, although small in proportion to the upper tusks, while both are early shed in the female. The second character is equally decisive; it is the displacement of the first and second molars in the vertical direction, by a tooth of a simpler form than the second, a true *dent de remplacement*,[1] developed above the deciduous teeth, in the upper, and below them in the under jaw.

"These two dental characters, which are of greater importance than many accepted by modern zoologists as sufficient demarkations of existing groups of mammalia, have been recognised in the species called *Mastodon giganteus*, most common in North America, and in the *Mastodon angustidens*, which is the prevailing species of Europe."

But the value of these alleged characters, as furnishing certain distinguishing marks between Mastodon and Elephant, is far from being absolute. It will be seen in the sequel that premolars,

[1] 'British Foss. Mammal.' p. 273-4, and repeated in the 'Odontography,' p. 615. These characters were not overlooked by Bronn: the inferior tusks are included in his dental formula of Mastodon; and the displacement of the anterior grinder by a vertical successor is also adverted to.

instead of being invariably wanting in the Elephants, are developed in greater number in one typical fossil species, than they are known to be in any ascertained species of Mastodon; while, on the other hand, they do not appear to be constant in every species of the latter group; and, although the inferior tusks have been observed in three species of Mastodon, there are other forms in which they have not yet been detected, even in specimens of the young animal.

With respect to the European species, Professor Owen considers, like M. de Blainville, that *M. angustidens* and *M. longirostris* belong to a single form; and he refers the whole of the elephantine remains which occur so plentifully in England, whether in the fluvio-marine crag, or in the superficial drift and gravel, also to a single species, *E. primigenius*. He describes the dentition of the Indian species, discovered by Clift, under the designation of *Transitional Mastodons*.

We shall now proceed to the special consideration of the teeth, as the organs which have the greatest share of influence in determining the modifications in the construction of the cranium, and in the development of the general form, presented by the different species in the Proboscidea.

§ II.—On the Structure and Form of the Molar Teeth.

Plates 1, 2, and 3 are intended to represent, by careful copies of nature, the modifications in structure and form exhibited by the molar teeth of the Proboscidea; they show, in vertical sections, a series of gradations, commencing with *Dinotherium* and *Mastodon Ohioticus* at one extremity, and running through the other species to *Elephas primigenius*, in which the greatest deviation from the ordinary form of a grinding tooth is met with.

Each molar in the *Proboscidea*,[1] as is the case with all other animals, is developed within a closed membranous sac, called the

[1] The substance of the four following paragraphs is drawn from the admirable descriptions given by Cuvier in the Ossemens Fossiles, tom. i. p. 32, and by Owen in his valuable systematic work on the teeth. Odontography, p. 649.

capsule, which is lodged in a cavity of the maxillary bone, and which forms the mould, so to speak, of the tooth. The exterior of this sac is simple, while its internal surface is expanded into numerous folds, which determine the arrangement of the 'ivory,' 'enamel,' and 'cement,' entering into the composition of the tooth. From the bottom of the sac a gelatinous mass, the 'pulp nucleus,' is projected upwards, subdivided into transverse digitated plates or segments, varying in number, length, and thickness in different species, and more or less numerous in different molars of the same individual, according to the age of the tooth. These 'pulp' segments are attached only by their base, and attenuate gradually upwards to their summits, being entirely free from adhesion, either to the opposite side of the sac, or to the contiguous 'pulp' divisions. The ossification of this 'pulp nucleus,' by the deposition of calcareous matter within the cells of its tissue, constitutes the ivory core, or central part of the tooth, being the substance called 'dentine' by Professor Owen.

From the opposite or coronal side of the capsule, other folds or induplications are given off, which proceed into the spaces between the divisions of the 'pulp nucleus.' Their attachment is continued along the parietes of the sac, so that on every side, except the base, they envelope the processes of the 'pulp nucleus,' over which they are closely applied, interlocking with the latter; the two sets of processes thus forming productions from the interior of the sac which are opposed to each other in the manner of salient and re-entering angles. The ossification of these peripheral folds in a continuous surface constitutes the 'enamel,' or vitreous shell, which encloses the ivory core of the crown of the teeth, terminating abruptly where the fangs commence.

Exterior to, and following the folds of this 'enamel pulp,' there is another modification of the internal membrane of the sac, the ossification of which, during the last stage of the development of the tooth, constitutes the external 'cortical layer,' or 'cement,' which, in a crust of greater or less thickness, is continued over the enamel of the crown, and down upon the fangs. In the true

Elephants this cement substance completely fills up the hollows between the plates of enamel.

The production of the hard tooth takes place by a process of calcification, which commences in the summits of the 'ivory pulp' segments, the solidification extending gradually downwards along the digital processes, which unite into a transverse plate; and these plates, at their base, are combined so as to form the common body of ivory which occupies the central mass of the tooth. Simultaneously with this production of the ivory, a similar process of solidification goes on in the corresponding and contiguous portions of the 'enamel pulp,' forming a shell of enamel which is closely applied to, and moulded on the form of, the ivory segments and their digital subdivisions. When the calcification has reached the common base of ivory, the enamel plates covering the contiguous segments of ivory unite along their lines of junction in the bottom of the clefts between the ridges.

The basal mass of the 'pulp nucleus' is not connected in a continuous surface with the bottom of the sac, but, as it were, by pedicles which, after the solidification of the body of the tooth, elongate and become contracted, with more or less of subdivision. These pedicles undergo the same process of calcification, and form the fangs, by which the tooth is implanted in the jaws. The fangs bear a relation to the divisions and vertical height of the crown, being few, thick, and more or less distinct in the Mastodons, while they are numerous, slender, and confluent in the Elephants.

The three constituent dental substances are structurally distinguished by very different characters, and their combined modifications in the molar teeth furnish the best differential marks for the arrangement of the groups of *Mastodon* and *Elephas*, and for the discrimination of the different species.

The molars of the North American Mastodon, and of the existing Indian Elephant, may be selected as convenient illustrations of the opposite extremes of form presented by these teeth in the Elephantidæ. Taking the last tooth of the upper jaw as the example; in the former, the crown is nearly rectangular in

outline, somewhat higher in front than behind, the dimensions being about seven inches in length, by four of width at the anterior end. The height of the crown, from the base of the enamel to the summit of the first ridge (vide Section, pl. 3, fig. 9), is about two and a half inches, decreasing a little successively to the fourth or last principal ridge. The grinding surface is divided in two directions, viz., longitudinally along the axis by a narrow cleft, which, as in the Hippopotamus and most other Pachydermata bisects it into nearly equal segments; and transversely by four deep open hollows, alternating with as many trenchant ridges. Each of the lateral divisions of these ridges is composed of a pair of compressed confluent points; in the upper molars the outer division is more elevated, and slopes gradually towards the inner side which, although lower, is the most complex in composition, giving off the 'talons' and accessory tubercles, which are more or less developed in different species, the inner points being commonly the largest. This relation continues during the wear of the teeth, the inner side being more worn by the process of trituration than the outer. The teeth of the lower jaw agree with the upper in the form and subdivision of the crown; but the disposition of the lateral segments is reversed, the inner being higher, and continuing so during the wear, while the outer are lower, but more complex in composition. The higher and lower portions of the crowns of the opposed teeth are thus brought to act against each other, and serve more effectually the triturating function of the teeth. The plane of the grinding surface is nearly level from back to front, both in the upper and inferior grinders. In consequence of the peculiar mode of protrusion of the teeth, from behind forwards, the crown ridges come successively into use, commencing with the first, and each of the lateral divisions is ground down to a rhomboidal disc, surrounded by a band of thick enamel: as the wear of the tooth advances, the separate discs unite, forming a wide transverse depression corresponding to the configuration of the ivory nucleus, and the shell of enamel which invests it. The 'cement,' or third dental substance, is very sparingly developed upon the crowns of the molars of the

North American Mastodon, being only distinguishable in a thin layer under the microscope. It is more abundant upon the fangs. The anterior ridge is supported by two stout united fangs, and the three posterior ridges by fangs agreeing with them in number, but more or less confluent into an irregular hollow cone.

In the existing Indian Elephant, the last grinder of the upper jaw is of a subtriangular rhomboidal form in the vertical section, widely different from that of the North American Mastodon. The crown is very high in front, and declines rapidly behind. In a large specimen of this tooth from Assam, the dimensions are upwards of fourteen inches of length, by eight inches of height in front, which is reduced to about one-third at the last ridge, while the width does not exceed three inches at the anterior end, from which it narrows gradually behind. The coronal surface is convex across, and also in the antero-posterior direction. There is no indication of the longitudinal cleft, which, in the North American and other Mastodons, bisects the crowns of the molars into lateral segments. The ridges, which in the first-mentioned species do not exceed four, are multiplied in the last upper grinder of the Indian Elephant to twenty-three or twenty-four thin plates, which terminate upwards in slender, cylindrical digitations, hence called *Cheirolites*, by the early palæontologists, when found separate. The cement substance enters largely into the composition of the tooth, being interstratified with the enamel plates in a layer which also envelopes the entire body of the tooth. The fangs are slender, and numerous, bearing a relation to the lamellæ but they are confluent into large hollow groups, which are of inconsiderable length, as the tooth is held firm in the jaw by a large portion of the crown being imbedded in the alveolus. Instead of being protruded in a nearly horizontal direction, as in the North American Mastodon, the teeth move forwards in the arc of a circle ; the anterior plates in the upper grinders are inclined forwards, and by the process of wear they are ground down, so that the front part of the tooth is truncated obliquely (pl. 1, fig. 2, and pl. 7, fig. 4.) long before the posterior lamellæ come into use. The plane of detrition makes

a large angle with the unworn plane of the crown, and in the upper grinders it slopes from the inside outwards, being the reverse of what takes place in the Mastodons. In the lower jaw, the crown of the last molar is concave from behind forwards, and convex across ; the grinding plates, especially towards the posterior end, recline backwards, and the plane of wear, which is concave, slopes from the outside inwards, bearing a reversed relation to that of the upper jaw. The side of the jaw to which the teeth belong is readily distinguished by these characters, and by the circumstance that the upper grinders are convex on the outer, and concave on the inner side, the reverse taking place in the grinders of the lower jaw. The last inferior molar attains a length of fifteen inches, and presents occasionally as many as twenty-six or twenty-seven constituent plates in the largest sized individuals of the Indian Elephant.

When the teeth come into use, the digitated summits of the anterior ridges are first ground down into circular rings of enamel enclosing a pit of ivory ; these rings then unite into oval groups (pl. 7, fig. 4*a*) ; and as the wear descends below their point of separation, the smaller discs disappear in a common transverse band which is bounded by a projecting edge, or *machæris* of enamel. These edges, which represent a transverse section of the enamel plates, either run across in straight and parallel lines, or they are minutely crimped and undulated, or dilated into round loops, or angular expansions in the middle of the ridge : such modifications holding with great constancy in the different species, and yielding the characters by which they are most readily distinguished. The three constituent dental substances being of unequal hardness, are worn unequally by the process of trituration ; the hard enamel projects above the ivory, and the softer cement wears quicker than either. The grinding plane of the tooth thus presents, throughout its period of duration, a surface highly organised by natural inequalities, to serve a constant triturating purpose. As the anterior lamellæ are worn down, the corresponding fangs are gradually absorbed.

Between these extremes, furnished by the North American

Mastodon and the existing Indian Elephant, there is a series of intermediate forms, which establishes an almost unbroken passage from the one into the other.

Fig. 6*a*, pl. 2, represents a vertical and longitudinal section of the last upper molar of an Indian fossil species, which we have named *Elephas insignis* in this work. It is selected as furnishing the best illustration of the intermediate type of a proboscidean molar tooth, from which those of the other species diverge in opposite directions. It is in the most favourable state of age and use for showing the characters, the four anterior ridges being affected by wear, and the six posterior ridges entire, while the fangs are fully developed, their mode of implantation in the jaw being distinctly shown. The tooth is convex from back to front, in the outline of the crown. The white mass in the centre represents the body of ivory, which is projected upwards in ten angular lobes terminating in a sharp edge. The height of these lobes does not much exceed the width of their base, and closely applied over them is seen a thick layer of enamel, reflected up and down in a continuous zig-zag plate. The interspaces of the five posterior ridges of enamel are completely filled up by a mass of cement, or 'cortical,' much exceeding the enamel in thickness; and in quantity in nearly as great an amount of development as the ivory core of the ridge. This tooth belongs to one of the forms which have been included under the name of *Mast. Elephantoides*, by Mr. Clift; and which Professor Owen names 'Transitional Mastodons.' It is important to observe the characters presented by the cement in this case, as its supposed absence or presence in the molar teeth was the principal character upon which Cuvier rested his generic distinction between *Mastodon* and *Elephant*. Professor Owen, in his Odontography, states, in regard to the teeth of this species, that, "the interspaces are not filled with cement, as in the true elephant: only a thin layer of that substance is continued upon the unworn enamel, as in the true Mastodons."[1] But this statement must be received with some modification. Fig. 7, pl. 6, represents a portion of the same section drawn to the natural size, and com-

[1] Odontography, p. 624.

prising the sixth and seventh ridges. The cement exhibits an appearance of lamination, of which from nine to eleven layers may be counted, and is developed in as great a quantity as the intervals between the ridges could admit of. The four anterior ridges have been well used, so that the two first are worn down to a common disc, from which the enamel has disappeared; and the cement of the four anterior hollows, being the softest of the tooth substances, has been completely, or partially, worn away by the same process of detrition. The dark granulated shade below the portion of the ivory nucleus which sustains the five posterior ridges, indicates, in the figure, the hollow of their common posterior fang, which is occupied in the fossil by a core of sandstone; the same matrix also fills the cells of the maxillary bone. The anterior simple fang is shown in the section, of much smaller size. This tooth measures 10.3 inches in length.

Fig. 6 *b*, represents a similar section of the anterior portion of an adult tooth of the lower jaw of the same species. In this instance the two front ridges only, have been touched by wear. Instead of being convex, the common curve of the crown is slightly concave. The ivory, enamel, and cement present the same characters as in the upper molar, except that the cement in the interspaces is less considerable in quantity, although sufficiently abundant to indicate that it was functionally serviceable in the grinding operation of the tooth. The posterior part of the basal portion of the pulp nucleus had not yet completed the stage of calcification, its place being occupied in the fossil by a nest of calcareous crystals, bounded in the figure by the undulated line. The figure shows also a portion comprising the two last ridges of the preceding molar, with their common fang implanted in the lower jaw.

The next serial modification in the disposition of the three dental substances, and in the consequent form of the teeth, is exhibited in fig. 5 *a* of the same plate, which represents a section of the penultimate upper molar of another Indian fossil species which we have named *E. planifrons*. This tooth shows nine ridges, the three anterior of which alone have been in use, the

two first being worn down to a single disc of ivory. The common nucleus of this substance is of less thickness than in the corresponding tooth of *E. insignis*, and the divisions which are continued upwards from it into the centre of the ridges are more elongated, with a narrower base, forming irregular-shaped wedges. The layer of enamel is diminished in thickness and is less uniform in outline, and the surface in contact with the cement shows a feathered or ragged edge, indicating superficial inequalities for the firmer cohesion of this latter substance. The enamel is reflected over the ridges of ivory, and down into the hollows zig-zag wise, exactly as in fig. 6 *a*, the principal difference being that the ridges are narrower, with a greater vertical height. The cement substance attains its maximum of development in this species, completely filling up the wide interspaces of the ridges, over which it is continued in a thick mass. This tooth measures 8.7 inches in length.

Fig. 5 *b*, represents a corresponding section of a portion of the last molar of the lower jaw of the same species, comprising nine ridges. This tooth had been longer in use than that of the upper jaw, and all the ridges are more or less worn except the two last. It presents the same general characters exhibited by fig. 5 *a*, in the elongated cuneiform ivory ridges, unequal enamel, and abundant cement, the differences being merely such as constantly hold between molars of the upper and lower jaws, and of different ages in the same species.

The existing African Elephant furnishes another link in the chain of modifications presented by the molars in this family. Fig. 4 *a*,[1] shows a section of the penultimate grinder of the upper jaw of this species, which is composed of nine principal divisions and a subordinate 'talon' ridge, the four anterior of which are partly worn, the rest being entire. The elongation of the ivory segments, which commences in *E. planifrons*, is carried here to a much greater extent. The segments are produced into long

[1] We are indebted to the kindness of Mr. Charles Stokes for the specimens which have yielded the sections 4 *a* and 4 *b* of the African Elephant, the teeth of this species being comparatively rare in English collections.

narrow wedge-shaped plates, the height of which is many times greater than the width of their base. The interspaces of the plates are proportionally deep, and filled up with a copious mass of cement, which completely envelopes the tooth. The quantity of this substance is measured by the proportion which it bears to the other dental materials, and it is seen to be thicker than the ivory plates. The layer of enamel is reflected over the ridges and down upon the hollows as in *E. insignis*, but it is much thinner, and the attenuation is proportioned to the elongation of the plates. The common basal mass of ivory is greatly reduced in quantity, if compared either with the sections of *E. insignis*, fig. 6 *a*, or of *E. planifrons*, fig. 5 *a*, there being little more of this substance than is sufficient to establish a common connection between the bases of the segments, and a foundation for the offset of the fangs, which are numerous. The vertical height of the tooth is considerably greater than that of either of the two other described species. This tooth measures 8.7 inches in length.

Fig. 4 *b*, represents a penultimate molar of the lower jaw of the same species in vertical section. Like that of the upper jaw, it is composed of nine cuneiform plates. This tooth had been a long time in use, all the plates except the last being affected by wear. The anterior part of the crown has been ground down to nearly one-third of its original height, so that the enamel divisions between the two anterior ivory plates have disappeared, and the latter are confluent into a common mass. It is not, therefore, in the condition best adapted to show the characters presented by a good section; but it indicates sufficiently the correspondence of the lower with the upper molars, in the disposition, form, and relative proportion of the ivory, enamel, and cement substances. It bears a very close resemblance to the section of the lower molar of *E. planifrons*, fig. 5 *b*, keeping in mind, that the latter is taken from an older and larger tooth. They exhibit the same kind of wedge-shaped ivory plates, a similar amount of cement in the interspaces, and an analogous thickness of enamel. The resemblance between the lower, in

these instances, is greater than between the corresponding upper molars of the two species. This specimen measures 7.2 inches in length.

If the eye is carried along these sections in succession, it will be readily perceived that they constitute a series of gradations in form conducted from *E. insignis* to *E. Africanus*, through *E. planifrons*. The modifications are effected by the elongation and thinning of the ridge-plates, with a corresponding increase in the depth of the hollows, and in the vertical height of the teeth; by a diminution of the basal mass of ivory; by a greater number of divisions in the same extent of tooth surface, and a gradual diminution in the thickness of the layer of enamel. Plate 1, represents another succession of links which, in like manner, conduct us from the African Elephant on to the extremity of the series in *E. primigenius*.

Fig. 3 *a*, of this plate shows a section of the penultimate upper molar of an undescribed Indian fossil species named *E. Hysudricus* in this work. The tooth is in the middle stage of wear, eleven of the thirteen plates of which it is composed, having been in use, and the two anterior ridges being worn out. The same vertical disposition of ivory, enamel, and cement, is presented as in the African Elephant, but the plates are thinner and a greater number of them is included in the same length, nine or ten plates in the latter being developed in the space occupied by thirteen or fourteen plates in the equivalent teeth of *E. Hysudricus*. The plates are also more vertical, the interspaces occupied by the cement are wider in general than the ivory plates which represent very attenuated wedges. The layer of enamel is proportionally thicker than in the African Elephant, approaching, in this respect, the teeth of *E. planifrons*, fig. 5. The vertical height of the tooth is comparatively less in this specimen than in the African species, the difference being compensated by a greater development of the basal mass of ivory. This specimen measures 7.7 inches in length.

A portion of the last molar of the lower jaw of this species is shown in vertical section in fig. 3 *b*, comprising about fifteen

plates. The entire tooth, which is seen in figs. 12 and 12 *a* of pl. 7, *in situ* in the jaw, is more elongated, and includes a greater number of divisions than is usual in the last inferior grinder of *E. Hysudricus*. The same general character, in the disposition and relative proportion of the ivory, enamel, and cement, are exhibited as in the upper molar (fig. 3 *a*), bearing in mind that the latter is a younger and consequently smaller tooth. The layer of enamel, however, is thinner than in the upper molar, owing to the unusually large number of developed plates. The ivory segments are curved backwards near their base, and the apices of the posterior plates lean towards the front of the tooth, a disposition which is still more strongly exhibited in the lower teeth of the existing Indian Elephant. The granulated dark shade, below the undulated outline of the ivory, indicates a core of sandstone, which occupies the place of the unossified part of the pulp nucleus, and of the undeveloped fangs. Both specimens, 3 *a* and 3 *b*, are implanted in portions of the jaws.

The existing Asiatic Elephant, *E. Indicus*, furnishes the next modification represented in this plate. Fig. 2 *a*, shows a section of the penultimate upper of molar of this species. The gradual attenuation of the plates, successively exhibited from *E. insignis* to *E. Hysudricus*, is here carried to excess, eighteen of these divisions being comprised within the space occupied by about nine in the equivalent tooth of the African species. They are produced vertically in the same proportion, the height of the middle plate being about three-fourths of the entire length of the tooth; they, in fact, represent parallel perpendicular lamellæ, of nearly uniform thickness, from the base to the apex, interstratified with layers of cement of nearly the same thickness. The layer of enamel is attenuated into a thin transversely undulated brittle plate, the surface of which is deeply wrinkled with striæ, for the firm cohesion of the cement. The general character of the section is a pectinated arrangement of the lobes like the teeth of a comb, which contrasts strongly with the chevron-formed ridges of *E. insignis*, and the cuneiform plates of *E. planifrons*. The mass of ivory at the base of the tooth is much thinner than in the corresponding

molar of *E. Hysudricus*, bearing but a very slender proportion to the height of the tooth; and numerous small and distinct fangs are given off from its inferior edge. This tooth had been some time in use, the anterior part of the crown being worn off as far as the ninth plate. The plane of the truncated portion is very oblique, being inclined nearly at a right angle to the coronal surface of the unworn portion. This specimen is 8.2 inches in length.

Fig. 2 *b* represents the section of a very fine specimen of the last inferior molar of the existing Indian Elephant of Assam, from the collection at the India House. It is an unusually large specimen, showing as many as twenty-seven plates, the anterior twelve of which have been in use. Precisely the same disposition of the dental substances is observed in this case as in the upper grinder, and they are developed in the same relative proportions. The vertical height of the plates is still greater than in the corresponding lower molar of *E. Hysudricus*. The upper surface is concave, and the under very convex. The anterior plates are nearly vertical, while the posterior gradually slope backwards till they become almost horizontal in the hindmost portion, with a corresponding gradual diminution in their height. This is a mechanical arrangement arising from the contracted diameter of the posterior part of the dental canal, in which the back part of the tooth is developed, close under the condyle, the plates being disposed so as to occupy the least vertical space. The basal mass of ivory between the plates and the fangs is reduced to a small quantity. This tooth measures $15\frac{1}{4}$ inches long in a straight line.[1]

Fig. 1 represents a section of the last upper molar of *E. primigenius*, from an English specimen in the museum of the Geological Society, found near Kingsland. We arrive here at the last link in the chain of modifications, exhibited by the molar of the typical Elephants. The section bears a close resemblance to that

[1] The artist has drawn this figure reversed, as compared with the other sections, the worn end of the tooth being to the right. The same remark applies to fig. 6 *a* of pl. 2. In pl. 1 the Indian Elephant has been named in the reference *E. Asiaticus* (Blum.) instead of *E. Indicus*.

of the corresponding tooth of the Indian Elephant, but the ivory segments are more vertical, thinner, and more approximated; there being about twenty-two plates in the space occupied by eighteen or nineteen in the latter; and the layer of enamel is still more reduced in thickness. The disposition of the plates presents the extreme degree of 'pectination' seen in the molars of any known species of Elephant. The differences observable in the vertical section are, however, so inconsiderable, that, if regarded in this light merely, the Mammoth and the Indian Elephant might pass for the same species. But when the grinding surface of the crowns of their molars is examined, the transverse plates of enamel in the Indian Elephant are seen to be thicker and very closely undulated, with the flexures deeply wrinkled for the attachment of the stratum of cement; while in the Mammoth the crowns of the teeth are broader, the enamel plates are thinner and less undulated, so much so that they are frequently described as being transverse and straight. Such at least is the character of the typical form of grinder in *E. primigenius*. This tooth measures ten inches in length, being considerably under the size attained by the largest specimens of the Mammoth. It has not been deemed necessary to give a figure of the section of an inferior molar, which differs in no respect from the upper, more than in the case of the existing Indian species.

These are the principal modifications in the construction of the teeth of the Elephants. Although, at first sight, the molars of *E. insignis* and *E. primigenius* appear to be very different, the other intermediate forms constitute a series which establishes a passage between them. The species have been traced in a retrograde order, from the simpler to the more complex forms, with the object of making the descriptions more intelligible. It is interesting here to observe how the existing species are intercalated: the serial order of structural development in the teeth does not correspond with the order of succession of the species in time. The extinct Mammoth exhibits the greatest amount of complexity, constituting the terminal link of the chain; and next follows the existing Indian Elephant, interposed between two fossil

species. In like manner, the existing African Elephant is placed between two extinct species, *E. Hysudricus* and *E. planifrons*. The three plates of sections include only the principal forms requisite to establish the passage. Another extinct Indian species *E. Namadicus* (to be described in the sequel), which is closely allied to the existing Indian form, comes between it and *E. Hysudricus*, together with a European fossil species, which we believe to be distinct from the Mammoth ; and the gap between the existing African Elephant and *E. planifrons* is filled up by another well-marked European fossil species, *E. priscus* (?), pl. 13, fig. 7, which is closely allied to the former. This species will also be noticed in a subsequent page.

We shall now revert to *E. insignis*, and endeavour to trace the forms which diverge from it in an opposite direction through the Mastodons, the tendency in this series being towards a greater simplicity in the construction of the grinders, and a reduction in the number of coronal segments.

Fig. 7 *a*, pl. 3., represents a section of the last upper molar of an undescribed Indian fossil species, named *E. Ganesa*, in this work. The crown consists of ten principal ridges, with a subordinate 'talon' ridge in front and behind. The anterior seven ridges have their summits worn, the two in front being ground down to the common base of ivory, the tooth having been a considerable time in use. A small portion is broken off at the anterior end. The disposition and relative proportions of the ivory, enamel, and cement, bear the closest resemblance to those of the corresponding tooth of *E. insignis* (pl. 2, fig. 6 *a*), and the number of ridges agrees. The section presents the same chevron-formed character in the ridges, but the interspaces are narrower, the cement is in less quantity, and the layer of enamel is thicker. The common grinding surface of the crown is also less convex. But these differences are so inconsiderable, when taken into account with the range of variation through which the molars run, that they are practically insufficient for the discrimination of the two species. To guard against error, the sections have been taken in both instances from specimens consisting of the palate

with a double line of teeth; and, notwithstanding that the molars agree so closely, the crania are remarkably different in the two forms; that of *E. insignis*, pl. 15, being singularly modified so as to bear an analogy to the cranium of *Dinotherium giganteum;* while the head of *E. Ganesa* does not differ much from the ordinary type of the Elephant. In fact, we have entirely failed in the detection of any good characters by which the teeth of these two species can be distinguished satisfactorily when met with in fragments, as is most generally the case. A similar agreement in the form of the teeth is observable in certain closely-allied species of Mastodon. The tooth represented in this section measures nine inches and a quarter in length.

Fig. 7 *b*, shows a section of one of the posterior molars of a lower jaw, which we infer to belong to the same species. A small portion of the anterior end of the crown has been broken off; but the presence of the anterior fang proves that the section includes the whole length of the tooth except the first ridge, the posterior end being entire. It appears to have consisted of eight principal ridges, with a 'talon' ridge behind, and a subordinate ridge in front. Five of the ridges have been in use, the anterior two in the section being worn down close to the common base of ivory, while the three last ridges are entire. Like the upper molar of *E. Ganesa*, it bears a close resemblance to the corresponding inferior tooth of *E. insignis* (pl. 2. fig. 6), in the form of the ridges, thickness of enamel, and proportion of cement. This specimen measures about seven inches and a half in length.

The next serial modification in the form of the molars occurs in another extinct Sewalik species, named *E. bombifrons*, in this work. It is not included among the sections in pl. 3. This species, of the distinctness of which we are assured, by possessing several crania containing perfect teeth, belongs to the same group as the two species last described. The crown is divided into similar transverse ridges, composed of numerous mammillæ, which yield a corresponding chevron-shaped section, and the interspaces are occupied by a thick coat of cement; but they differ, in being broader and less elevated, with more open hollows. The principal

ridges of the last molar do not exceed eight in the upper jaw, and nine in the lower; while in *E. insignis* they amount to ten in the former, and reach as many as thirteen in the latter. The last tooth of the upper jaw measures eleven inches in length, by four and a half in width. This species will be described in detail in a subsequent chapter.

The same group comprises a fourth extinct Indian species, named in this work, *E. Cliftii*, which furnishes the next link in the chain of forms presented by the molars of the Elephantidæ. It is not figured among the sections in pl. 3. In our view, the tooth represented in pl. 39, fig. 6, of Mr. Clift's memoir in the Geological Transactions, under the name of *Mastodon Elephantoides*, and the palate specimen represented in pl. 36 of the same memoir, under the name of *M. latidens*, belong to this species.[1] The reasons for this opinion will be given, along with the detailed description of the species. The penultimate and antepenultimate molars in the upper jaw have only six transverse ridges, continuous, and chevron shaped, with numerous mammillæ, as in *E. insignis* and *E. Ganesa;* but the cement does not fill up the interspaces of the ridges, being reduced to a comparatively inconsiderable quantity in the bottom of the hollows. *E. Cliftii*, in the reduced number of the coronal ridges, and in the other characters of the teeth, appears to constitute the dental link which forms the immediate passage from *Elephas* into *Mastodon*. Mr. Clift, in reference to his *M. Elephantoides*, and *M. latidens*, has justly remarked, that, "On an examination of the structure of the teeth, this discovery" (viz. of these two species) "will be found to have still higher claims to attention; for it illustrates the gradual shades of difference by which nature passes almost imperceptibly from one form to another, and helps to fill up the interval which has hitherto separated the Mastodon from the Elephant."[2]

The three species last described, along with *E. insignis*, constitute a peculiar section of *Elephas*, of nearly equivalent value to the section which includes *E. primigenius*, *E. Indicus*, and

[1] Geol. Trans. 2nd Ser. vol. ii. p. 369.

[2] *Idem, loc. cit.* p. 370.

E. Hysudricus. That they belong to *Elephas* proper, rather than to *Mastodon*, is clearly indicated by all the principal characters of the teeth: viz. the crowns are divided into many transverse ridges, consisting of numerous mammillæ resembling the digital terminations of the plates in the Indian Elephant; the hollows are occupied by a more or less abundant layer of cement; and, as in the typical Elephants, there is no appearance of the longitudinal cleft along the axis, which, in almost all the species of *Mastodon*, bisects the crown into lateral divisions. The same direction of affinity is indicated by the characters presented by the crania.

We here take leave, for a time, of the proper Elephantine forms; and from this point the complexity in the molars gradually diminishes till they assimilate to the character exhibited by the ordinary Pachydermata.

Fig. 8 of pl. 3 shows a section of another of the specimens described in Mr. Clift's memoir under the name of *Mastodon latidens*,[1] and represented by him in pl. 37. fig. 1. It consists of the two last molars of the upper jaw. The figure is drawn on a scale of two-thirds of the natural size. The last tooth shows five principal ridges with a posterior talon ridge and a subordinate ridge in front. The ridges are transverse, and divided by a longitudinal cleft into two pairs of principal points without intermediate mammillæ in the hollows. The enamel is very thick, and the cement is reduced to a thin layer which is only observable in the bottom of the hollows. The ivory lobes resemble those of *E. Ganesa*, fig. 7 *a*, but they are less elevated with a broader base. The artist has been eminently successful in his representation of the texture of the two dental substances in this specimen. The anterior tooth had been a long time in use, and the ridges are nearly all worn out. They were four in number, in this as well as in the two teeth which preceded it in the jaw. We believe this to be a small or dwarf variety of *M. latidens*, a species the adult teeth of which generally attain a large size. The last

[1] This valuable specimen, discovered by Mr. Crawfurd in Ava, belongs to the collection of the Geological Society, the President of which has liberally allowed a section of it to be made for the illustration given in fig. 8.

tooth figured in the section measures $5\frac{1}{2}$ inches in length. *M. latidens*, of the known forms of Mastodon, is that which is most nearly allied to *E. Cliftii*, and through that species to the true Elephants. One or more intermediate links perhaps still remain to be discovered. It closely resembles the European *M. Arvernensis* (M. longirostris of Kaup) in the form of the molars. The correspondence is so great, in the last milk molar, and in the antepenultimate and penultimate true molars, that they have been regarded as identical species.

Fig. 10*a* represents a section of the last molar of the upper jaw of an Indian fossil species named *Mastodon Sivalensis* in this work. The ridges in this species are more complex in their composition than in *M. latidens*. The crown is traversed by a longitudinal furrow which bisects them, each division being composed of a pair of contiguous or connate conical mammillæ, placed more or less alternately. The hollows are in consequence interrupted. This tooth, like its equivalent in *M. latidens*, consists of five principal ridges, with a subordinate ridge in front, and a 'talon' ridge behind. Eight divisions of the ivory may be counted in the figure, the smaller segments arising from the direction in which the section has been made through the alternate mammillæ. The ridges are approximated, and the layer of enamel bears a large proportion to the conical lobe of ivory which it invests. The cement is entirely wanting, except in the bottom of the clefts. This tooth measures about seven inches in length.

Fig. 10 *b* shows a section of a fragment comprising the greater part of the last lower molar of the same species. There is a similar alternate arrangement of the mammillæ, and the tooth differs from the corresponding upper molar, only in being complicated with an additional ridge.

The teeth of this species bear an exceedingly close resemblance to certain of the European fossil grinders, which have been described under the indefinite name of *M. angustidens*. The three species, *M. latidens*, *M. Arvernensis*, and *M. Sivalensis*, with perhaps a fourth, of doubtful determination, constitute a particular section of *Mastodon*, characterized by the same numerical division

of the crown ridges in the last deciduous molar, and in the first and second true molars in both jaws.

Fig. 9, as previously described, represents a section of the last upper molar of *Mastodon Ohioticus*. It consists of four principal ridges, and a small talon lobe. The successively increasing simplicity of form which has been traced from *E. insignis*, attains its extreme limit in the molars of this species. The ridges are transverse, terminating in a trenchant edge; the ivory segments are in regular angular lobes, the layer of enamel is of uniform thickness, and the hollows between the ridges are very wide and open, being almost rounded at the bottom. The cement is present only in an exceedingly thin crust, continued over the fangs in greater thickness. The common plane of the grinding ridges of the crown is nearly horizontal, while it is more or less convex in all the previously noticed species. It has not been deemed necessary to give a delineation of the section of an inferior molar, which differs in no respect from the upper, except in being complicated with an additional ridge.

To the same group belong two other species, *M. angustidens* and *M. Andium*, and probably a third, *M. Tapiroides*, the dentition of which is but imperfectly known. The molars of the two first differ from those of *M. Ohioticus*, in the same manner that *M. Arvernensis* and *M. Sivalensis* differ from *M. latidens;* viz., the crown ridges, instead of being transverse, are composed of mammillæ, which are placed more or less alternately, projecting into the interspaces, and interrupting their continuity. The teeth of *M. Andium* are remarkable in being invested with a coat of cement, which fills up the bottom of the hollows, and is extended over the mammillæ in a considerably greater quantity than occurs in any other species of true *Mastodon*. These three species, *M. Ohioticus*, *M. angustidens*, and *M. Andium*, constitute a distinct section, agreeing in having the three molars which precede the last, viz., the third deciduous molar, and the penultimate and antepenultimate true molars, uniformly characterized by having their crown divided into *three* ridges in both jaws; while the same teeth in the preceding group have each a crown with *four* ridges.

The teeth of *M. Andium* and *M. angustidens* are not included in the plates of sections. Following the same serial arrangement which has been observed throughout, their place would be between *M. Sivalensis* and *M. Ohioticus*, the latter of which forms the terminal link in the chain, establishing the nearest passage into *Dinotherium*, and through that genus into the ordinary Pachydermata.

Figs. 11 and 12 of pl. 3, drawn of the natural size, represent sections of the penultimate lower molar of two species of *Dinotherium*, the former a fragment, showing the posterior half of the tooth in *D. Indicum*, and the latter the whole tooth in *D. giganteum*. The sections exhibit the same arrangement of the dental substances as in *M. Ohioticus*. The tooth, fig. 12, consists of two transverse crenulated ridges, and a talon ridge, while in the equivalent molar of *M. Ohioticus*, there are three principal ridges. Corresponding to the smaller number of divisions, the ridges in *D. giganteum* are more widely separated, less elevated, and broader at their base, while the interspaces are also wider and more open than in the North American Mastodon; the layer of enamel is of similar thickness, and there is no appreciable crust of cement. The correspondence is followed out in the form of the subordinate heel ridge. *D. Indicum* is the species which is most nearly allied to *M. Ohioticus;* and all the ascertained evidence regarding it tends to prove that it belonged to a true Proboscidean pachydermatous genus like the latter.

§ III.—On the Succession of the Molars, and their Characters as indicating Sectional Groups of Species.

The molar teeth, developed during the course of life in the ordinary Pachydermata, are divisible into three well-marked sets; the milk or deciduous molars, the false molars or successional premolars, and lastly, the true molars. The milk teeth are so distinct in their transitory character, from the permanent series, that the consideration of the former is usually omitted in the construction of generic definitions; but in *Mastodon* and *Elephas*, the succession of the teeth is so modified, and the premolars are

so completely, or partially suppressed, that the triple division is rendered very obscure, and it has commonly been found necessary, by systematic authors, to include the whole series, in framing the expression of the dental formula. In fact, till the appearance of Professor Owen's Odontography, the normal division and theoretical signification of the different molar teeth in these genera were not understood.[1]

In the ordinary Pachydermata, which the Rhinoceros may be supposed to represent, there are normally four milk or deciduous molars in both jaws, the hindmost of which has the complicated form which characterizes the last true molar of the adult animal. They are frequently reduced to three in other genera, by the suppression of the anterior tooth, which is the most variable and rudimentary in form. These teeth are succeeded vertically by an equal number of premolars, the last of which is always of a simpler form than the tooth of which it takes the place; and they, in like manner, are subject to a numerical reduction by the non-development of one or more of the anterior teeth. Behind the premolars are the true molars, the normal and developed number of which is invariably three, this set being exempt from the partial suppression to which the others are subject. They are distinguished from the premolars by greater complexity of form; they come into place like the milk molars, in antero-posterior succession, and the first of the series is protruded and in use before the appearance of the last premolar, which immediately precedes it in position in the jaw. In the adult animal, in most genera, the whole of the premolars and true molars are simultaneously present and in use in the jaws. A remarkable exception from this rule takes place in the subgenus of the hog tribe, called *Phacochœrus*, in which, in consequence of the complicated form and large size of the last true molars, there is not room in the jaws to accommodate the whole number at one time, and the first true molar is worn down and pressed out before the last molar is protruded. This last molar is gradually pushed forward, causing the anterior teeth to be shed, so that the number of molar teeth in the upper jaw, which

[1] *Ante*, p. 11.

at one time in the adolescent animal amounts to five on each side, is finally reduced to one or two in the advanced age.[1] Precisely analogous conditions take place in the true Elephants, in which this kind of exception from the ordinary mode of dental succession is carried to the greatest known excess.

Dinotherium.—The first and most simple deviation from the usual Pachydermatous type, in the dentition of the Proboscidea, is presented by *Dinotherium*. In this genus, only two milk molars, viz., the penultimate and last, have been met with in both jaws, one or two of the anterior teeth of this set being suppressed. The last milk molar, above and below, is three-ridged, while the penultimate has only two ridges. These teeth are replaced vertically by an equal number of premolars, which represent the penultimate and last, the two anterior teeth of this series being also suppressed. The last premolar, as well as the penultimate, is only two-ridged, conforming to the ordinary rule of being simpler in form than the milk molar which it succeeds. Of the three true molars, the first or antepenultimate, in both jaws, is three-ridged, repeating the complex form of the last milk molar, while the penultimate and last are only two-ridged. This is a very remarkable anomaly, of which no other example is known among the Pachydermata, as it is commonly the last true molar which reiterates the form of the last milk molar. The first true molar is protruded and in use before the last milk molar is shed, so that in the adolescent animal there are two contiguous teeth, which have each three ridges. We have, in this circumstance, the first essential proboscidean character, which at once distinguishes *Dinotherium* from the Tapirs and allied genera, and indicates its near relations to *Mastodon*.

In regard to the number of teeth which are in place and in use at the same time, *Dinotherium* is less aberrant than even *Phacochœrus*, as the two premolars and three true molars in the adult animal are simultaneously present in both jaws. The molar formula *Dinotherium* is therefore 2 premol. + 3 mol. = 5 in each side of both jaws; and the number of ridges in the different teeth,

[1] Owen, Odontography, p. 550.

according to their successive position in the jaw, is 2 + 3 in the milk molars; 2 + 2 in the premolars, and 3+2+2 in the true molars.

Mastodon. Sect. Trilophodon.—*M. Ohioticus.*—The next degree of deviation from the ordinary dental rule is presented by *Mastodon Ohioticus.* In this species, which appears to be the most nearly allied of the well-known forms to *Dinotherium*, there are three deciduous molars in both jaws, the most anterior of the series being suppressed. Of these, the antepenultimate, or anterior tooth (being theoretically the second) in the upper jaw, measures 1.4 inches in length, by about 1.4 in width; and the penultimate, or second (theoretically the third), measures 1.7 by 1.75 inches. These teeth are of the same form, each consisting of four points, which are disposed in two transverse ridges; and they further correspond with the same teeth in the ordinary Pachydermata by differing but slightly in relative size. The third milk molar, as in *Dinotherium*, consists of three transverse ridges, each composed of two pair of confluent points. It measures three inches in length, by 2.4 in width. The milk molars of the lower jaw differ in no important respect from those of the upper, except in being narrower in proportion to their length: and in the greater development of the anterior and posterior subordinate talon ridges.

With respect to the premolars, the statements which have been advanced regarding them are conflicting. They have never been observed in either of the jaws by Godman, Hays, Cooper, Harlan, or any other of the American Naturalists who have described the dentition of *M. Ohioticus;* nor has their presence been noticed by Dr. Grant. But Professor Owen, in his British Fossil Mammalia, affirms that they have been recognised in this species; and, in his Odontography,[1] he figures and describes a tooth as the penultimate premolar of the upper jaw. It is there stated to be composed of two bifid transverse ridges, girt by a basal cingulum, and to be of a simpler form than the second deciduous molar; the crown being broader in proportion

[1] *Loc. cit.* p. 260. Pl. 144, fig. 3, *p.* 1.

to its length, and measuring one inch five lines, by one inch four lines.

Professor Owen also gives a figure of the hypothetical position of the same tooth in the lower jaw,[1] the presence of which he admits has not yet been established in the species. The accurate determination of this point is of considerable systematic importance, as the occurrence of this premolar constitutes one of the two characters upon which (failing those advanced by Cuvier) Professor Owen founds his generic distinction between *Mastodon* and *Elephas*. Had the tooth been observed *in situ* in the jaw as in the Dax Specimen of *M. angustidens*, figured by Cuvier and in the specimen of *M. longirostris*, figured by Kaup, its occasional presence in the upper jaw of *M. Ohioticus* would have been placed beyond doubt; but the tooth described by Professor Owen appears to have been a detached specimen, and no characters are attributed to it inconsistent with its being the first milk molar of the upper jaw. In order to arrive at a certain determination of the point, we have been permitted to make a section of a specimen consisting of the entire palate, of a young *Mastodon Ohioticus* in the British Museum, containing the second and third milk molars, with the first true molar protruded, and the second true molar in germ. A section was made both along the palate, and along the outside of the jaw; but not a trace of a premolar was visible, although the cranium was exactly of the age when a premolar, if developed, ought to have been shown. A similar negative result attended a corresponding section of a specimen of the same age of the lower jaw. The only other evidence which could establish the case would be the finding of an unworn tooth in front of the third milk molar. But, so far as we are aware, no instance of this sort has been recorded, notwithstanding the great number of young specimens which have been described by different observers; and the result of the whole evidence at present is, that, ordinarily, the premolars are entirely suppressed in *M. Ohioticus*, in both jaws.

There is nothing, therefore, in the mode of succession of the

[1] *Ibid.* Pl. 144, fig. 7, *p*. 1.

teeth in this species, to show where the deciduous series terminates and the true molars begin. The last milk molar is followed in antero-posterior succession, as in *Dinotherium*, by a tooth which has its crown divided also into three ridges, and is thus indicated to be the antepenultimate, or first true molar. It measures four inches long, by about three in width, differing only in size from the tooth which precedes it. The penultimate, or second true molar (being the fifth in the order of succession), consists, also, of three ridges, and measures about five inches by three and a half. The third, or last true molar, consists of four principal ridges, and a small heel ridge, which varies considerably in amount of development. This tooth measures 7.25 inches or upwards, by about 4.5 in width.

The inferior true molars in *M. Ohioticus*, agree with the upper in the form and division of their crowns, except the last which has usually five principal ridges. They are narrower in proportion to their length, and the subordinate talon ridges are more developed. The molar formula in this species is, therefore, 3 milk molars in the young animal; and 0 premol. + 3 premol. = 3 in each side of both jaws of the adult; the number of ridges in the different teeth according to their succession being $\frac{2+2+3}{2+2+3}$ in the milk molars, and $\frac{3+3+4}{3+3+5}$ in the true molars. With regard to the number of teeth which are simultaneously present in the jaw; the lower jaw of *Tetracaulodon* figured by Godman,[1] shows the three milk molars in use, and the first true molar in its alveolus, there being four out of the whole number of six teeth at one time in the jaw. These are ultimately in advanced age reduced to the last tooth, the others being shed.

M. angustidens. — The dentition of *M. angustidens* is involved in great confusion, in consequence of most authors, who have written on this species, having mixed up, under this name, two distinct forms, the one characterized like *M. Ohioticus*, by a *ternary*, the other, by a *quaternary* division in the ridges of the middle teeth. It will be necessary to enter

[1] Amer. Phil. Trans., New. Series, vol. iii. pl. xviii.

at some length upon the evidence on this point, more especially, as the two latest authorities of weight, Prof. Owen and M. de Blainville do not admit a specific difference between *M. angustidens*, and *M. longirostris*. On the other hand Dr. Kaup has, in some instances (as in the case of the Stellenhoff lower jaw found near Vienna,[1]) excluded from his *M. longirostris*, specimens which assuredly belong to it; while in others (viz. the Georgensmünd Mastodon teeth described by von Meyer) he has transferred to this species, molars which appear to pertain to *M. angustidens*.

The first point to determine, under these circumstances, is the form to which the specific name of *M. angustidens* is properly applicable. Cuvier's description of the species commences with the Simorre tooth (Oss. fossil. tom. i. p. 255, Divers Mastodontes, pl. 1. fig. 4) which has the crown divided into three ridges, with a back talon of two tubercles, measuring 4.5 inches in length by 2.35 in width. The next specimen which he describes as belonging to it, is the Dax fragment (pl. 3. fig. 2.) containing two teeth implanted in the palate on one side, the anterior of which is the unworn germ of a premolar, and the posterior, nearly of the same size as the Simorre tooth, like it consists of three ridges and a small talon of two tubercles. A third tooth which he immediately afterwards attributes to this species, is another Simorre specimen (pl. 3. fig. 3.) measuring 3.6 inches by 2.6, and having its crown also divided into three ridges. It is therefore to a species having the intermediate molars distinguished by a ternary division of the crown, as in *M. Ohioticus*, that the specific name of *M. angustidens* is strictly applicable, so far as priority of description, and reference to original types can be taken as the guides to a decision on the point.

Of the other specimens referred by Cuvier to his *M. angustidens*, and represented in the four plates devoted to 'Divers Mastodontes,' the South American teeth (figs. 6 and 7 of pl. 1, and fig. 4 of pl. 3) appear to belong to *M. Andium*, as has been advanced by M. de Blainville, and nearly all the rest, which are susceptible of determination, belong to *M. Arvernensis* (M. longirostris of

[1] Cuv. Oss. Foss. edit. 1834, tom. ii. p. 363. pl. 2, figs. 4 and 5.

Kaup), with the exception of figs. 1 and 2, of pl. 1. fig. 11, of pl. 2. and fig. 14, of pl. 3., which are probably to be referred to *M. angustidens*.

We have already stated the grounds (ante p. 21,) upon which von Meyer, following up the observations of Croizet and Jobert, distinguished *M. Arvernensis* from *M. angustidens*, and that Kaup was led by his researches to the same conclusion. It would appear, from a communication in Bronn's Lethæa, that the ridge formula which Kaup attributed with doubt, to *M. angustidens* is $\frac{2+?+3?}{?+3+3}$ in the deciduous series, and $\frac{3?+4+5}{3?+4+4}$ in the true molars.[1]

M. de Blainville has entered at great length, in his Ostéographie, on what had been previously written regarding *M. angustidens*, and he has given a beautiful series of illustrations of all the teeth in succession, in both jaws, as he conceives them to be developed in this species. The rich collection of specimens, discovered by M. Lartet, and others, in Gascony and along the flanks of the Pyrenees (a large portion of which is displayed in the palæontological gallery of the Paris Museum) furnishes ample materials for establishing the specific independence of *M. angustidens* and *M. longirostris*. But M. de Blainville has not attached sufficient importance to the constancy of the ridge formula: he has throughout his illustrations intercalated Eppelsheim teeth of the latter species, having four ridges, with Gascon specimens of the former, having three ridges. In consequence, the teeth of the two species are not merely intermixed, but a wrong position in the jaw is in many instances assigned to M. Lartet's specimens of the true *M. angustidens*. This remark applies, without exception, to the determinations of the two last teeth of the upper jaw. Giving a numerical expression to M. de Blainville's descriptions of the different teeth, the ridge formula in *M. angustidens* would be $\frac{2+3+4}{2+2+3}$, $\frac{3+4+5}{3+4+6}$, respectively, in the three deciduous, and three true molars, on each side of both jaws. It is apparent that the lower numbers do not coincide with the upper, and that, followed in

[1] Lethæa Geognost. p. 1239.

sequence, they deviate widely from the uniform succession of three ridges presented by the last deciduous, and the first and second true molars in *M. Ohioticus*.

Professor Owen has on two occasions described, in detail, the dentition of *M. angustidens*, and the result stated in his 'Odontography' is, that he has seen as yet no evidence that the teeth described by Cuvier and by Kaup characterize different species. In his 'British Fossil Mammalia,' he identifies English specimens with some of the typical forms figured by Cuvier, and the number of ridges which he assigns to the different teeth, according to their succession, is $2+3+3$ to the deciduous molars, 2 to the small premolar, and $3+4+5$ to the true molars.[1] This formula is liable to the same objections as that put forward by M. de Blainville. In his 'Odontography,' however, published subsequently, Professor Owen describes the teeth of *M. angustidens* in a different manner, and the number of ridges assigned by him to the successive molars in the upper and lower jaws may be expressed thus: $\frac{2+3+4}{2+3+4}$, in the deciduous molars, and $\frac{4+4+5}{4+4+5}$, in the true molars.[2] This formula, with the exception of the number attributed to the last milk molar of the lower jaw, is precisely the same as that assigned by Dr. Kaup, to his *M. longirostris*, Professor Owen having referred, in almost every instance, on this occasion, to Kaup's figures, which he quotes as the types of his descriptions. But he still alludes to Cuvier's Dax specimen of *M. angustidens*, as identical with Kaup's species, although it is represented in the original figure, and described by Cuvier, as three ridged; and he states in the 'British Fossil Mammalia,' that, the rich series of analogical facts in the dentition of *M. giganteus* (*M. Ohioticus*), would "now appear to complete the demonstration of the specific identity of the *Mastodon longirostris*, and *Mastodon angustidens*," (p. 290).

From these details it will be seen how various and opposed the opinions of the best authorities are, up to the present time, regarding *Mastodon angustidens*. In consequence of its rarer occur-

[1] 'British Foss. Mammalia,' p. 286.

[2] 'Odontography,' p. 619—23.

rence in the fossil state, the available materials for tracing the dentition of this species are less numerous and complete than in the case of *M. Ohioticus*. The following descriptions are chiefly derived from specimens in the Paris Museum, the most of which have been figured by M. de Blainville.[1] Of the milk or deciduous molars in the upper jaw, the third only has yet been met with, *in situ*, in the palate. It is well shown, on the right side, in the posterior tooth of the Dax specimen figured by Cuvier (Oss. Foss. pl. 3. fig. 2.), and referred to above, the crown consisting of three transverse ridges, and an accessory talon of two tubercles, each of the ridges being composed of two pairs of confluent mammillæ. A single tubercle juts out into each of the hollows between the ridges alternately with the principal points, causing the trefoil-shaped discs, which the worn teeth present in this species, so different from the lozenge-shaped discs of *M. Ohioticus*. The dimensions of this tooth are not mentioned by Cuvier, but it may be gathered from the context of his description, that it measured a little above three inches long by about two in width. The same tooth, of the left side of the upper jaw, is seen in a most instructive specimen found by M. Lartet, near Sansans, in the department of Gers, containing two molars *in situ*, both of which are three-ridged. Of these the anterior, which is the third milk molar corresponding with the Dax tooth, is in an advanced stage of wear, the ridges of the crown being ground down into three disc surfaces. No back talon is distinguishable; if originally present, it has merged into the wear of the last ridge. This tooth measures 3.15 inches long, by two of width in front, and 1.75 behind, narrowing a little towards the posterior end. It is figured by M. de Blainville.[2] The same collection possesses another detached specimen from M. Lartet, of exactly the same size, but less worn, which shows three distinct ridges, and a small subordinate talon. The grinder described and figured by von Meyer, in his memoir on the fossil remains of Georgensmünd (p. 38, tab. 2. fig. 7.)

[1] One of the authors, during a visit to Paris, had the freest access to these specimens, by the liberal permission of MM. de Blainville and Laurillard. H. F.

[2] Ostéographie, pl. xv. fig. 3 *c* sup.

appears to furnish another example of the third milk molar of the upper jaw, left side, of this species. The crown is divided into three ridges, with a small posterior talon. It corresponds closely to the Gers specimens in dimensions, being three inches long by two in width. Von Meyer describes this tooth as the second milk molar of *M. angustidens*, but the size would seem to be conclusive against the correctness of this determination. Kaup compares it to the third upper molar of his *M. longirostris*. (Oss. Foss. de Darmst. p. 81.)

With regard to the first and second upper milk molars, neither of these teeth having yet been observed *in situ* in the jaw, we are unable to refer with confidence to any specimens for their characters. But we are inclined to regard the tooth described by von Meyer (Georgens. p. 38, tab 1, fig. 4), as representing the penultimate or second, and fig. 2 of the same plate as the first. The former measures 2.2 inches by 1.4, and is composed of three ridges, which are so far advanced in wear as to furnish no good diagnostic characters. Von Meyer refers it with doubt to the last milk molar of the lower jaw, while Kaup considers it to be the second upper of the left side of his *M. longirostris*.[1] The specimen (fig. 2 of von Meyer's plate) here regarded as the antepenultimate or first milk molar, has a square crown composed of four points. It measures 1.6 inches in length by 1.4 in width, resembling closely in form and dimensions the small Simorre specimen figured by Cuvier (Diver. Mast. pl. 1, fig. 2), which is also about 1.6 in. long by 1.4 wide, and is regarded by M. de Blainville as the first upper molar of *M. angustidens*. This eminent palæontologist assigns the same place to several other specimens from M. Lartet and others; but such of these figures as are susceptible of exact determination, from their being found *in situ* in the jaw, are derived from Auvergne and Eppelsheim specimens of *M. longirostris*. The same remark applies to M. de Blainville's figures and descriptions of the second milk molar in both jaws.

Of the inferior milk molars, the two anterior, like the upper,

[1] Oss. Foss. de Darmst. Pt. iv. p. 73.

have not yet been found *in situ*, and the specimens which have been assigned to them are, in consequence, in a great measure conjectural determinations. The first was probably a simple tooth consisting of a pair of cusps; and the second, reasoning from the analogy of the same tooth in the nearly-allied *M. Andium*, was probably three ridged. The third is represented by the 'dent de Saxe' (Oss. Foss. pl. 2. fig. 2.), upon which Cuvier founded his nominal species of *M. Minutus*, but which M. de Blainville, with reason, attributes to *M. angustidens*. It is of the left side of the lower jaw; the crown is divided into three ridges, each composed of two pairs of confluent points, with a well-developed back talon of two tubercles, and one or two subordinate tubercles in the spaces between the ridges. The dimensions of this specimen are 3.25 inches long, by 1.25 of width in front, and 1.65 behind. An unworn germ, of unknown origin, in the British Musuem, of the same size as the Saxon tooth, and exactly resembling it in the ternary division and form of the crown ridges, furnishes another example of the third inferior molar. M. de Blainville (loc. cit. pl. 15. fig. 3 *b*,) attributes the same place to a worn three-ridged tooth, from the collection of M. Lartet, found near Sansans.

We have seen that the premolars, of which two are developed in *Dinotherium*, appear to be entirely suppressed in *M. Ohioticus*. But there is no doubt about the presence of one in the upper jaw of *M. angustidens*. A beautiful illustration of this tooth is furnished by the Dax specimen, previously referred to. As figured in the 'Ossemens Fossiles,' (pl. 3. fig. 2 *a b*) it is shewn as a germ of a square form and composed of four points. It is proved to be a premolar, and to be protruded vertically in the ordinary manner, by being unworn, while the third milk molar behind it has the three ridges well affected by wear. This circumstance is clearly indicated by Cuvier in his description of the specimen.[1] Von Meyer refers to the same tooth, the Georgensmünd specimen represented in tab. 1. fig. 1. of his Memoir, which resembles the Dax specimen in form, and in the crown being composed of four points; it measures about 1.6 inches square.

[1] Ossemens Fossiles, tom. i. p. 256.

This upper premolar, as has been pointed out by Professor Owen, takes the place of the second milk molar; it therefore represents the penultimate of this series. There is no evidence that the third milk molar of the upper jaw in this species is followed by a corresponding vertical successor. It is of importance to observe this apparent irregularity in the order of suppression. In *Dinotherium*, the two last premolars are developed, the two anterior being suppressed; in *M. Ohioticus* the whole four remain undeveloped; while in *M. angustidens*, the penultimate alone is developed, the two anterior and the last being suppressed. A similar order of suppression has been observed in the premolars of *M. longirostris*.

In regard to the lower jaw, there is no evidence yet that a premolar is included in the dental succession of the inferior grinders. Von Meyer, with doubt, assigns this place to a detached tooth which he figures (*loc. cit.* tab. 1. fig. 2.), but the determination is merely conjectural, Kaup referring it to his *M. longirostris;* and it is by no means certain that this specimen does not belong to the upper, rather than to the lower jaw. That a rudimentary lower premolar may have been developed in this species is highly probable; but we are not warranted, in the absence of direct proof, to hazard any inference respecting organs, which are liable to be entirely suppressed, and which, when developed, are so rudimentary in form as not to be of functional importance in this tribe of animals.

The materials to illustrate the dentition of the adult animal have been found in sufficient abundance to leave no room for doubt respecting the characters and succession of the true molars. The antepenultimate, or first,[1] is seen in the Sansans specimen from M. Lartet, *in situ* in the left side of the upper jaw along with the third milk molar, which we have described. It is an oblong tooth, in the condition of an almost unworn germ, having the crown divided into three distinct ridges, with a well-marked basal cingulum on the inside, and a small back talon. It measures 4.13 inches in length by 2.75 of width in front, and 2.25 behind.

Another example of this tooth appears to be furnished. by fig. 5,

[1] De Blainville, Ostéographie, pl. 15. fig. 4.

of tab. 1. of von Meyer's memoir. The crown has the same three-ridged form as the Sansans specimen, with which it agrees very closely in dimensions, being 4.2 inches long, by 2.7 in width. Von Meyer refers it with doubt to the third molar of the lower jaw, right side of this species, while Kaup assigns to it the same position in the lower jaw of his *M. longirostris* (*loc. cit.* p. 81).

The penultimate, or second true molar, is shown *in situ* along with the last, in another instructive Gascon specimen from M. Lartet, displayed in the Paris Museum. This fragment, likewise, is of the left side of the upper jaw. Of the two teeth which it contains, the anterior (or penultimate) had been a long time in use, and is very much worn. It is nearly rectangular in form, and the crown is distinctly divided into three discs, which indicate the same number of ridges. No back 'talon' is distinguishable, the abrasion of the last ridge being far advanced. The dimensions of this tooth are 4.5 inches long by 2.75 of width in front, and 2.6 behind. It is described by M. de Blainville as the fourth, or ante-penultimate.[1] The posterior tooth in this specimen, being the third, or last true molar, like its equivalent in *M. Ohioticus*, is more complicated in form than the two which immediately precede it. The crown consists of four ridges, each composed of two pairs of confluent points, arranged somewhat alternately, and there is no distinct heel ridge appended to the posterior extremity. This tooth is wide in front, and contracts very considerably backwards, a character common in most species of Mastodon, to the last molar of the upper jaw. The dimensions are,—length 6.25 in.; width in front, 3.25; width behind, 2.25. The palæontological gallery of the Paris Museum contains numerous other specimens of the last upper molar of *M. angustidens*, four of which, from different localities, have been admirably figured[2] in the 'Ostéographie.' They all agree in having the crown invariably divided into four ridges; the only variety which they present being in the greater or less development of the 'talon' appendage of the last ridge. Of these, the superb Tournans specimen,[3] which comprises

[1] De Blainville, *loc. cit.* p. 296, pl. 15. fig. 4 *b* sup.

[2] *Ibid.* fig. 5 *a*, *b*, *c*, *d*, sup.

[3] Ibid. pl. 14.

FAUNA ANTIQUA SIVALENSIS.

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DESCRIPTION OF THE PLATES

OF THE

FAUNA ANTIQUA SIVALENSIS

FROM NOTES AND MEMORANDA

BY

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ERRATA.

Page 82, line 5, *omit* The drawing shows the descending process of the jaw.

Pages 82 and 83, *substitute* upper jaw *for* lower jaw *in descriptions of figures* 1, 3, 11, *and* 15 *of Plate LXII.*

Page 104, line 4 of description of Fig. 4, *for* premolars *read* premolar.

A

DESCRIPTION OF THE PLATES

IN

THE FAUNA ANTIQUA SIVALENSIS.

[This description has been mainly compiled from the following sources:—1. Memoranda in Dr. Falconer's note-books and papers; 2. References to certain of the figures in his published memoirs on Elephant, Mastodon, &c.; 3. References to other figures in his correspondence with scientific friends; and 4. Labels in his handwriting on the specimens figured which are now in the British Museum. Although the figures are drawn to scale, the actual measurements have, as far as practicable, been introduced into the description of each figure. It has been thought that by their means, the value of the descriptions would be increased to those who have not an opportunity of consulting the Plates, and that even to those who possess the Plates the comparison of specimens would be facilitated. The measurements are given in English inches, and in tenths of an inch. The letters B.M. indicate that the specimen referred to is in the British Museum.]

Plates I., II., and III. are intended to represent, by careful copies of nature, the modifications in structure and form exhibited by the molar teeth of the *Proboscidea*. They show in vertical sections a series of gradations, commencing with *Dinotherium* and *Mastodon Ohioticus* at one extremity, and running through the other species to *Elephas primigenius*, in which the greatest deviation from the ordinary form of a grinding tooth is met with.

Plate I.

Fig. 1.—*Elephas primigenius*, or the true Mammoth: longitudinal and vertical section of last upper molar, left side, from an English specimen found near Kingsland, and formerly in the Museum of the Geological Society. Shows the 'ridge formula' and the form and relative proportions of the alternate layers of ivory. The section closely resembles that of the corresponding tooth of the Indian Elephant, but the ivory segments are even thinner, more vertical, and more approximated. The disposition of the plates presents the

extreme degree of 'pectination' seen in the molars of any known species of elephant.—B.M.

Length, 11 in. No. of plates, 21. Depth of enamel at tenth plate, 6·2 in. Length of space to 10 plates, 4½ in.

Fig. 2 *a*.—*Elephas Indicus*. Vertical section of an upper penultimate molar of the existing Indian Elephant. It is composed of seventeen ridges, with a reduced talon splent behind, the anterior talon being confluent with the first ridge. The anterior eight plates are inclined forwards, and by the process of wear they are ground down, so that the front part of the tooth is truncated obliquely before the posterior lamellæ have come into use. The plates are very thin and vertical, and the enamel is thin. The gradual attenuation of the plates, successively exhibited from *E. insignis* to *E. Hysudricus*, is here carried to excess, eighteen being comprised within the space occupied by about nine in the equivalent tooth of the African species. The pectinated arrangement contrasts strangely with the chevron-formed ridges of *E. insignis* and the cuneiform plates of *E. planifrons*. The mass of ivory at the base of the tooth is much thinner than in the corresponding molar of *E. Hysudricus*.

Length of crown, 8·2 in. Space occupied by 10 plates, 4½ in. Height at tenth plate, 6 in.

Fig. 2 *b*.—*Elephas Indicus*. Vertical section of unusually large specimen of last lower molar of an Indian Elephant, from Assam, in India House collection. The entire length of the crown is about fifteen inches, and it includes as many as twenty-seven ridges, of which the anterior thirteen are more or less abraded. The first five or six ridges incline a little forwards, while the posterior ridges incline so much in an opposite direction, that the hindermost are nearly horizontal, producing the flabelliform character that so readily distinguishes in most instances the last from the penultimate lower molar. The same disposition and proportions of the dental substances are observed as in the upper grinder.

Fig. 3 *a*.—*Elephas Hysudricus*, from the Sewalik hills. Vertical section of penultimate upper molar, left side. The tooth is in the middle stage of wear, eleven of the thirteen plates of which it is composed having been in use, and the two anterior ridges being worn out. The same vertical disposition of ivory, enamel, and cement is presented as in the African Elephant, but the plates are thinner and more vertical; the layer of enamel is proportionally thicker; and the interspaces occupied by the cement are wider in general than the ivory plates.—B.M.

Length, 7·7 in. Length of 10 plates, 5·75 in.

Fig. 3 *b*.—*Elephas Hysudricus*. Vertical section of portion of last molar of lower jaw, comprising about fifteen plates. The same general character, in the disposition and relative proportion of the ivory, enamel, and cement are exhibited as in the upper molar, bearing in mind that the latter is a younger and consequently smaller tooth. The layer of enamel, however, is thinner than in the upper molar. The ivory segments curve back near their base, and the apices of the posterior plates lean towards the front of the tooth, a disposition still more marked in the existing Indian Elephant. The dark shade below the ivory indicates a core of sandstone, occupying the place of the unossified part of the pulp nucleus, and of the undeveloped fangs.—B.M.

Plate II.

Fig. 4 *a*.—*Elephas Africanus*. Vertical section of a penultimate grinder, upper jaw, of the existing African Elephant, in the possession of Mr. C. Stokes. It is composed of nine principal divisions and a subordinate talon ridge, the four anterior of which are partly worn, the rest being entire. The ivory segments consist of long narrow wedge-shaped plates, the height of which is many times greater than the width of their base. The interspaces are deep and filled up with copious cement. The enamel and common basal mass of ivory are much less than in either *E. insignis* or *E. planifrons*, the latter being only sufficient to establish a common connection between the bases of the segments, and a foundation for the offset of the fangs, which are numerous.

Length, 8·7 in.

Fig. 4 *b*.—*Elephas Africanus*. Vertical section of penultimate molar of lower jaw, belonging to Mr. C. Stokes. It is composed of nine cuneiform plates. This tooth had been a long time in use, all the plates, except the last being affected by wear. The anterior part of the crown has been ground down to nearly one-third of its original height, so that the enamel divisions between the two anterior ivory plates have disappeared, and the latter are confluent into a common mass. The section exhibits the same kind of wedge-shaped ivory plates, a similar amount of cement in the interspaces, and an analogous thickness of enamel as in *E. planifrons*, fig. 5 *b*.

Length, 7·2 in.

Fig. 5 *a*.—*Elephas planifrons*, from the Sewalik hills. Vertical section of penultimate upper molar, with nine ridges, the three anterior of which alone have been in use, the two first being worn down to a single disc of ivory. The ridges are seen to be much more elongated vertically than in *E. insignis* (fig. 6 *a*), but to be considerably less so than in the African Elephant. From the latter it also differs in the enormous quantity of cement, filling up the valleys and enveloping the ridges, and in the much greater thickness of the folded plates of enamel. The enamel is reflected over the ridges of ivory, and down into the hollows zig-zag wise, exactly as in *E. insignis*.—B.M.

Length, 8·7 in.

Fig. 5 *b*.—*Elephas planifrons*. Vertical section of portion of last molar of lower jaw, with nine ridges, and presenting the same general characters as fig. 5 *a*. The lower tooth, however, had been longer in use, and all the ridges are more or less worn, except the two last.—B.M.

Fig. 6 *a*.—*Elephas insignis*, from the Sewalik hills. Vertical section of last upper molar. The four anterior ridges are affected by wear; the six posterior ridges are entire, the fangs are fully developed, and their mode of implantation in the jaw is distinctly shown. The white mass in the centre represents the body of ivory, which is projected upwards in ten angular lobes, terminating in a sharp edge. The height of these lobes does not much exceed the width of their base, and closely applied over them is a thick layer of enamel reflected up and down in a continuous zig-zag plate. The interspaces of the five posterior ridges of enamel are completely filled up by a mass of cement much exceeding the enamel in thickness (*vide* Plate VI. fig. 7). This is the best illustra-

tion of the intermediate type of a proboscidean molar tooth, from which those of the other species diverge in opposite directions. It belongs to the *Mastodon Elephantoïdes* of Clift. The dark granulated shade below the portion of the ivory nucleus sustaining the five posterior ridges indicates the hollow of their common fang, which in the fossil is occupied by a core of sandstone.—B.M.

Length of tooth, 10·3 in.

Fig. 6 *b*.—*Elephas insignis*. Vertical section of anterior portion of adult tooth of lower jaw. The two front ridges only have been touched by wear. The ivory, enamel, and cement present the same characters as in the upper molar, but the common curve of the crown is slightly concave instead of convex. The posterior part of the basal portion of the pulp nucleus has not completed the stage of calcification, its place being occupied by a nest of calcareous crystals. The figure also shows two ridges of the preceding molar, with their common fang implanted in the lower jaw.—B.M.

Plate III.

Fig. 7 *a*.—*Elephas Ganesa*, a fossil Indian species. Vertical section of last upper molar. The crown consists of ten principal ridges, with a subordinate talon ridge in front and behind. The anterior seven ridges have their summits worn. A small portion is broken off at the anterior end. The disposition and relative proportions of the ivory, enamel, and cement bear the closest resemblance to those of the corresponding tooth of *E. insignis*, and the number of ridges agrees. In fact, there are no good characters by which the teeth of these two species can be satisfactorily distinguished, although the crania are so remarkably different.—B.M.

Length of tooth, 9·25 in.

Fig. 7 *b*.—*Elephas Ganesa*. Vertical section of posterior molar of lower jaw. A small portion of the anterior end of the crown has been broken off, but the presence of the anterior fang proves that the section includes the whole length of the tooth, except the first ridge, the posterior end being entire. It appears to have consisted of eight principal ridges, with a talon ridge behind, and a subordinate ridge in front. Five of the ridges have been in use, the anterior two being worn down close to the common base of ivory ; the three last ridges are entire. It bears a close resemblance to the corresponding inferior tooth of *E. insignis* in the form of the ridges, thickness of enamel, and proportion of cement.—B.M.

Fig. 8.—*Mastodon latidens* (Clift). Vertical section of two last molars of upper jaw. The specimen of which the section was made was formerly in the collection of the Geological Society, and is figured in Clift's memoir (Plate XXXVII. fig. 1). The last tooth shows five principal ridges with a posterior talon ridge and a subordinate ridge in front. The ridges are transverse and divided by a longitudinal cleft into two pairs of principal points without intermediate mammillæ in the hollows. The enamel is very thick and the cement is reduced to a thin layer, only observable in the bottom of the hollows. The ivory lobes resemble those of *E. Ganesa*, but are less elevated, with a broader base. The anterior tooth had been a long time in use, and the ridges are nearly all

worn out; they were four in number. *Mastodon latidens* is the form most nearly allied to *E. Cliftii*, and, through that species, to the true Elephants.—B.M.

Length of last tooth, 5·5 in.

Fig. 9.—*Mastodon Ohioticus.* Vertical section of last upper molar. It consists of four principal ridges and a small talon lobe. The ridges are transverse, terminating in a trenchant edge; the ivory segments are in regular angular lobes; the layer of enamel is of uniform thickness, and the hollows between the ridges are very wide and open, being almost rounded at the bottom. There is only an exceedingly thin crust of cement, continued over the fangs in greater thickness. The common plane of the grinding ridges of the crown is nearly horizontal. *M. Ohioticus* constitutes the terminal link in the chain, and through *Dinotherium* establishes a passage into the ordinary Pachydermata.—B.M.

Fig. 10 *a*.—*Mastodon Sivalensis*, from the Sewalik hills. Vertical section of last upper molar. The ridges are more complex in their composition than in *M. latidens*. The crown is bisected by a longitudinal furrow, each division of the ridge being composed of a pair of contiguous conical mammillæ placed more or less alternately. The hollows are in consequence interrupted. There are five principal ridges, with a subordinate ridge in front, and a talon ridge behind. Eight divisions of the ivory may be counted in the figure, the smaller segments arising from the direction in which the section has been made through the alternate mammillæ. The ridges are approximated, and the enamel bears a large proportion to the conical lobe of ivory which it invests. The cement is entirely wanting, except in the bottom of the clefts.—B.M.

Length of tooth, 7 in.

Fig. 10 *b*.—*Mastodon Sivalensis.* Vertical section of greater part of last lower molar. The tooth differs from the corresponding upper molar only in being complicated with an additional ridge.—B.M.

Fig. 11.—*Dinotherium Indicum* (Falc.), from Perim Island. Vertical section of posterior ridge and talon of the penultimate lower molar, left side. The internal structure exhibits the same agreement with that of the European Dinotherium, as is indicated by the external form. The only perceptible difference is, that the angle formed by the ridge of the ivory is more acute, and the enamel thicker in the Indian species. The centre is occupied by a rhomboidal core of arenaceous matrix marking the form of the unossified pulp nucleus. This tooth is described and figured in Dr. Falconer's Memoir on Perim Island Fossils.

Fig. 12.—*Dinotherium giganteum* (Kaup), from Eppelsheim. Vertical section of entire penultimate lower molar, consisting of two transverse crenulated ridges, and a talon ridge, while in the equivalent molar of *Mastodon Ohioticus* there are three principal ridges. Corresponding to the smaller number of divisions the ridges are more widely separated, less elevated, and broader at their base, while the interspaces are also wider and more open than in the North American Mastodon. The layer of enamel is of similar thickness, and there is no appreciable crust of cement. The correspondence is followed out in the form of the subordinate heel ridge. *D. Indicum*, however, is the species most nearly allied to *M. Ohioticus*.—B.M.

Plate IV.

Elephas Hysudricus. (Falc. and Caut.), from the Sewalik hills. Front view of skull, one-fifth nat. size. This fine specimen was purchased from Conductor Dawe.—B.M.

Length of the cranium from the protuberances of the occipital to the broken tip of left incisive, 45· in. Length from broken occipital condyles to anterior border of alveolus, 28· in. Vertical height of head, from broken condyles to the pyramidal bulge of sinciput, 26·in. Vertical height from surface of occipital to the tip of the nasals, 27·75 in. Extreme width of the head restored on left side, 38·5 in. Width at narrowest part of forehead between zygomatic fossæ, 10·5 in. Width of naso-maxillary fissure, 18·5 in. Depth from tip of nasals to anterior margin of naso-maxillary fissure, 3·5 in. Depth of rami of naso-maxillary fissure, 4· in. Width between middle of the orbits, mesial, 26· in. Greatest width of zygomatic fossa, 12· in. Depth from hollow of frontal to condyles, 20·in. Depth from posterior border alveolus to margin of naso-maxillary fissure, 21·5 in. Length of alveolus of last grinder, 10·5 in. Depth of hollow of frontal below mesial plane, 4·5 in. Extreme width of alveolus, 4·75 in. Width of incisive sheath in front of the alveolus, 18·5 in. Transverse diameter of the left tusk, 7·5 in. Antero-post. of the left tusk, 7·75 in. Depth below mesial plane of the occipital hollow, 8·5 in. Width of bottom of occipital hollow, 5·75 in. Depth of posterior bulge of the cranium from the occipital bone to surface of zygomatic fossa, 15·5 in. Least width at back part of cranium behind the alveoli, 8·5 in. Depth from posterior broken surface of condyle to the posterior border of the alveolus, 19· in. Depth of infra-orbital foramen, 2·5 in. Transverse diameter of foramen, 1·75 in. Length of infra-orbital canal, 6· in. Depth of the left orbit, 6·75 in. From anterior margin auditory foramen to anterior border of the orbit, 20· in. Vertical diameter auditory foramen, 1·5 in. Depth of the fossa between incisive sheaths at the top of it, 6·5 in. Width across fossa, 3· in. Depth of the naso-maxillary vault, 12· in. Depth of skull from posterior end of socket to the orbit, 22·5 in.

Plate V.

Figs. 1, 2, 3, and 4.—*Elephas Hysudricus.* Four different views of same skull as in Plate IV., $\frac{1}{8}$ nat. size.—B.M.

Plate VI.

Figs. 1 and 2.—*Elephas Hysudricus.* Perfect small head from the Geol. Soc. Museum, with the second and third milk molars, and first true molar in germ. The second milk molar on left side is much worn. The infra-orbital hole is very large. The tusks are oval on section, as shown in fig. 3 of another animal of same age. The palatal bones are divergent in front. The tusks are also a little divergent, and are very near in size those of the young Indian Elephant, but are narrower in front and more convex. The palate is not figured.—B.M.

Extreme length from occipital crest to broken incisor, 23·3 in. Length from occiput to tip of nasals, 13·8 in. Width of nasal opening, 7·1 in. Depth of nas. op. at sides, 2·8 in. From lower end of nasal opening to tip of incisives, 9·5 in. Semi-diameter from tip of nasals to left orbit, 6·3 in. Width of brow, 12·6 in. Width at contraction of incisive sheaths, 5·6 in. Extreme length of orbit, 3·5 in. Width at tips of incisive sheaths, 5·6 in. Vertical diameter of left tusk, 1·8 in. Transverse diameter of left tusk, 1·5 in. From outer margin of orbit to occiput, 16·8. in. Width of brow at temporal contraction, 6· in. Length of second milk molar, 2·1 in. Width of second milk molar behind, 1·6 in. Number of plates, 5. Length of third milk molar, 4·3 in. Width in front, 2·1 in. No. of ridges 7, with a front and heel ridge. Interval between second milk molars in front, 1·9 in. Interval between third, 2·2 in. From niche of palate to commencement of diasteme, 5·3 in. Length of diastemal ridges to tip, 6·3 in. Interval between ridges at base, 1·4 in. Expansion at tip, 2·9 in.

Fig. 3.—*Elephas Hysudricus*, under surface of young skull. This

specimen agrees in age and characters with that shown in figs. 1 and 2, except that the third milk molar has 8 principal ridges, with a front and back heel, instead of 7 as in the other.—B.M.

Length of second milk molar, 2·2 in. Width of second milk molar, 1·6 in. No. of plates about 5. Length of third milk molar, 4·3 in. Width, 2· in. Interval between second teeth, 1·2 in. Between third, 2·1 in.[1]

Figs 4, 5, and 6.—*Elephas planifrons* (Falc. and Caut.), from the Sewalik hills. Portion of cranium with palate containing premolar, third milk, and first or antepenultimate true molar. The left premolar consists of three principal ridges and an indistinct front and back ridge. Their direction is so oblique that they point nearly fore and aft. This little tooth is nearly globular in form and is quite untouched by wear. The crown is composed of a number of tubercles irregularly huddled together, somewhat in a botryoidal manner, and presenting no distinct indication of transverse ridges. A hollow filled with matrix is seen on the right side, where the corresponding tooth had dropped out. The third milk molar is very broad, all the six ridges worn, enamel thick. The first true molar is entirely in germ. —B.M.

Length of premolar, 1·2 in. Width, 1·1 in. Height of crown, ·8 in. Length of third milk molar, 4· in. Width, 2·4 in. Number of ridges 6, with a heel and front ridge. Length of first true molar, 5·5 in. Width, 2·7 in. Greatest height at fourth ridge, 3· in. Number of plates 7, with front and back ridges. Interval between third milk molars in front, 2·3 in. Ditto at niche of palate behind, 2·8 in.[2]

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[1] Notes by Dr. Falconer of other specimens of *E. Hysudricus*, not figured.

1. A small head with second and third milk molars, of exactly the same age as the small head, Plate vi. fig. 3, and Plate vii. fig. 1, if anything younger, as only the first ridge is touched by wear. Shows the plates of the second milk molar better than any other.

Length of second left milk molar, 2·5 in.; width, 1·6 in.; has 5 distinct ridges and a heel. Length of third milk molar, 4·1 in.; width, 2· in.; has 7 main ridges with a large front ridge and large heel, or 9 good plates. Interval between teeth in front, 1·6 in.; between last teeth behind, 2·1 in.

2. Another imperfect head of young *E. Hysudricus*, of same age as fig. 1 of Plate vi. Has second and third milk molars in use and first true molar in germ. The second milk molar is well worn, the third has the five first plates worn.

Length of second milk molar, 2·3 in.; width, 1·7 in.; number of plates 5, and a heel. Length of third milk molar, 4·6 in.; width, 2·3 in.; number of plates 8, with front and heel plates in addition. Height of sixth plate, 2·6 in.

3. Fragment of a very large cranium comparatively as regards the age of the teeth. Contains the third milk molar and first true molar. The third milk molar is well worn, with 7 ridges and a back and front ridge; the two front ridges worn. The tooth is very broad, broader even than the third milk molar of *E. planifrons* (Plate vi. figs. 4 and 5); the enamel is thin, and finely crimped. The first true molar is equally remarkable in being broad and short and in having few ridges. The first four ridges are touched by wear. It is proved to be *E. Hysudricus* by the great size of the nasal opening, and the downward direction of the rami.

Length of third milk molar, left side, 3·8 in.; width, 2·6 in. Length of first true molar, 6· in.; width, 2·6 in.; number of plates 8, with a large front ridge and a very large heel. Interval between the front teeth on either side, 1·6 in.; behind at the niche, 2·7 in. Depth of cranium from posterior surface of molar to brow between the orbits, 13·8 in. Width of brow between middle of orbits, 13·6 in. Width of naso-maxillary opening, 9·4 in. Width of muzzle at suborbital foramen, 10· in.

[2] Another valuable specimen of palate of *E. planifrons* is of same age as that in Pl. vi. figs. 4, 5, and 6, but is a little further advanced and belonged to a larger animal. The first true molar is an inch longer and is much broader and

Fig. 7.—*Elephas insignis*. Section of molar showing laminated character of cement filling up the valleys. In some sections as many as eleven distinct strata of this substance may be counted. The section is a portion of the tooth represented in Plate II. fig. 6 *a*, comprising the sixth and seventh ridges, and drawn to natural size.

Plate VII.

Fig. 1.—*Elephas Hysudricus*. Fragment of upper jaw containing second and third milk molars. Age of individual about same as in Pl. VI. fig. 3.—B.M.

Figs. 2 and 2 *a*.—*Elephas Hysudricus*. Fourth tooth, or first true molar, upper jaw, right side; 12 plates. Vertical Section in B.M.

Figs. 3 and 3 *a*.—*Elephas Hysudricus*. Fragment of upper jaw containing fifth tooth or penultimate true molar, 13 plates. Vertical section in B.M.

Figs. 4 and 4 *a*.—*Elephas Indicus* (erroneously designated *E. Hysudricus* in Plate). Last grinder of upper jaw. The anterior plates are inclined forwards, and by the process of wear they are ground down, so that the front part of the tooth is truncated obliquely, before the posterior lamellæ have come into use. The plane of detrition makes a large angle with the unworn plane of the crown, and slopes from the inside outwards. On the worn surface the digitated summits of the anterior ridges are found ground down into circular rings of enamel enclosing a pit of ivory.—B.M.

Fig 5.—*Elephas Hysudricus*. Fragment of lower jaw, left side, with second milk molar, vertically divided, and showing 7 or 8 plates. Specimen shows also remains of alveolus of first tooth.—B.M.

Fig. 6.—*Elephas Hysudricus*. Inferred to be lower jaw ? left side ? with second milk molar. Large variety, with 9 plates.—B.M.

Length, 3·4 in. Width in front, 1·1 in. Width behind, 1·8 in.

Figs. 7 and 7 *a*.—*Elephas Hysudricus*. Fragment of lower jaw, left side, with second milk molar, showing 7 or 8 plates.—B.M.

Length, 3·1 in. Width, 1·5 in.

Fig. 8.—*Elephas Hysudricus*. Lower jaw, left side, with third milk molar.—B.M.

Length, 5·5 in. Width, 2·2 in. No. of plates, 9.

Fig. 9.—*Elephas Hysudricus*. Fragment of lower jaw, with third milk and first true molars. The former has 9 plates; the latter is in germ.

Figs. 10 and 10 *a*.—*Elephas Hysudricus*. Fragment of lower jaw, with the first true molar, presenting 12 plates.

Figs. 11 and 11 *a*.—*Elephas Hysudricus*. Fragment of lower jaw, with penultimate ? true molar, presenting 12 plates.

Figs. 12 and 12 *a*.—*Elephas Hysudricus*. Fragment of lower jaw, with last molar, entire, *in situ*. The tooth is more elongated, and

higher. The points of the plates are few, being about 6 to the fifth and sixth plates. The apices of the plates are somewhat incurved or bent forward. The specimen consists of the back portion of left side of palate. The last ridge of the third milk molar is in front.

Length of first true molar, 6·5 in.; greatest width, 3·4 in.; height at fourth ridge, 3·5 in.; has 7 principal ridges with front and back ridge.

includes a greater number of divisions (17 or 18) than is usual in the last inferior grinder of *E. Hysudricus*. The specimen is now cut into sections.—B.M.

Plate VIII.

Fig. 1.—*Elephas Hysudricus*. Specimen of cranium in Mr. W. Ewer's collection. Shows the palate with the first and second true molars and tusks on both sides; the first well worn, and partly ground away in front; the second has the first four ridges well worn. The molars consist of ten ridges and a large heel ridge, eleven in all. The tusks of the opposite sides do not correspond, the left being nearly circular and the right oval. One large sub-orbital foramen.

Depth from back molar to the front at top of incisives, 17·5 in. Contraction of muzzle at sub-orbital foramen, 13·8 in. Breadth, outer surface maxillaries, 9·1 in. Vertical diameter, left tusk, 5·7 in. Transverse diameter, 5·1 in. Greatest diameter, right tusk, 6·2 in. Least, 4·3 in. Interval between teeth in front, 2·2 in. Behind, at niche of palate, 3· in. Length of anterior (first true) molar, 4·1 in. Width, 2·7 in. Number of ridges remaining, 5 and a heel. Length of left back molar, 8· in. Width in front, 3· in. Number of ridges, 10 and a large heel.

Figs. 2 and 2 *a*.—*Elephas planifrons* (misnamed *E. Hysudricus* in plate). Very perfect specimen of lower jaw. Has three mentary foramina on the right side, only two on the left; none on either side at the symphysis. The beak is very deep and thick, and appears to have terminated bluntly. The enamel is very thick. The teeth are certainly the last of the lower jaw, with few points to the back ridges. The slope of wear inclines very much from the outside inwards, the difference being nearly $\frac{3}{4}$ inch, at the third ridge of the left side. The front fang portion has dropped out. Nine ridges remain in the left tooth; on the right side are the remains of ten or eleven. The teeth are very broad, and there is considerable mesial expansion.—B.M.

Extreme length of right side, 24· in. Divergence of rami behind, 21·6 in. Height to front of alveolus, right side, 8·3 in. Greatest thickness behind, 6·7 in. Length of right molar, 8·8 in. Greatest width, 3·8 in. Distance between the teeth in front, 2·8 in. Divergence of teeth behind, 5·6 in.

Fig. 3.—*Elephas Hysudricus*. Lower jaw of small-sized adult. The inside only of this specimen has been figured, and only the portion from the last ridge backwards as a fragment. It is a very old jaw with the last molar. The anterior part of the tooth had dropped out. The last ten ridges remain, all of them worn. The enamel is thick, but very much crimped, and the plates are close together. The condyle is broad and very convex, and the long axis, instead of being transverse, runs obliquely fore and aft. The edge connecting with coronoid commences immediately below the condyle, instead of sloping down with a narrow neck as in *E. planifrons* (See Plate XI. fig. 3).—B.M.

Extreme length of jaw, 19· in. Height of ramus to top of condyle, 17·7 in. Transverse diameter of condyle, 4·5 in. Antero-posterior diameter, 2·8 in. Greatest thickness of ramus behind, 5·7 in. Antero-posterior extent of ascending ramus, 9·6 in. Height to alveolus, 6·2 in. Length of remaining portion of molar, 9·5 in. Width, 3·1 in.

Fig. 4 (and Plate XIII. A. fig. 7).—*Elephas Hysudricus*. Beautiful specimen of entire lower jaw, with two molars. The number of plates in the anterior molar is nine, with a front ridge and a small heel, inner

side. Nine plates of the next following tooth are seen in germ. From H. F.'s collection.—B.M.

Extreme length, including beak, 16·6 in. Extreme divergence of rami behind, 14·1 in. Height to alveolus, 4·4 in. Height of condyle, 11·2 in. Antero-posterior extent of ascending ramus, 7·4 in. Greatest thickness behind, 3·8 in. Length of anterior right molar, 5·4 in. Width, 2·3 in. From inner side of symphysis to tip of beak, 3·3 in.

Fig. 5.—*Elephas Hysudricus.* Extremely old lower jaw, right side, with the last tooth nearly worn out, and showing about five remaining plates extremely distorted. Belonged to an individual of small size. The figure is chiefly intended to show the distortion.—B.M.

Plate IX.

Elephas planifrons (Falc. and Caut.), from the Sewalik hills. Front view of skull, one-third of natural size. The forehead of this species is very flat; the naso-maxillary opening very small, and the occipital fissure very low.—B.M.

Plate X.

Elephas planifrons. Four different views of same cranium as figured in Plate IX. The last true molar is seen in germ and intact on the right side, and well worn on the other, so that the corresponding tooth on the right side of the lower jaw had probably been wanting. It has eleven ridges and a heel. The pterygoids are very low.—B.M.

Extreme length of cranium from occiput to broken incisives, 25· in. Extreme width of occiput, 21·7 in. Height of occiput (condyles broken), 13·7 in. From middle of occipital notch to tip of nasals, 11· in. Transverse diameter of nasal opening, 8·7 in. Vertical, 2·8 in. Interval from posterior orbital process to margin of nasal opening (partly broken), 8·3 in. Estimated width at posterior orbital processes, 27·8 in. Greatest contraction between the temporals, 14·7 in. From occiput to anterior margin of orbits, 20·7 in. Width of muzzle at orbital foramina, 12·5 in. Depth from surface of molar to brow at contraction between the temporals, 16· in. Antero-posterior diameter of orbit, 4·6 in. Transverse ditto, 4·5 in. Length of right molar, 9·7 in. Greatest height of crown plates, unworn, 4· in. Width of crown in worn tooth, 3·5 in.

Plate XI.

Fig. 1.—*Elephas planifrons.* Fine specimen of old palate, with last molar of either side. A section was made of the right molar, which consisted of ten ridges, back heel inclusive. The section showed the anterior fang complete; the enamel very thick; general expansion of the plates; points in the plates very few, fewer even than in *E. insignis.* Specimen in Mr. W. Ewer's collection (See note, page 14, No. 1).

Length of last molar, left, 11· in. Width in front, 4·5 in. Width at seventh ridge, 3·5 in. Interval between the teeth in front, 2·6 in. Interval behind at niche of palate, 5·4 in.

Fig. 2.—*E. planifrons.*—Superb specimen of lower jaw. It has two mental foramina placed, as in fig. 3, much worn in front. The last true molar is beautifully preserved on either side. They have thirteen principal ridges, and a back heel and front ridge; enamel very thick; points few; an intermediate mammilla, the detrition of which causes the mesial expansion; the tooth curves a good deal out. No long spout as in *E. Africanus.* From Sir Proby Cautley's collection (See note, page 14, No. 2).—B.M.

Extreme length of jaw, 19·2 in. Divergence of rami behind (outer surfaces),

19· in. Height to anterior margin of alveolus, 8· in. Greatest thickness behind, 6·5 in. Interval between teeth in front, 3·6 in. Interval behind, 5·6 in. Length of right molar, 11·8 in. Width of right molar in front, 3· in. Width behind, 2·8 in.

Fig. 3.—*E. planifrons.* Superb specimen of left half lower jaw, entire. The coronoid crescent slopes downwards from the condyle. Crown of the tooth very low. Seven last plates of tooth only remain; great thickness of enamel and abundant cement, and mesial expansion; enamel plates projecting. Proved to be *E. planifrons* by the distance between the plates, the very low crown, thick enamel, and two mental foramina.—B.M.

Extreme length of jaw, 24·2 in. Height of alveolar margin, 7·5 in. Height of ascending ramus to top of the condyle, 20·2 in. Width of ascending ramus from coronoid margin to posterior edge, 10·5 in. Greatest thickness, 6·1 in. Transverse measurement of condyle, 4·2 in. Length of molar, 10· in. Width of molar at middle, 3·6 in.

Fig. 4.—*E. planifrons.* Is a most remarkable fragment of the last molar, upper jaw, right side, taken out of a palate in H. F.'s collection. It is figured to show how diversified the species may be, and also the dedalian line of flexure.

Length of fragment, 5·4 in. Width, 2·5 in.

Fig. 5.—*Elephas planifrons.* Enormous tooth-fragment, with very thick enamel, low plates, and mesial expansion. This specimen is twice figured (See Plate XVIII. A. fig. 2). It is the last molar, lower jaw, right side.—B.M.

Length, 10·5 in. Greatest width, 4·2 in. Height of ninth plate, 3·5 in. Number of ridges, 9.

Fig. 6.—*Elephas planifrons.* Lower jaw, left side, with first and second (antepenultimate and penultimate) true molars. The first tooth is much worn; shows about six plates; enamel transverse with little crimping. The penultimate has nine ridges and a small heel, or eight and a double heel; the two front ridges barely touched. The ridges have few points, the fourth having only five. (*Vide E. insignis*, Plate XVIII. fig. 7).—B.M.

Length of front molar, 6· in. Greatest width, 2·8 in. Length of penultimate, 8· in. Width at fourth ridge, 2·8 in.

Fig. 7.—*E. planifrons.* Left side of lower jaw, with last molar very old. All the first half of the grinding ridges worn out. Very great expansion of the plates. Three mental foramina outside.—B.M.

Length of molar, 10·2 in. Greatest width, 4· in.

Fig. 8.—*E. planifrons.* A magnificent typical specimen, consisting of a fragment of the lower jaw with whole length of penultimate true molar; the anterior fang exposed; the three first ridges on this fang gone by wear; eight other ridges, making eleven ridges and a heel; enamel very thick; plates wide apart; much cement; few points; three mental foramina.—B.M.

Height of jaw to alveolar margin, outer side, 8·6 in. Greatest thickness, 6·4 in. Length of molar, 12·1 in. Width at fourth ridge, 3·6 in. Greatest width, 3·8 in.

Fig. 9.—*Elephas planifrons.* A fragment of last lower molar, left side, intended to show the large digitations and few points of the species. It has the three last ridges and a heel; points very distinct,

and enamel very thick; ridges very low; resembles Plate XVIII. A. fig. 1.—B.M.

Fig. 10.—*E. planifrons.* Lower (upper in MS.) jaw, left side, with penultimate and last molar. The whole of the penultimate much worn; the two front ridges worn out; has eight ridges and a very small heel. The tooth is very broad for its length; has a great abundance of cement; the enamel is very thick; figured for the remarkable fact of there being no crimping whatever, only a little flexuosity, and no mesial expansion. Last tooth is quite untouched by wear.—B.M.

Length of penultimate, 7· in. Width of ditto behind, 3·7 in. Length of first five ridges of last tooth, 5·6 in. Width at third plate, 3·7 in. Height of fifth plate unworn, 3·8 in.

Plate XII.

Figs. 1 and 1 *a.*—*Elephas planifrons.* Antepenultimate milk molar of upper jaw, with four ridges; drawn of natural size. Fig. 1 *b* shows a vertical section of same tooth.

Fig. 2.—*E. planifrons.* Section of second milk molar, upper jaw, right side. It has six main ridges, and back talon and front heel. The four front ridges are touched by wear; great quantity of cement and thick enamel. Resembles the third milk molar in Plate VI. figs. 4 and 5.—B.M.

Length, 3·8 in. Greatest width, 2·3 in.

Fig. 3.—(None in the plate).

Figs. 4 and 4 *a.*—*E. planifrons.* First true molar, upper jaw, much worn, showing five ridges and a heel remaining; two ridges probably gone.—B.M.

Length, 5·2 in. Width, 2·8 in.

Fig. 5.—*E. planifrons.* Fragment of upper jaw with first and penultimate true molar. The first molar is that numbered as fig. 4. The penultimate has eight ridges and a front heel. The specimen is broken behind, but the artist in the drawing has repaired the eighth ridge and added a little. Another first true molar in Plate VI. fig. 5 (See also note 2, page 7).

Length of penultimate, 8· in. Width, 3· in.

Fig. 5 *a.*—*E. planifrons.* Is a distinct specimen from fig. 5. It is a most valuable palate specimen, showing entire the penultimate or second true molar on either side. On the left side the cavity for the last molar is seen. The penultimate has eight distinct ridges and a front and back heel; all the ridges are more or less worn; the points are few and large, and the enamel thick. Has all the characteristic marks of *E. planifrons.* Specimen in Mr. W. Ewer's collection.

Length of left molar, 7·5 in. Width in front at third plate, 3·2 in. Width at last or eighth ridge, 2·6 in. Interval between teeth in front, 3·2 in. Interval behind, 5·4 in.

Figs. 6 and 6 *a.*—*E. planifrons.* Penultimate true molar *in situ* in upper jaw of a large animal. Tooth has eight main ridges.

Figs. 7 and 7 *a.*—*E. planifrons.* This is a beautiful little specimen of right side of lower jaw, containing the second milk molar. It shows a very small front splent, with six main ridges and a small heel limited to the inner two-thirds of the width of the last plate. Has exactly the same number of ridges as the corresponding tooth in young African Elephant (six main plates), but is a larger and broader tooth.

The first three plates are worn. The specimen also shows at *b* the fang-holes of the first milk molar.—B.M.

Length, 6·2. Height to alveolar margin in front, 3·2 in. Ditto behind, 2·7 in. Greatest thickness, 2·6 in. Length of second milk molar, 2·4 in. Greatest width of crown at fourth ridge, 1·4 in.

Figs. 8 and 8 *a*. *Elephas planifrons*.—Left side of lower jaw. This is a superb specimen. It displays three teeth *in situ*, viz. in the posterior extremity the last milk molar; in front of it the penultimate milk molar (*b*), nearly worn out, and emerging from below the latter a small vertically succeeding premolar (*c*). The third or last milk molar has seven main ridges, with a double front heel and a small splent behind; the four front ridges are worn; it is broader behind than in front: the reverse in the upper.—B.M.

Length of last molar, 4·4 in. Width at second ridge, 1·8 in. Width behind (greatest), 2·4 in. Length of small premolar, 1· in. Width behind, ·8 in.; does not show the ridges.

Fig. 9.—*Elephas planifrons*. Shows at *c* the penultimate premolar. It is considerably smaller in all its dimensions than the antepenultimate milk molar (fig. 1 *a*), drawn to the same scale. It is of a roundish form, and shows no distinct indication of ridge-divisions. It was, therefore, of small importance, functionally, in the economy of the species.

Figs. 10 and 10 *a*.—*Elephas planifrons*. This is an invaluable specimen. Proved by its size and development to be the first true molar, lower jaw, left. Shows seven main ridges and a small ridge in front; no heel behind, or only a very small one; is broader behind than in front; the five first ridges are worn; enamel very thick with mesial expansion; few points to the plates; much cement. The most interesting point is the third premolar (*b*) in front *in situ*. The back part of it only seen; it had not protruded through the jaw. Shows a last plate of three points and a small heel.—B.M.

Length of fragment of jaw, 8· in. Height to alveolar margin, 5·9 in.; greatest width, 4·4 in.; greatest height to crown behind, 6·8 in. Length of the first true molar, 6·7 in.; width in front, 2·3 in.; greatest width behind at fourth-ridge, 2·6 in. Length of premolar fragment, 1· in.; height of crown, 1·5 in.; width, 1· in.

Fig. 11.—*Elephas planifrons*. Last premolar (*b*) vertically divided through the middle, the anterior portion being wanting. Although partly emerged, it is still embedded in the alveolus and intact, while the tooth behind it is well worn. It is of comparatively small size, but presents distinct indications of two transverse ridges terminating in the thick digitations characteristic of the species. This figure refers to the same specimen as fig. 10, but is drawn on a larger scale.

Figs. 12 and 12 *a*.—*Elephas planifrons*. This appears to be the last true molar, lower jaw, right side; has ten main plates, with a front plate and heel; is apparently of a small sized individual; has the enamel straighter in the bend than usual; ridges low.—B.M.

Length, 10· in. Width in front, 3·5 in.; ditto behind, 2·9 in. Height of crown at seventh plate, 4· in.

Fig. 13.—*Elephas planifrons*. Lower jaw, left side, with last true molar entire; crown not figured; very thick enamel plates reclined; considerable mesial expansion; points in the back plates few; in the front plates a good deal of crimping; shows about thirteen ridges and a

heel, or possibly fourteen. Resembles very much an unfigured specimen in H. F.'s collection (See note, No. 3).[1]—B.M.

Length of molar, 12·7 in.; width, 3·6 in.; height at tenth ridge. 4·5 in.

Fig. 13 *a*.—*Elephas Hysudricus*. (Has no connection with fig. 13. Is misnamed *E. planifrons* on plate.) It is the last molar, right side, lower jaw. Has a peculiar slew or twist in the wear, in front from the inside out, and behind from the outside inwards. Is an enormous tooth. Shows the anterior fang in section, only one or two plates gone; enamel very thick and plaited; mesial expansion. Has ten plates and a heel.—B.M.

Length of tooth, 11·3 in.; width in front, 3·9 in.; in middle, 4·4 in. Height to alveolar margin, 9· in. Height of jaw to crown of molar behind, 9· in. Greatest thickness of jaw, 6·3 in.

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[1] The following notes refer to unfigured specimens of *Elephas planifrons*:—

1.—The most characteristic specimen of this species consisting of the last molar, upper jaw, has not been figured. Its measurements are: extreme length, 11· in.; width in front at second ridge, 3·7 in.; ditto at eighth ridge, base, 3·8 in.; ditto at eighth ridge, near apex, 2·4 in.; height at eighth ridge, measured from reflection of enamel plates below, 4·8 in. Number of principal ridges twelve, with a front ridge and heel. This tooth resembles very much in wear Mr. Ewer's specimen, Pl. xi. fig. 1, and H. F.'s specimen, Pl. xii. fig. 5. Of the 12 plates composing it, the first eight are touched by wear. The front subordinate ridge is joined on by a neck or reduplication of enamel to the first principal ridge. The enamel is very thick. There is a good deal of crimping in the first three ridges, but no great amount of mesial expansion. The points are few in number, there being only six which are worn into round rings to the seventh ridge. A comparison of this tooth with the last upper molar of *Elephas Hysudricus* is as follows:

	E. planifrons Inches	*E. Hysudricus* Inches
Extreme length of last upper molar	11·0	11·0
Width in front at 2nd ridge	3·7	3·4
Width at 8th ridge	2·4	3·3
Height at 8th ridge	4·8	5·4

2.—A superb specimen of the lower jaw in H. F.'s collection. The specimen has the left molar entire; of the right, only the first eight ridges remain; all the ridges on to the heel are worn. Enamel very thick with beautifully marked mesial expansion, forming a sharp loop. The back loop of one plate nearly in contact with the front lamina of the next ridge! Is a most beautiful and characteristic specimen. The beak, although broken, projects sufficiently to prevent the ramus from resting on its lower surface. The diastemal ridges are not raised as in *E. antiquus* (*E. meridionalis* in note of date about 1846, see note, p. 23), but form a broad flat beak (not sharp and narrow, as in *E. insignis*) which projects downwards as in the African Elephant, although it is more abruptly bent down, shorter and flatter, something as in *E. primigenius*. In this respect the specimen is more perfect than Pl. xi. fig. 2. The molars are nearly parallel in front, and diverge afterwards. There are three outer mentary foramina, and one on the inside. The backmost foramen begins below the front fang of the molar; the two others are on the same sloping line in front.

Extreme length, 21·6 in. Height to alveolus, 7·5 in. Greatest width, 7·7 in. Interval between teeth in front, 3·8 in. Width of diasteme, just below the beginning of the symphysis, 3·5 in. Length of the left molar, 11·0 in.; width at third ridge, 2·9 in.; greatest width in the middle, 3·3 in.; height of 8th plate, 3·0 in.; number of plates, 13 and a heel.

3.—Specimen of the entire last lower molar, right side, contained in a mutilated lower jaw. This magnificent specimen shows the entire length of the tooth, and a small portion of the penultimate in front of it. The seven anterior ridges are touched by wear. The enamel is very thick with a mesial expansion and somewhat crimped. The sixth ridge shows six annular discs; the seventh only five points. The tooth is very broad; much cement; the last plate or heel is an oblique splent of only three or four irregularly placed points. The fang projects behind it. The tooth in its direction curves much outwards, and is very nearly of the same width from back to front.

Extreme length of last molar, 11·8 in. Extreme width at sixth ridge, 3·9 in. Height at eleventh plate, 4·6 in. Number of principal ridges 14, and a small heel of three points.

Plate XII. A.

Elephas Namadicus (Falc. and Caut.) From the valley of the Nerbudda. Probably a female, from small size of tusks. This specimen was presented to the Museum of the United Service Institution by Major Orlando Felix, and was received by him with other Nerbudda specimens, from Lieut.-Colonel Ouseley. It was chiselled out by Dr. Falconer, and determined by him to be a new species. In a letter to Lieut.-Colonel Ousely, Dr. F. writes thus: 'It is probably the most perfect specimen of a fossil elephant's cranium in Europe. The species is especially interesting from the form of the cranium, which is so grotesquely constructed that it looks the caricature of an elephant's head in a periwig. I have named the species *E. Namadicus*, after the Nerbudda river, the Namadus of Ptolemy.' There is a very similar specimen in the Museum of the Asiatic Society of Bengal.

Extreme length from occipital bosses to molar surface, 29·8 in. Extreme width of occiput, 30·0 in. From plane of occipital bosses to tip of nasals, 17·4 in. From bottom of fossa of bosses to tip of nasals, 12·9 in. From bottom of bosses to anterior margin of frontal bulge, 10·5 in. Depth of occipital fossa below the plane of the bosses, 7·5 in. Length of crista galli-like plate, 11·2 in. Greatest contraction of brow between the temporals, 20·0 in. Projection of frontal bulge above plane of forehead, 2·7 in. From anterior margin of orbit to occipital bosses, 24·8 in. Width of deep occipital fossa, 5·6 in. Transverse extent nasal opening, 15·0 in. Vertical height of nasal at sides, 5·3 in. Width of brow between middle of orbits, 20·0 in. Width between tips of posterior orbital processes, 25·0 in. Antero-posterior diameter right orbit, 6·2 in. Width of base of muzzle at contraction of the sub-orbitaries, 10·8 in. Interval between outside of maxillaries, 10·1 in. Vertical diameter sub-orbitary foramen, 3·1 in. From auditory foramen to anterior margin of orbit, 14·0 in. Transverse diameter, right tusk, 2·9 in. Vertical diameter of right tusk, 2·5 in. Depth of temp. fossa from ear (foramen auditor.) to frontal margin of fossa at contraction, 13·3 in. Interval across the occipital condyles, 9·7 in. Antero-posterior diam. left condyle, 4·6 in. Transverse, 3·2 in. Antero-posterior diam. occipital foramen, 3·0 in. Transverse diameter occipital foramen, 3·6 in. From anterior margin occipital hole to posterior of surface palate, 13·9 in. Length of palate from niche to diasteme, about 8·4 in. Width of base of skull at posterior end of zygoma, 26·2 in. Width between ridge of pterygoids, 9·1 in. Height of pterygoid ala of sphenoid above Vidian hole, 10·0 in. Length of articular surface for lower jaw, 5·1 in. Across articular surface for lower jaw, 3·3 in. Length of remaining portion left molar, 7·5 in. Width of remaining portion left molar, 3·7 in. N.B.—Twelve plates in this extent. Width of palate in front (between molars), 2·8 in. Width behind, 4·1 in.[1]

[1] *Memorandum upon the Nerbudda Fossil Elephant, India House specimen.*

Measurements of the sixth or last True Grinder	Elephas Namadicus	Assam, recent	Corse's large specimen Brit. Mus.	Elephas Hysudricus	Elephas primigen.
	Inches	Inches	Inches	Inches	Inches
Length of the eleven anterior plates measured near the base	8·1	5·7	5.6	7·7	4·5
Width or thickness of the ivory core, third plate, one inch above the base .	0·45	0·2	...	4·5	...
Width or thickness of the ivory core, fifth plate, one inch above the base .	0·5	0·2	...	0·35	0·3

Plate XII. B.

Figs. 1, 2, and 3.—*Elephas Namadicus*. Three different views of same skull as figured in Pl. XII. A. The molars are less perfect than

Memorandum upon the Nerbudda Fossil Elephant—continued.

Measurements of the sixth or last True Grinder	Elephas Namadicus	Assam, recent	Corse's large specimen Brit. Mus.	Elephas Hysudricus	Elephas primigen.
	Inches	Inches	Inches	Inches	Inches
Width or thickness of the ivory core, eighth plate, one inch above the base .	0.55	0·2	...	0·35	...
Width or thickness of the ivory core, eleventh plate, one inch above the base .	0·5	0·2	...	0·25	...
Average thickness of enamel plates	0·2	0·1	...	0·15	...
Height of enamel plate, tenth ridge . . .	7·5	7·4	...	4·8	6·2
Greatest width of tooth, at fourth plate . . .	...	...	3·5	3·5	...

The specimen is upper jaw, right side, with the last grinder of which the eleven anterior plates remain; there must have been several more behind, from the great height of the last plate. On comparing the section with that of the *E. Hysudricus* and existing Indian species, it is at once seen to differ from the former in the extreme height of the plates, from their slight amount of thinning upwards and their nearly vertical direction. They are as straight and vertical as in the Mammoth. There is besides no loop about the middle of the tooth plates, in the enamel and comparatively thin crusta. It is assuredly different from the *E. Hysudricus*. Compared with the existing species, the ivory is very much thicker, with *no curve* towards the apex; the enamel plates are very much thicker also. The crown of the plates resembles very much the last tooth of Corse's big head in the transverse direction of the plate ribands, and in the excessive amount of crimping or fine plaiting of the enamel. From the measurement given it will be seen, however, that the enamel and ivory in thickness indicate a wide difference, which is further borne out by the verticality of the plates. Having seen nothing among the existing teeth of a range of difference at all approaching this, I am compelled to consider the species, as far as my present information goes, as distinct. There is no possibility of considering it a variety of *E. Hysudricus*. I call it therefore provisionally *Elephas Namadicus* (from the Greek name of the Nerbudda 'Namadus'). It was found along with Hippopotamus, Buffalo, &c., in the Nerbudda. There must have been at least nine or ten plates more, and it would rank in place between the existing Indian elephant and the *E. Hysudricus*—

Thus, *E. primigenius*,
E. Indicus,
E. Namadicus,
E. Hysudricus,
E. planifrons, *&c.*

The inferred distinctness of species is further borne out by the excessive width of palate in the other Nerbudda specimen, seven inches behind. The Perim species is probably the same.

N.B.—Prinsep, in the Journal of the Asiat. Society of Bengal, vol. iii. p. 585, describes and figures the lower jaw, one side nearly entire, of a fossil Elephant from the Nerbudda, which he states to be so like the existing Asiatic Elephant, judging from a comparison with a jaw in the Calcutta Museum, that it was impossible to distinguish them, although it may be confidently distinguished from the *E. primigenius*. The figure shows about fifteen or sixteen plates in wear, and at least seven more behind, or twenty-three to twenty-four in all. The rami, however, as sketched by Prinsep, are much more apart than in the Asiatic species generally. Dimensions: length, 11½ in., width in the middle, 3½ in.; transverse diameter of jaw at coronoid disc, 6 in., and girth of jaw in front of coronoid, 24 in.

This in all probability belongs to the *Elephas Namadicus*, as also the prodigiously large humerus at the India House.

in the corresponding specimen in the Museum of the Asiatic Society of Bengal.

Fig. 4.—*Elephas Hysudricus.* This fragment of skull, which is probably female, and is but very slightly concave on the forehead, yields very few good measurements. The figure is chiefly given for the form. It has two small tusk sheaths; the tusks are broken off near the base of the nucleus, and show only a thin plate. Only one orbital foramen, very large. This specimen is very remarkable in the molars having so few plates, only eight to the first true molar and no heel.—B.M.

Length of penultimate molar, 5·2 in.; width, 2·3 in. The penultimate entirely in germ shows eleven plates. Extreme length of the fragment, 28·5 in. Length from occiput to tip of nasals, 18·0 in.; width of nasal opening, 12·5 in.; width of brow across orbits, 21·6 in. Interval between the teeth in front, 2·1 in.; interval at niche of palate, 3·8 in.; diameter of the right tusk, 2·5 in.

Plate XII. C.

Figs. 1 and 1 *a*.—*Elephas Namadicus.* A small fragment of lower jaw, with three plates of what is probably the first true molar.—B.M.

Figs. 2 and 2 *a*.—*Elephas Namadicus.* Lower jaw, left side. This specimen contains the third milk molar well worn and the first true molar in germ.—B.M.

Extreme length, 12·5 in. Height at alveolus, 4·1. Thickness of jaw behind, 4·0 in. Length of anterior molar, 5·2 in.; width, 1·8 in. Number of plates remaining, 7.

Figs. 3 and 3 *a*.—*E. Namadicus.* Young lower jaw, right side, with third milk molar, which has ten ridges and a heel. The crimped character of *Elephas antiquus*[1] is well shown. A small vertebra is attached to the ramus.—B.M.

Length of fragment, 11·0 in. Height at alveolus, 4·8 in. Thickness behind, 4·0 in. Length of third milk molar, 5·5 in.; width, 1·9 in.

Figs. 4 and 4 *a*.—*E. Namadicus.* Right lower jaw of adult, containing last molar with twenty plates and a heel. The specimen shows two mentary foramina. The broken coronoid portion of the ramus shelves more out than in *E. antiquus*,[2] and the mentary foramina are placed higher. Presented by C. Frazer, Esq.—B.M.

Extreme length of fragment, 23·6 in. Height at alveolus, 9·2 in. Length of the molar partly concealed and chiselled, 14·7; width, 3·11 in. Width of jaw behind, 8·0 in.

Figs. 5 and 5 *a*.—*E. Namadicus.* Adult lower jaw of large size. The specimen does not show the beak distinctly, and is more obtuse there than in *E. antiquus*.[3] The number of outer mentary holes is uncertain, as in *E. antiquus*[4] there is no inner hole. Presented by C. Frazer, Esq., and described in Journ. Asiat. Soc.—B.M.

Extreme length, right side, 20·5 in. Expansion of rami, 24· in. Height of jaw at beginning of alveolus, 10· in. Length of right molar, 14· in. Width, 3·7 in. Number of plates remaining about 15. Greatest width of jaw, 8·1 in.

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[1] '*Elephas meridionalis*' in original notes, written about 1846. The close resemblance of the *E. Namadicus* from the Nerbudda to the *E. antiquus* of the oyster beds of Norfolk coast, in England, is dwelt on in the memoir on Elephants, in vol. ii. See also note, p. 23.

[2] See last note.

[3] See note 1.

[4] See note 1.

Figs. 6 and 6 *a*.—*Elephas Hysudricus*. Lower jaw, left side, with first true molar which has ten plates, with a small heel and front ridge. It is excessively like Plate VII. fig. 11, which is the penultimate of *E. Hysudricus*. The specimen is very remarkable as it is believed to have come not from the Sewalik hills, but from the valley of the Nerbudda; the mineral condition, however, is very hard, unlike the Nerbudda specimens. Presented by C. Frazer, Esq.—B.M.

Length of molar, 8· in. Width, 2·6 in. Height at 8th plate, 4·2 in.

Plate XII. D.

Figs. 1 and 1 *a*.—*Elephas Namadicus*. Beautiful specimen of lower jaw, left side, containing the first true molar with thirteen ridges, and a heel and front ridge, fifteen ridges in all.—B.M.

Extreme length, 16·2 in. Height at alveolus, 6·3 in. Length of molar, 7·4 in. Width, 2·2 in.

Figs. 2 and 2 *a*.—*E. Namadicus*. Lower jaw, right side. This is a little larger than the last specimen, and contains the first true molar with about thirteen ridges. All these specimens show two highly-placed mentary foramina. Part of the molar is concealed behind. A portion of the third milk molar is seen in front.—B.M.

Extreme length, 19·5 in. Height at alveolus, 6·4 in. Length of molar, 7·3 in. Width, 2·5 in. Width of jaw behind, 6·4 in.

Figs. 3 and 3 *a*.—*E. Namadicus*. Lower jaw, left side. This is a most beautiful specimen, containing the second true molar. The alveolus of the last tooth is shown behind. It contains about fifteen plates, twelve to thirteen of which remain. The whole length of the tooth is present. It narrows very much in front. N.B.—Another specimen of same jaw, opposite side, not figured, is exactly similar.—B.M.

Extreme length, 13·6 in. Length of molar, 10·2 in. Width at middle, 3·3 in.

Figs. 4 and 4 *a*.—*Elephas antiquus*.[1] Lower jaw, left side, with first true molar. This tooth is a beautiful specimen; shows twelve to thirteen ridges, with front ridge and heel. It narrows excessively in front and behind, like fig. 3 of *E. Namadicus*! The crimping, &c., are also exactly alike.—B.M.

Length of molar, 8· in. Width at middle, 2·6 in. Width in front, 1·3 in.

Figs. 5 and 5 *a*.—*Elephas antiquus*.[2] Last? molar of upper jaw, right side, showing sixteen ridges and a small heel, much worn. Specimen belonging to the Canterbury Museum and labelled '$\frac{3}{2}$ Tooth of Mammoth, Kent.'

Length, 10·8 in. Width, 3·3 in. Extreme height, 6· in.

Plate XIII.

Figs. 1, 1 *a*, and 1 *b*.—*Elephas Namadicus*. Fragment of upper jaw, right side, containing eleven plates of the 6th molar or last true grinder. Fig. 1 *a* shows well the crimping of the enamel, and fig. 1

[1] Misnamed '*E. meridionalis*' on plate, but corrected by Dr. F. in copy of 'Fauna Antiqua Sivalensis,' belonging to British Museum. See also note, page 23.

[2] See last note.

shows a longitudinal vertical section of the tooth. Presented by C. Frazer, Esq., to India House.—B.M.

Length, 7·9 in. Width behind, 2·5 in. Width in front, 4·2 in. Height anteriorly, 2· in. Height posteriorly, 8·4 in.

Figs. 2 and 2 *a*.—*Elephas Namadicus*. Palate with sixth or last molar on both sides. Presented by C. Frazer, Esq.—B.M.

Length of fragment of grinding surface of molar of right side, 7·3 in. Greatest breadth posteriorly, 3· in. Length of fragment of left side, 6·9 in. Width posteriorly at first plate, 2·6 in. Width at fifth plate, 3·8 in. Width of palate posteriorly, 5·3 in. Width of palate anteriorly, 4·9 in.

Figs. 3 and 3 *a*.—*Elephas Namadicus*. Fragment of upper true molar with six plates; enamel crimped.

Length of fragment, 4·2 in. Width at second plate, 2·9 in. Width of posterior plate, 2· in. Greatest height, 6·1 in.

Plate XIII. A.

Lower Jaws of Elephants viewed from above.

Fig. 1.—*Elephas primigenius*. Old. One mentary foramen inside and three outside. Right true molar has thirteen plates, and measures 9·4 in. in length, and 3·6 in. in width.

Fig. 2.—*E. primigenius*. Young. Contains the antepenultimate or first true molar on either side with twelve ridges, and a small heel and front ridge, all of which, except the posterior talon, are affected by wear. The plates are very fine. The tooth is not so broad relatively to the length as in other specimens. The discs of wear form closely compressed transverse bands, with attenuated plates of enamel. Some of these plates differ from the ordinary type of the Mammoth in exhibiting a certain amount of irregular crimping, but in no degree approaching that seen in the Indian Elephant, this character concurring with a less than ordinary width of crown. The penultimate true molar is seen in germ behind. There is one inner mentary foramen on either side. A Rhine specimen from Dr. Kaup.

Extreme length of jaw, 16·8 in. Extreme expansion behind, 16· in. Height to broken condyle, 12·5 in. Height to alveolus, 4·7 in. Thickness of jaw at middle, 4·8 in. Length of molar, 5·4 in. Width, 2·2 in.

Fig. 3.—*E. primigenius*. English fossil specimen, with two last true molars on either side. In the last left molar there are eighteen plates in 7·7 inches. The jaw has a short beak, and one inner mentary foramen on either side. In this, as in figs. 1 and 2, representing the jaw at different ages, it is to be noted that the opposite lines of molars are more or less convergent instead of being parallel, or nearly so, as laid down by Cuvier.—B.M.

Extreme length of jaw, 23·6 in. Divergence of rami behind, 21·3 in. Height at alveolus, 7·2 in. Greatest width of jaw, 6·3 in. Breadth of condyle, 10·3 in. Width of last molar, 2·8 in.[1]

Fig. 4.—*Elephas antiquus*.[2] Lower jaw with penultimate and last true molars on either side. The last molar is very perfect and has seventeen plates, of which the nine anterior ones only are worn. Only six plates of

[1] Another lower jaw of *E. primigenius*, not figured, from Siberia, contains the last molar only, very much worn. It has thirteen plates in 8·9 in., is very narrow, and has hardly any crimping. It has one large outer mentary foramen in front and one inside. It is very circular in outline in front.

Extreme length, 22·5 in. Height to condyle, 18·7 in.

[2] Misnamed '*E. meridionalis*' in Plate.

See notes pages 18 and 23.

the penultimate are seen. No mentary foramen. Specimen in Geological Society's Museum. (Reproduced in Plate IX. of vol. ii.)

Extreme length of jaw, 26· in. Divergence of rami, 24·5 in. Height at alveolus, 9·2 in. Height to broken condyle, 16·3 in. Breadth of ascending ramus, 11·5 in. Thickness of jaw, 7· in. Length of anterior molar, 3·9 in. Width, 3· in. Length of last molar, 12· in. Width in front, 3·1 in. Number of plates 18.

Fig. 5.—*Elephas antiquus.*[1] Fragment of lower jaw with first true molar on either side. The number of plates is twelve, with a heel. There is no mentary foramen inside. This specimen formerly belonged to the Earl of Aylesbury, but is now in B.M. (*Vide* Pl. XIV. A. fig. 7).

Length of right ramus, 14·5 in. Height, 5·1 in. Length of right molar, 6·7 in. Width, 2·3 in.

Fig. 6.—*Elephas Indicus.* Existing Indian Elephant. Specimen from Malacca in Museum of Asiatic Society. The jaw contains the last molar on either side. The number of plates is twenty-two or twenty-three, of which the eleven anterior are worn.

Extreme length of jaw, 19·3 in. Height of condyle, 18·4 in. Breadth of ascending ramus, 9· in. Thickness of jaw, 5·2 in. Length of molar, 10·4 in. Width, 2·9 in.

Fig. 7.—*Elephas Hysudricus.* Same specimen as figured in Pl. VIII. fig. 4. The description and measurements have been already given.—B.M.

Fig. 8.—*Elephas Africanus.* Young lower jaw with two molars (third milk and first true) on left side, and with first true molar and alveolus of third milk molar, right side. The antepenultimate true molar has seven ridges and a back and front talón. From Museum of Asiatic Society.

Plate XIII. B.

Lower jaws of elephants in profile. The numbers correspond to the eight specimens figured in Pl. XIII. A. In these figures, which represent the groups *Loxodon* and *Euelephas*, the back of the symphysis is seen to be a prolongation of the inferior margin into which the diastemal ridges descend with great obliquity and also to be attenuated towards the apex, to terminate in an obtuse point.

Fig. 1.—*Elephas primigenius.* Showing three outer mentary foramina.

Fig. 2.—*E. primigenius.* With two outer mentary foramina on left side. There were four on right side.

Fig. 3.—*E. primigenius.* Two outer mentary foramina.

Fig. 4.—*E. antiquus.*[2] Two outer mentary foramina on left side.

Fig. 5.—*E. antiquus.*[3] Three outer mentary foramina on left side.

Fig. 6.—*E. Indicus.* Five outer mentary foramina on left side.

Fig. 7.—*E. Hysudricus.* One small outer mentary on left side. (See also Pl. VIII. fig. 4.)

Fig. 8.—*E. Africanus.* Three outer mentary foramina on left side.

Plate XIV.

Figs. 1, 1 *a*, and 1 *b*.—*Elephas antiquus.*[4] Second milk molar, lower jaw, left side, with six ridges and a front and back heel, from Grays, in Essex.—B.M.

Length, 2·4 in. Width, 1·3 in.

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[1] Misnamed '*Elephas meridionalis*' in Plate. See notes pages 18 and 23.

[2] See last note.

[3] See note 1.

[4] See note 1.

Figs. 2, 2 *a*, and 2 *b*.—*Elephas antiquus*.[1] Second upper right milk molar, with six ridges and a heel, from Grays, in Essex.—B.M.

Length, 2·4 in. Width, 1·3 in.

Figs. 3 and 3 *a*.—*E. primigenius*, probably (*sic*). Small milk molar: 9 ridges.

Fig. 4.—*Elephas Africanus*. Lower jaw of young animal with pre-antepenultimate (*a*), antepenultimate (*b*), and penultimate milk molars on both sides. The right penultimate molar has six plates and a heel. This is the interesting specimen figured and described by De Blainville.

Length of jaw, 9·7 in. Length of penultimate right milk molar, 2·3 in. Width, ·9 in.

Figs. 5 and 5 *a*.—*Elephas Africanus*. Penultimate right lower molar, with eight ridges and a heel. The ridges are broad, and the fangs supporting the five posterior ridges are confluent.

Length, 7·4 in. Width of crown, 2·4 in. Height of crown at eighth plate, 3·4 in.

Fig. 6.—*Elephas priscus*. Mutilated fragment of penultimate lower molar, left side, from the brick-earth deposits of the valley of the Thames. Shows only the entire discs of five partially worn ridges. The outline of the discs corresponds very closely in form with those of the posterior ridges of the larger specimen from Gray's Thurrock, shown in fig. 7. There is the same mesial angular expansion, and a still greater tendency to the discs assuming a crescentic form. The mutilated state of the specimen renders its identification somewhat doubtful, but it is inferred to belong to *E. priscus*.—No. 18,966 B.M.

Length, 5· in. Width, 3· in. Height behind, 2·8 in.

Figs. 7 and 7 *a*.—*Elephas priscus*. This is a most interesting specimen from Gray's Thurrock, purchased from Mr. Ball, of last lower molar, left side, containing eight ridges, heel inclusive. It is slightly concave on the outside, and convex on the inner side. A small portion of the anterior end—two plates, perhaps—is broken off. The fangs of the whole of the anterior part remain attached. The seven anterior plates are worn down to wide discs; the hind talon has also begun to wear. Is excessively like African Elephant in lozenge-shaped expansion, and in the thickness of the enamel lamellæ. The rhomb form is not so sharply defined in the discs of wear, but the greatest expansion is at the centre, where there is a tendency to an outlying loop (*Vide* fig 5). Besides the great expansion, this tooth differs from all true *E. antiquus* specimens in the lowness of the crown ridges (*Vide* Pl. XIV. A., *passim*, and especially fig. 8). If not a separate species, is a very marked variety.—No. 39,370 B.M.

Fig. 7 *b*.—Longitudinal section of same molar of *E. priscus*. Shows the closest relation to the existing African Elephant (Pl. II. fig. 4 *b*,) in all that relates to the relative proportions of the alternate layers of ivory, enamel, and cement, and in the cuneiform character of the ridges.[2] (Reproduced in Plate VII. of vol. ii.)

Length of molar, 7·8 in. Width of crown at first plate, 2·35 in.; at second, 2·6 in.; at third, 2·75 in.; at fourth, 2·8 in.; at fifth, 2·7 in.; at sixth, 2·45 in.; at seventh, 1·8 in.; at talon, 1·3 in. Height at seventh plate, 2·5 in. Expansion

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[1] Misnamed *Elephas meridionalis* in Plate. See notes pages 18 and 23.

[2] The differences between *E. priscus* and *E. Africanus* are considered in detail in Dr. F.'s Memoir on Fossil Elephants.

of first plate at the middle, ·8 in.; of second, ·95 in.; of third plate, ·85 in.; of fourth, ·75 in.; of fifth, ·7 in.; of sixth, ·6 in.; of seventh, ·5 in.

Fig. 8.—*Elephas planifrons.* A very fine and characteristic specimen of the last upper molar, right side. Was found in contact with the lower jaw specimen, fig. 9. Shows about eight or nine ridges and a heel; the three first ridges worn out. The enamel is very thick, with irregular lozenge-shaped expansion, and a loop in the middle. The plates stand high in relief from the cement. The denticles are very few and thick, the last ridge showing only three crown plates very low, the last being but $2\frac{1}{2}$ inches high.—B.M.

Length of molar, 10· in. Width of crown, 3·5 in. Height behind, 2·5 in.

Fig. 9.—*Elephas planifrons.* Last lower molar, right side. Is very valuable from having been found in contact with the upper molar (fig. 8). Shows only eight ridges and a heel. The plates are very thick and low. The sixth ridge shows only four denticles. In this and the last figure the discs of wear form transverse bands, which are broader, fewer in number, and wider apart than in the Indian Elephant; the bounding edges of enamel are sometimes nearly parallel; in other cases they show a slight angular expansion, or throw out a salient loop (or outlying) tubercle near the middle.—B.M.

Length of molar, 9·5 in. Width of crown, 3·5. Height of crown at sixth ridge, 3· in.

Fig. 10.—*Elephas planifrons.* Fragment of lower jaw, with antepenultimate and penultimate milk teeth *in situ*.[1]—B.M.

Plate XIV. A.

Molars of *Elephas antiquus*.[2]

Figs. 1 and 1 *a*.—Second upper milk molar, right side, from Kent, with five plates. Specimen in Canterbury Museum.

Figs. 2 and 2 *a*.—Third upper milk molar, right side. Has about ten plates. Specimen from Southwold, in Museum of Geological Society.

Length, 5·5 in. Width, 2·3 in. Height, 2·8 in.

Figs. 3 and 3 *a*.—Third milk molar, upper jaw, left side. Has ten plates and a heel.—B.M.

Length, 6· in. Width, 2·2 in. Height, 3·5 in.

Figs. 4 and 4 *a*.—First true molar, upper jaw, right side. Eight plates. From Southwold. Geol. Soc. Mus.

Length, 5·5 in. Width, 2·6 in. Extreme height, 4·8 in.

Figs. 5 and 5 *a*.—Last true molar, upper jaw, right side. Has fourteen plates and a heel, well crimped. From forest bed, Ostend, Norfolk. Green collection.—No. 16,229 B.M.

Length, 10· in. Width, 3·4 in. Height, 6·5 in.

Figs. 6 and 6 *a*.—Third milk molar, lower jaw, right side, imperfect.

[1] In the plate this specimen is designated *E. Hysudricus*, but this is doubtless an error, as the figure is referred to as that of molar of *E. planifrons* in Dr. F.'s Memoir on Fossil Elephants, vol. ii.

[2] Erroneously designated *Elephas meridionalis* on plate. The error is corrected in Dr. F.'s handwriting in the copy of the 'Fauna Antiq. Sival.' belonging to the British Museum. See also note, page 23.

Has seven well crimped plates. Specimen is from Suffolk, and was presented by Dr. Cooke to Geol. Soc. Mus. (No. 8,411).

Length, 4·2 in. Width, 2·1. in. Height, 3· in.

Figs. 7 and 7 *a*.—Third milk molar, lower jaw, right side, from Kent; not quite perfect behind. Is narrow in front, broader behind, and well crimped. Proves Lord Aylesbury's specimen to be first true molar (*Vide* Pl. XIII. A. fig. 5).

Length, 5·4 in. Width, 2· in. Height behind, 2·5 in.

Figs. 8 and 8 *a*.—First true molar, lower jaw, right side; embedded in fragment of jaw. Has twelve plates.—No. 18,967 B.M.

Length of molar, 8·3 in. Width, 2·5 in. Height, 4·2 in.

Figs. 9 and 9 *a*.—Fragment of lower jaw, right side, with portions of two last molars. The plates are enormously higher than in the *Elephas priscus* from Grays. The specimen is believed to be from Rome, from Cardinal Gualteri's collection.—B.M.

Length of anterior molar (imperfect), 4· in. Width, 3· in. Length of last molar, 7· in. Height of section, 7·3 in. Number of plates remaining, 9.

Figs. 10 and 10 *a*.—This is probably a second true molar, lower jaw, right ride. Has twelve plates and a heel, five of the plates worn.—No. 19,844 B.M.

Length, 10· in. Width, 2·5 in. Height, 6· in.

Figs. 11 and 11 *a*.—Last molar, lower jaw, left side, with fifteen to sixteen plates and a heel. Portion in front gone. Specimen belonging to Mr. Bowerbank. It was brought from Saffron Walden by Mr. Sampson Hancock, and presented to the Mathematical Society at Dover, in whose collection it remained until its dissolution. It then passed into the hands of Mr. J. S. Bowerbank, who has known the specimen for about thirty years. (MS. Note on Plate, March 22nd, 1858.) Reproduced in Plate IX. of vol. ii.

Length, 12·3 in. Width, 3· in. Height, 5· in.

Figs. 12 and 12 *a*.—Last lower molar, right side, from Happisburgh. Only the eleven posterior plates are present. Plates very crimped and bent.—B.M.

Length, 10·5 in. Width, 3·4 in. Height, 5·7 in.

Figs. 13 and 13 *a*.—Last lower molar, left side; fourteen plates remaining, but some in front missing. From Cardinal Gualteri's collection. Via Appia, Rome.—B.M.

Length, 11· in. Width, 3·4 in.

Plate XIV. B.[1]

Figs. 1 and 1 *a*.—*Elephas meridionalis*. Plan- and side-view of the penultimate or second upper milk molar. It is a germ-specimen,

[1] Great confusion has existed with regard to this plate, which I hope to have succeeded in now clearing up. In the published plate (xiv. B.), figs. 1 to 9 and 11 to 16 are said to belong to *E. meridionalis*, and figs 10, 17, and 18, to *E. antiquus*. While the plates of the 'Fauna' were passing through the press Dr. Falconer became satisfied that he had committed a mistake in making the fossil remains of the fluviatile beds of the Thames valley identical with the extinct Elephant of the Val d'Arno, instead of the fossil remains of the 'Crag.' In his memoir on British Fossil Elephants, written ten years later (1857), but not published until after his death, he says that although convinced that the 'Crag'

without fangs, and a good deal rolled. The crown is composed of six principal ridges, besides front and back talons. It was compared with the corresponding tooth of *E.* (*Loxodon*) *planifrons*, which it resembles very closely, but it has a broader crown. The dimensions are :—

Length, 2·6 in. Width of crown at first plate, 1·15 in. Width of crown behind, 1·4 in. Height of crown at fifth ridge, 1·55 in.

The corresponding tooth of *E.* (*Eueleph.*) *antiquus* and of *E. primigenius* yields normally eight transverse plates. The precise origin of the specimen is not recorded; but it is supposed to have belonged to Mr. Samuel Woodward, and to have been derived from the Norfolk coast. Norwich Museum, No. 11.

Figs. 2 and 2 *a*.—*Elephas meridionalis*. Another example of the same tooth, a penultimate upper milk molar, right side, discovered in the Norwich Crag at Easton, Suffolk, by Captain Alexander. It presents six ridges, well advanced in wear. Norwich Museum. The dimensions are :—

Length, 2·4 in. Width in front, 1·0 in. Width behind, 1·6 in.

Figs. 3 and 3 *a*.—*Elephas meridionalis*. Another well-worn penultimate milk molar, probably of the lower (?) jaw, right side. It is of a larger size than the others, but shows the same number of plates, namely six, with talons. It is very broad in the crown relatively to the length. The discs of the ridges are very wide, like the Italian specimens. This molar belonged to the collection of Mr. Samuel Woodward; it is now in the Norwich Museum. It is heavy and dark-coloured, and bears fresh patches of marine incrustation, and may have come from the 'oyster-bed' of Mundesley and Happisburgh.

Figs. 4 and 4 *a*.—*Elephas meridionalis*. The last milk molar of the lower jaw, left side. The crown is worn, and comprises eight ridges. The ends and sides of the crown are partly injured. In mineral condition it is black and heavy, but free from patches of marine incrustation. It is supposed by Mr. Samuel Woodward to have been procured from the coast (Norwich Museum, No. 10). The dimensions are :—

Length of crown, 3·9 in. Width of crown in front, 1·4 in. Width of crown at sixth ridge, 2·0 in. Height of crown at seventh ridge, 2·1 in.

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molars were identical with those of *E. meridionalis*, he had, in order to prevent confusion, continued in the subsequent plates the nomenclature adopted in the earlier ones, intending to give a full explanation of the whole in the letter-press, and he concludes as follows :—'I beg leave to explain now that all the plates bearing the name of *E. meridionalis* in the "Fauna Antiqua Sivalensis," including the outline figures of crania in Plate xlii., belong to *E. antiquus*, while those that bear the latter name belong to *E.* (*Loxodon*) *meridionalis*. In the descriptions which follow they will be cited as such.'—Quart. Journ. Geol. Soc., August, 1865, p. 281. According to this correction, all the figures in Plate xiv. B., except 10, 17, and 18, should belong to *E. antiquus*, although mostly from the Crag and some even from the Val d'Arno! The correction, moreover, is incompatible with the description and identification of every figure in Plate xiv. B., given in a subsequent part of the same memoir, and extracted above, according to which every figure in the plate, with the single exception of fig. 16, belongs to *E. meridionalis*. The fact is that the descriptions in Dr. F.'s memoir on Elephant were taken, in 1857, *from a proof copy of the plate, in which all the figures were designated E. antiquus*, but that in the plate as published in 1847, Dr. F. had actually corrected the designations of most of the figures.

The proof copy has been deposited in the Library of the Geological Department of the British Museum.—[Ed.]

The 'ridge-formula' in these specimens yields the same ciphers as are found to hold in the Italian specimens; and they agree in the other characters of a broad crown, with low ridges and thick plates of enamel.

Figs. 5 and 5 *a*.—*Elephas meridionalis*. A finely preserved entire specimen of the antepenultimate or first true molar, lower jaw, left side, composed of eight principal ridges, with front and back talons. The six anterior ridges are worn. The discs of the first three ridges are wide and open, but irregularly indented, with a tendency to mesial expansion, and surrounded by margins of thick enamel, which is vertically channelled externally, and slightly crimped; the posterior ridges show the apices of six or seven digitations; the interspaces filled with cement between the ridges are open, and the ridges well apart. The dimensions are:—

Length of crown, 5·3 in. Width in front, 1·6 in. Width behind, 2·3 in. Height of the seventh plate, 2·5 in.

One of the distinctive characters of the species, namely, the low height of the crown in reference to the breadth, is well exhibited. The specimen is dark-coloured and heavy, from ferruginous infiltration. It was discovered at Mundesley, and belonged to Mr. S. Woodward (Norwich Museum, No. 8).

Figs. 6 and 6 *a*.—*Elephas meridionalis*. Another left lower antepenultimate true molar of a larger individual, and more advanced in wear. The crown presents a front talon and eight ridges, all of them worn; the discs are wide and open, and the vallecular interspaces are also wide; the enamel edges thick, and in some of the plates disposed to slight crimping, with irregular angular expansion. The annular discs of the seventh ridge are of large size. This tooth bears the large anterior fang. It is a very characteristic specimen of *E. meridionalis*. The dimensions are:—

Length of crown, 5·5 in. Width of crown at second ridge, 2·2 in. Width of crown behind, 2·65 in. Height of crown at seventh ridge, barely worn, 2·0 in.

The specimen is hard, heavy, and dark-coloured, and is marked as having come from Mundesley (Norwich Museum, No. 7).

Figs. 7 and 7 *a*.—*Elephas meridionalis*. A fragment comprising the anterior two-thirds of the penultimate or second true molar of the lower jaw, right side. It includes seven worn ridges. The discs of wear are wide, and separated by broad bands of cement; the rings of the digitations are large; the plates of enamel are thick, with angular flexures and deep channelling on the outer surface, but free from crimping. The specimen is black and heavy, and bears patches of marine incrustation. The dimensions are:—

Extreme length, 5·2 in. Width of crown at second ridge, 2·3 in. Width of crown at seventh ridge, 2·9 in.

No note was taken of the height of the last ridge. The specimen is without fangs, and, although distinctly of *E. meridionalis*, the number of ridges to the entire crown is not shown. This also belonged to Mr. S. Woodward, and is now in the Norwich Museum (No. 13). It has all the mineral appearance of the Mundesley and Happisburgh beds.

Figs. 8 and 8 *a*.—*Elephas meridionalis*. The anterior portion of a lower right molar, comprising the remains of six well-worn ridges. It is figured to show the angular flexures that are sometimes seen when

the plates are ground down low. The side view, fig. 8 *a*, exhibits the thickness of the enamel. This specimen is too mutilated to fix its serial position with confidence. It is heavy and dark from iron impregnation, and corresponds with the fragments from Mundesley and Happisburgh, Norwich Museum, No. 18.

Figs. 9 and 9 *a*.—*Elephas meridionalis*. The posterior two-thirds of the crown of a lower molar of the right side. It is inferred to be a penultimate, but without certainty, and may be the last true molar. The crown shows six well-worn discs and a posterior talon; there are no fangs; the enamel is very thick, with large rings to the digitations; the discs are somewhat angularly expanded, and separated by wide interspaces of cement. This is best shown by the side view, fig. 9 *a*. From being worn low down, the plates exhibit a greater tendency to crimping than is usual. The specimen is dark and heavy, and bears fresh patches of marine incrustation. It is one of Woodward's specimens, probably from the 'Oyster-bed' (Norwich Museum, No. 14). The dimensions are:—

Length, 5·3 in. Width of crown at second ridge, 3·2 in. Width of crown at fourth ridge, 3·1 in.

This is a characteristic fragment of *E. meridionalis*.

Figs. 10 and 10 *a*.—*Elephas meridionalis*. A specimen in Dr. Buckland's collection from the Val d'Arno. It is figured to demonstrate how exactly the English specimens agree with the Italian form, as may be seen by comparing figs. 8 and 9 with fig. 10. The fragment of lower jaw, although mutilated, shows well the long symphysis, and the gradual inclination of the diasteme into the beak.—B.M.

Figs. 11 and 11 *a*.—*Elephas meridionalis*. The posterior portion of a last lower molar of the right side, including six discs of wear and the back talon. The discs are broad, the interspaces of cement the same, and the enamel plates are very thick, with deep external vertical channelling, but without crimping. The specimen is black, heavy, and bears patches of marine incrustation, indicative of its having been procured from the 'Oyster-bed.' From Woodward's collection (Norwich Museum). The dimensions are:—

Length, 5·6 in. Width of crown in front, 2·8 in. Width of crown behind, 3·1 in.

This is also a characteristic specimen of *E. meridionalis*.

Figs. 12 and 12 *a*.—*Elephas meridionalis*. A very notable fragment of the posterior end of a last lower molar, comprising two discs of wear and a talon. The crown is ground down low, the interspaces of cement are very wide, and the annular discs of the digitations are so thick as to approach the character of the worn ridges of some of the Stegodons. The dimensions are:—

Length of the fragment, 2·7 in. Width of crown, 4·2 in.

A solitary digitation is situated at the outer side of one of the valleys. It bears the appearance of a Mundesley specimen.

Figs. 13 and 13 *a*.—*Elephas meridionalis*. A mutilated fragment of a very old upper molar, formerly in the collection of the late Dr. Mantell, and now in the collection of the British Museum (Old Palæontol. Cat. No. 7,456), comprising the remains of ten discs of wear, ground down nearly to their common base. The central discs exhibit a certain amount of open crimping. The specimen is also remarkable

for the breadth of the crown; it is understood to have been derived from the 'Oyster-bed' of Mundesley or Happisburgh. The dimensions are:—

Length of crown, 8·2 in. Width, 4·3 in.

I regard it as being of *E. meridionalis*.—H.F. 1857.

Figs. 14 and 14 *a*.—*Elephas meridionalis*. The crown of a fine last upper molar, left side, of a very old animal, and in an advanced stage of wear. There are nine ridges remaining, the first five of which are ground down into transverse discs; the posterior four exhibit rings that are not confluent. There is a talon behind enveloped by cement. In front of the first remaining disc there is a broad depressed surface of ivory, indicating the position of two or three worn-out discs in front. The discs are expanded, with a slight tendency to a crescentic bend, the cornua being bent forwards. The plates of enamel are very thick, and deeply channelled exteriorly, so that there is a spurious appearance of crimping on that surface; but the edges in contact with the cores of ivory are unplaited. The specimen in its mineral condition is black and heavy. It is understood to have belonged to Woodward (Norwich Museum, No. 10). The dimensions are:—

Length of crown, 9·2 in. Width of crown at second remaining ridge, 3·6 in.

The antero-posterior convexity of the grinding surface determines the tooth to be an upper molar. (Reproduced in Plate VIII. of vol. ii.)

Figs. 15 and 15 *a*.—*Elephas meridionalis*. A very remarkable fragment of upper molar, of enormous width. It is worn down close to the base, the grinding surface being somewhat convex from front to rear. The remains of seven discs of wear are visible. They are irregularly expanded, and the surrounding plates of enamel are thick and deeply channelled on the outer surface, but with only a very slight amount of crimping. The specimen is dark and heavy, and patched over with fresh marine incrustations. From Happisburgh (Norwich Museum, No. 13). The dimensions are:—

Length of the fragment, 5·4 in. Width of crown, 4·9 in.!

Figs. 16 and 16 *a*.—*Elephas antiquus*. 'The same plate, XIV. B., contains a representation, fig. 16, of an entire upper molar, comprising from sixteen to seventeen ridges within an extent of eleven inches. Only three of the anterior ridges are worn, the rest being intact. I now regard it as a molar of *E.* (*Euelephas*) *antiquus*, and not of *E. meridionalis*.'—H.F. 1857. (Norwich Museum.) Believed to be the *last* true molar, upper jaw, right side, from its triangular form and the way in which the ridges fall off in height very rapidly behind.

Height at fourth plate, 6·8 in. Height at posterior ridge, 2·8 in. Width of crown in front, 3·5 in.

Figs. 17 and 17 *a*.—*Elephas meridionalis*. A Val d'Arno lower molar of the same age, from Dr. Buckland's collection in the Oxford Museum, crown side.

Length of crown, 10· in. Width of crown, 3·4 in. Height of crown, 5· in.

Figs. 18 and 18 *a*.—*Elephas meridionalis*. 'The finest detached molar of this species that has come under my observation is a specimen which was discovered in the "Mammalliferous Crag" on the Thorpe Road, near Norwich, by Mr. Prestwich. The authority of so eminent and accurate a geologist is a sufficient guarantee for the locality and

the formation. It is now lodged in the Museum at Norwich, and is the specimen which first convinced me many years ago that the "Crag" yielded a species of Elephant entirely distinct from the Mammoth and from *E. antiquus*. It is represented, one-third of the natural size, by figs. 18 and 18 *a* of Pl. XIV. B., under the misnomer already explained, of *Elephas antiquus*, in the "Fauna Antiqua Sivalensis." It is the last true molar, lower jaw, right side, showing eleven principal ridges, an anterior talon, and a back talon limited to a single thick digitation. The first five ridges are slightly worn, the rest being intact. The fangs are broken off, but the definition of the anterior large fang is distinctly traceable. The cement over the surface generally has been decomposed or denuded, and is replaced by a crust of Crag matrix, of a very rusty appearance, filling the interspaces. The anterior talon thins off from the outside inwards, and is considerably narrower than the first ridge, of which the inner edge is broken. The apices of the ridges, from the second to the fifth inclusive, are all more or less fractured, and the digitations present very thick enamel. The sixth, seventh, and eighth ridges show each about four thick digitations; the ninth and tenth from four to five, converging; and the eleventh four digitations. the innermost of which is fractured. The definition of the base of the crown behind is a little damaged, but nothing is wanting. The dimensions are:—

Extreme length of crown, 11·25 in. Width of crown in front, 3·3 in. Width at fifth ridge, where the crown is broadest, 3·8 in. Extreme height of ridge, 4·8 in. Width of ninth ridge, 3·5 in. Height of ninth ridge, 4·6 in.

'From these dimensions it is apparent that, in a length of $11\frac{1}{4}$ inches, there are eleven ridges, with talons, and the seven ridges from the fourth to the tenth inclusive, measured along the inner wall of the crown, yield a length of fully 7 inches, being an average of one plate to an inch, and fully equal to the expansion of the ridges in the African Elephant, or in *E.* (*Loxodon*) *planifrons*. The terminal divisions of the ridges form stout irregular cylinders, as thick as the little finger, while in the Mammoth they are more slender and quill-shaped. The digital lobes of the ridges in *E. meridionalis* are so massive and distinct that they have occasionally been figured and described as being of *Mastodon*.'—H.F. 1857. (Reproduced in Plate VIII. of vol. ii.)

Plate XV.

Elephas insignis[1] (Falc. and Caut.). From the Sewalik hills. This is the most remarkable of all the Indian fossil Elephants. The cranium is as singular and grotesque in construction as that of the *Dinotherium giganteum*.

The cranium is seen to differ remarkably from that of *E. Ganesa* (Plates XXI. and XXII.) notwithstanding that the molars of the two species agree so closely. That of *E. insignis* is flattened at the top, elongated from side to side and singularly modified, so as to bear an analogy to the cranium of *Dinotherium giganteum*, while that of *E. Ganesa* does not differ much from the ordinary type of the Elephants. (See also Plates XLII., XLIII., XLIV., and XLV.)—Specimen is not in B.M.

[1] This is one of the forms included under *Mastodon Elephantoïdes* by Clift. See note 1, p. 41.

Plate XVI.

Fig 1.—*Elephas insignis.* Broken cranium, oblique antero-lateral view. Left orbit, &c., gone. This head is very cubical in form, is old, very concave in front and vertically; teeth broken. Interval between incisive sheaths deep. No tusks. A black specimen in Cautley's collection.—B.M.

Extreme length from occiput to surface of molars, 26· in. Depth of brow from occiput to upper margin of nasal opening, 5·5 in. Antero-posterior diameter of orbit, 5·5 in. Width of incisive sheaths at orbitary foramina, 11·4 in. From occipital to brow between middle of orbits. 17· in.

Fig. 2.—Lateral view of same skull, as shown in fig. 4, showing zygomatic arch.—B.M.

Fig. 3.—Posterior view of same skull, as in Plate XVII. figs. 1 and 2, showing occiput, occipital foramen, and condyles.—B.M.

Fig. 4.—Palate view of skull with last upper molars, from a specimen in H. F.'s collection, the same as shown in fig. 2.—B.M.

Length of palate to commencement of diastemal ridges, 10· in. Length of molar, 9·4 in. Number of plates 10, and a heel; probably two plates dropped out in front. Interval between molars in front, 1·9 in.; interval behind, 3· in. Height of pterygoids to palate, 10· in. Length of articulating surfaces for condyles of lower jaw, 5·4 in.; width, 2·6 in. Transverse diameter of right tusk, 3·5 in. Length of zygomatic arch, 14·3 in. Length of temporal fossa, 9· in.; width of temporal fossa from pterygoids to maxillary surface, 7·8 in. Antero-posterior diameter of orbits, 6·3 in.

Plate XVII.

Figs. 1 and 2.—*Elephas insignis.* Anterior and lateral view of cranium, same as represented in Plate XVI. fig. 3.—B.M.

Extreme length from occipital bulge to plane of molars, 23· in. From occipital bulge to broken tips of incisives, 24· in. Extreme width of occiput, 25·5 in. Width of brow at post-orbitaries, 24·4 in. Greatest contraction of brow between temporals, 18· in. From occipital plane to tip of nasals, 7·9 in. Width of naso-maxillary opening, 11·3 in. Depth of opening at wings, 3·2 in. Contraction of incisives at orbitary foramen, 12·2 in. Vertical height of orbit, 5·3 in. From occipital condyles to anterior end of palate, 22· in. From anterior margin of occipital to posterior surface of palate, 12· in. Length of palate to commencement of diasteme, 11·8 in. Height from sphenoid to tip of pterygoids, 9·8 in. Width of palate posteriorly between molars, 3·2 in. Width of palate in front, 2·8 in. From posterior surface of pterygoid to extremity of molar, 5·1 in. Height from occipital condyles to middle of brow between the orbits, 20·5 in. Distance between the outer margins of the occipital condyles, 7·2 in. Vertical diameter of occipital condyles, 2·8 in. Transverse diameter of occipital condyles (length of one), 3·8 in. Transverse diameter of occipital foramen, 2·9 in. Vertical diameter of occipital foramen, 2· in. From occiput to anterior margin of orbit 15 6 in.

Figs. 3 and 4.—*E. insignis.* Anterior and lateral view of another cranium. Both zygomatic arches are missing, and the left side of the cranium is deficient. Shows the great length of the incisive sheaths.—B.M.

Plate XVIII.

Fig. 1.—*Elephas insignis.* Very young skull.—B.M.

Fig. 2.—*Elephas insignis.* Young skull with milk dentition.—B.M.

Fig. 3.—*Elephas insignis.* Skull of a middle-aged individual.—B.M.

Fig. 4.—*Elephas insignis.* Lower jaw with two (second and third) true molars. The specimen comprises only the right side, with symphysis

and beak. The left side has been restored in outline. The ascending ramus is broken off.—B.M.

Figs. 5 and 5 *a*.—*E. insignis*. Lower jaw, left side, with ascending ramus, but condyle broken off. Contains portion of last true molar. Fig. 5 *a* is a view of inner surface, with large opening for nutritious artery.—B.M.

Figs. 6 and 6 *a*.—*E. insignis*. Fragment of lower jaw, left side, of smaller individual, including ascending ramus and condyle.—B.M.

Fig. 7.—*Elephas planifrons*. Fragment of lower jaw with portions of two true molars.—B.M.

Plate XVIII. A.

Figs. 1 and 1 *a*.—*Elephas planifrons*. Last molar, lower (upper in MS.) jaw, left side. An enormous specimen in H. F.'s collection. Enamel very thick and denticles few. Eight plates. Is very like fig. 9 of Plate XI., and fig. 8 of Plate XIV.—B.M.

Length, 10·4 in.; width, 4·1 in.; height, 3·2 in.

Figs. 2 and 2 *a*.—*E. planifrons*. Last lower molar, right side. A very large specimen; enamel very thick; plates low; has a great fang in front; true type of large *E. planifrons*. This specimen is figured in a former plate (XI. 5).—B.M.

Length, 10·5 in. Width, 4·2 in. Height, 3·2 in. Height of plate where broken behind, 3·8 in.

Figs. 3 and 3 *a*.—*Elephas insignis*. Lower jaw containing on either side a molar with twelve ridges and a heel, the first six ridges worn; nine denticles to the seventh ridge; one large outer mentary foramen, none inside.—B.M.

Length of jaw, 20· in. Height at alveolus, 9· in. Length of molar, 12·2 in. Width of molar, 3·5 in.

Figs. 4 and 4 *a*.—*E. insignis*. Lower jaw, right side, with symphysis, but ascending ramus broken off. Contains two molars *in situ*; four ridges to first and seven to second; plates very deep. Edge of diasteme sharp; no mentary foramen shown.—B.M.

Extreme length of fragment of jaw, 18·2 in. Height at alveolus, 6·6 in. Greatest width, 6.6 in. Width of anterior molar, 3·4 in. Of last molar, 3·5 in.

Figs. 5 and 5 *a*.—*E. insignis*. Lower jaw, left side, containing last molar with eleven ridges and a heel of two points; the seven ridges in front are worn; plenty of cement. One large mentary foramen.—B.M.

Extreme length of fragment, 19· in. Height at alveolus, 7·4 in. Greatest width, 7·4 in. Length of molar, 11·3 in. Width in front, 4· in.

Figs. 6 and 6 *a*.—*Mastodon Sivalensis*. Lower jaw. Very indistinct specimen; teeth utterly worn out; enamel gone. One mentary foramen outside. Shows well the non-divergence of the rami behind.—B.M.

Height of jaw to alveolus, 8· in. Length of molar, 8·5 in. Interval between molars in front, 2·8 in. Interval between molars behind, 2·8 in.

Plate XIX.

Figs. 1 and 1 *a*.—*Elephas insignis*. Fragment of upper jaw containing first (*b*) and second milk molars, *in situ*. The second milk molar shows six ridges.—B.M.

Its length is 2·7 in., and greatest width, 1·6 in. It closely corresponds with a specimen in the Asiatic Society of Bengal.

Figs. 2 and 2 *a*.—*E. insignis*. Third milk molar, upper jaw, *in situ*, in same young skull as fig. 1. Length, 4·8 in.—B.M.

Fig. 3.—*E. insignis*. Vertical section of third milk molar, *in situ*, in a very young cranium, which also contains first and second milk molars (fig. 1) and penultimate tusk on left side.—B.M.

Figs. 4 and 4 *a*.—*E. insignis*. Fragment of skull, showing palate, with two molars on either side; the first (third milk) molars well worn. The first true molar has seven ridges and a heel.—B.M.

Figs. 5 and 5 *a*.—*E. insignis*. Fragment of upper jaw with two molars. Very similar to specimen of *E. insignis* (Pl. XXIV. fig. 6). The molars are first and second true.—B.M.

Figs. 6 and 6 *a*.—*E. insignis*. Portion of fine head with two back molars. A small piece only of the front tooth remaining. The last tooth has eleven ridges and a heel and a great abundance of cement; the five front ridges are worn. The fossa between the tusk-sheaths is very deep and narrow, as in the other specimens of this species, an outward twist in the sheaths marking the curvature of the tusks.—B.M.

Length of the two teeth, 12·5 in. Length of last tooth only, 11 in.; width, 3·8 in. Interval between teeth in front, 1·2 in. Interval at niche behind, 4·7 in. Height of pterygoids to palate, 10·4 in.

Fig. 7.—*E. insignis*. Transverse section of young tusk *in situ*, in same cranium as figs. 1, 2, and 3.

Plate XIX. A.

Figs. 1 and 1 *a*.—*Elephas insignis*. Fragment of upper jaw with two molars; the front one much worn; the last has seven ridges. Very doubtful whether they are the second and third milk molars, or the third milk and first true molar; in all probability the latter.—B.M.

Length of front tooth, 3·6 in. Width, 1·8 in. Length of back tooth, 5·5 in. Width, 2·7 in.

Figs. 2 and 2 *a*.—*E. insignis*. Portion of small head, showing palate with two last molars on both sides. The front tooth has seven ridges, all worn but the last; the last has eleven ridges and a front and back heel, and its plates are very compressed, showing nine to ten denticles.—B.M.

Length of penultimate, 6·6 in. Width, 3·1 in. Length of last tooth, 11·3 in. Width, 3·4 in.

Figs. 3 and 3 *a*.—*E. insignis*. Portion of very large skull. In this splendid specimen some of the characteristic marks of the species are shown, and especially the enormous height of the pterygoids, which are 10·2 inches from the Vidian hole to the summit, wrap over the maxillaries, and run up forming a very strong crested ridge into the base of the orbit. Posteriorly, they form a flat disc-like surface, 3·8 inches broad. There are also the indications of very deep trunk fossa. The last left molar has nine ridges and a heel; a portion in front has dropped out. The corresponding tooth on right side is very imperfect.—B.M.

Length of last molar, 10·7 in. Width at fifth ridge, 4· in. Interval between teeth in front, 2·5 in. Interval between teeth behind, 4·5 in. Length of palate, from niche to commencement of diasteme, 12·3 in. Height of pterygoids, 10·2 in. Width of pterygoids outside, 9·5 in. Width of flattened surface of pterygoids, 3·8 in.

Figs. 4 and 4 *a*.—*E. insignis*. This, though mutilated, is a superb and characteristic specimen of the skull. It shows the concavity of the

brow, and the great depth of the trunk fossa. In this respect it resembles *Mastodon Sivalensis*, but there is no great divergency of the tusks, as in that species. The tusks are small and nearly cylindrical. The front tooth, very fine, has eight main ridges and a front and back heel; the back tooth entirely in germ, shows ten plates, the hindmost reversed, and the ridges like compressed plates.—B.M.

Length of anterior molar, left side, 9·7 in. Width at second ridge, 3·5 in. Interval in front between the molars, 2·6 in. Interval between the molars behind, 3·6 in. Length of palate from niche to diasteme, 9·7 in. Depth of trunk fossa, 8·2 in.!

Figs. 5 and 5 *a*.—*Elephas bombifrons*. Portion of skull showing palate with two teeth on either side. The front tooth has six ridges; the back one nine ridges and a front and back heel, only one ridge worn. The teeth have a great quantity of cement and the enamel is roughly fluted. These are characters of *E. bombifrons* rather than of *E. insignis*, as the figure is designated in the plate. The back tooth is very narrow behind, and so it is in *E. bombifrons*. The specimen resembles Pl. XXIX. fig. 2.—B.M.

Length of front tooth, left side, 7·2 in. Width, 3·6 in. Length of back molar, 11·1 in. Width, 4·2 in.

Plate XX.

Figs. 1 and 1 *a*.—*Elephas insignis*. Fragment of lower jaw with two milk molars (second and third).—B.M.

Figs. 2 and 2 *a*.—*E. insignis*. Fragment of lower jaw with milk molar (third). The tooth has seven ridges and a front talon.—B.M.

Figs. 3 and 3 *a*.—*E. insignis*. Fragment of lower jaw with second and third milk and first true molars. The first and last teeth are imperfect.—B.M.

Figs. 4 and 4 *a*.—*E. insignis*. Lower molar (second true?) with ten ridges, five front ridges worn; ten denticles in fourth ridge from back.—B.M.

Figs. 5 and 5 *a*.—*E. insignis*. Fragment of lower jaw including ascending ramus, with portion of back molar.—B.M.

Figs. 6 and 6 *a*.—*E. insignis*. Fragment of lower jaw containing second true molar with nine ridges and front and back heel; not at all worn.—B.M.

Figs. 7 and 7 *a*.—*E. insignis*. Fragment of lower jaw containing last true molar, with twelve or thirteen ridges, the five front ridges worn.

Figs. 8 and 8 *a*.—*E. insignis*. Fragment of lower jaw with last true molar containing about twelve ridges, of which only the three front ridges are worn: the greater part of the tooth still in germ. (Reproduced in Plate V. of vol. ii.)

Figs. 9 and 9 *a*.—*E. insignis*. Fragment of lower jaw with (second? true) molar; ten ridges, or nine ridges and a back talon. Fragment of another tooth in front. Specimen in Geol. Soc. Museum. For further description see Pl. XX. A. fig. 6.

Plate XX. A.

Figs. 1 and 1 *a*.—*Elephas Ganesa* (Falc. and Caut.). From the Sewalik hills. Lower jaw with first and second true molars. Proved to be so by fig. 2. A most remarkable jaw, very high in front and with

very divergent rami behind; diastemal edges very sharp; two outer mentary foramina on right side. The front tooth much worn; has five ridges and a heel; the last tooth has eight ridges. Nothing else like this in the collection.—B.M.

Extreme length of jaw, 18·5 in. Height at alveolus, 8·5 in. Width of jaw in front, 4· in. Width of jaw behind, 5·8 in.! Length of front tooth 5·1 in. Width, 2·7 in. Length of last tooth, 9·3 in. Width, 3·2 in.

Figs. 2 and 2 *a*.—*Elephas Ganesa*. Portion of lower jaw with left penultimate lower molar. The jaw in this specimen is also very high and narrow in front, and low behind. The tooth has seven ridges and a heel. Behind it is seen a portion of the last molar.—B.M.

Length of fragment, 14·5 in. Height at alveolus, 8·3 in. Height behind, 5·8 in. Width in front, 3·3 in. Width behind, 6·6 in. Length of molar, 9·2 in. Width at back, 3· in.

Fig. 3.—*Elephas insignis*. Fine specimen of lower jaw, including ascending ramus. Two outer mentary foramina. Second and third ? true molars.

Figs. 4 and 4 *a*.—*E. insignis*. Fragment of anterior portion of lower jaw. Is the only specimen that shows a beak entire to the tip. Is very like the large specimen containing a molar with great number of plates (*Vide* Plate XVIII. A. fig. 3).—B.M.

Figs. 5 and 5 *a*.—*E. insignis*. Fragment of lower jaw with last molar, imperfect. The latter has eight plates remaining; seven denticles to the second (distinct) ridge.

Length of fragment, 16· in. Length of eight plates of last molar, 8·1 in. Width in front, 3·1 in. Width behind, 3·5 in.

Fig. 6.—*E. insignis* ? Fragment of lower jaw with second (third ?) true molar. The plates show seven to eight points. This is the specimen described by Clift in the Geological Transactions. It is very like *E. insignis*. It is also represented in Plate XX. figs. 6 and 6 *a*.—Geol. Soc. Museum.

Length of fragment, 19· in. Height at alveolus, 6·6 in. Length of molar, 12· in. Width in front, 3·2 in. Width in the middle, 3·6 in. Length of fragment of anterior tooth, 4·2 in. Width, 2·5 in.

Figs. 7 and 7 *a*.—*E. insignis*. Fragment of lower jaw, right side, with first true molar nearly worn out, and six ridges of second molar. The plates are very high and there is much cement. The teeth are very broad in relation to the jaw, as compared with *E. Ganesa* in fig. 1. This is a beautiful specimen from Baker's collection.—B.M.

Length, 14·7 in. Height, 7·7 in. Width in front, 3·5 in. Width behind, 6·7 in. Length of front molar, 4·6 in. Width, 2·7 in. Length of back fragment, 5·3 in. Width, 3 in.

Plate XXI.

Elephas Ganesa (Falc. and Caut.). From the Sewalik hills, in Colonel Baker's collection. Large skull, with fragment of left incisive *in situ*, and corresponding fragment of right incisive detached. The incisive alveoli are remarkably elongated, as in *E. primigenius*. The plane of the incisives is continuous with that of the frontal, but with a tendency to obliquity forwards. The skull is very imperfect on right side. Pl. XXI. gives a front view one-fifth of the natural size, and Pl. XXII. figs. 1 and 2, give a lateral and palate view of the same skull. Compare with skull of *E. insignis*, Pl. XV.—B.M. The dimensions are as follows:—

Length of cranium from occipital protuberance to the end of incisive, left side (four feet exactly), 48· in. From occipital condyles to left side, 39· in. From occipital condyles to anterior border of molar alveolus, 25·5 in. Vertical height from condyles to sinciput, 24·5 in. Diameter across the occipital condyles, 9·2 in. Antero-posterior diameter of left condyle, 5·1 in. Transverse diameter of right condyle, 3·85 in. Transverse diameter of occipital foramen, 3·0 in. Antero-posterior diameter of occipital foramen, 3·1 in. From the surface occipital bulge plane to anterior entire margin of naso-maxillary sinus, 19·1 in. Semi-diameter of widest part of occipital (making total of occiput, 29·2 in.), 14·6 in. Semi-diameter (transverse) of naso-maxillary sinus (entire diameter restored, estimated 16· in.), 7·9 in. Interval between naso-maxillary sinus and post-orbital margin of frontal, 4·55 in. Mesial width across forehead from post-orbital process to inner margin of incisive, left side, 13·1 in. (Width of forehead at this part restored, 26·25 in.) From tip of post-orbitary process to surface of occipital, 17·75 in. From tip of incisives outside to post-orbitary process, 30·75 in. Length of incisive to margin of naso-maxillary sinus, 31· in. Depth of zygomatic fossa, 4·25 in. Estimated width of cranium between middle of zygomatic fossæ, 19·5 in. Height from lower margin of auditory foramen to the summit of sinciput, 18· in. Depth or height of cranium from the posterior margin of molar alveolus (back part of palate) to the summit of sinciput, 32· in. Depth from posterior and upper margin occipital foramen to posterior margin molar alveolus, 9·5 in. Height of the orbit, 8·78 in. Length of anterior portion of the palate, from anterior end of molar alveolus to tip of incisive, 16· in. Transverse diameter, left incisive at tip, 11·5 in. (Estimated width of both incisives at tip, 24· in.) Vertical diameter of left incisive at tip, 10·6 in. Vertical height of sub-orbitary foramen, left, 3·85 in. Width of incisive at contraction below sub-orbitary foramen, 10·75 in. Width of incisive sheath at sub-orbitary foramen, 7·5 in. (Estimated width of both incisive sheaths at sub-orbitary foramen, 21·5 in.) Interval between the posterior molars, anterior end (width of palate in front), 2·7 in. Interval behind, 3·25 in. Length of right molar (backmost), 11·9 in. Width of right molar in front, 4·05 in. Width of right molar behind, 5· in. Vertical height from posterior outer margin of molar alveolus to post-orbitary process, 21· in. Interval between outer surfaces of the molars at fifth ridge from front, 12·6 in. Antero-posterior diameter auditory foramen, 1·15 in. Transverse diameter auditory foramen, 1· in. Estimated height of occiput at restoration from lower surface of condyles to sinciput, 24·5 in. Length of left tusk outside the incisive sheath, measured along lower surface, 10 ft. 6 in. Length of left tusk, inside sheath, 2 ft. 3 in. to 2 ft. 4 in. Estimated total length, 12 ft. 9 in. Total length of head from occipital protuberance to tip of tusk, 4 ft. + 10 ft. 6 in. = 14½ ft. Length of right tusk, 10 ft. 8½ in. Interval between the tusks at emergence from incisive sheath, 6· in. Interval between the tusks at nearest approximation, at 3½ ft. from incisive, 3·5 in. Divergence at tips, 5 ft. 3½ in. as restored. Height of versed sine of curve from tip to incisive border, right side, 23· in. Height of versed sine of curve, from tip to incisive border, left side, 23· in. Vertical diameter left tusk (14· in. from base) where greatest, 9· in. Transverse diameter, left tusk, at ditto, 7·9 in. Girth of left tusk, at ditto, 26· in.

Plate XXII.

Fig. 1.—*Elephas Ganesa.* Lateral view of large skull figured in Pl. XXI.—B.M.

Fig. 2.—*E. Ganesa.* Palate view of same skull. The right incisive is seen in section. The posterior true molar is seen on either side of palate. It has ten plates and a heel behind, and a small talon in front; the hind heel has few denticles; the four front ridges are worn. The alveoli are parallel as in the Mammoth.—B.M.

Fig. 3.—*E. Ganesa.* Sketch showing restoration of skull, with tusks, of *E. Ganesa*, profile view, one-thirteenth of natural size.

Plate XXIII.

Fig. 1.—*Elephas Ganesa.* Sketch showing restoration of skull, with

tusks, of *E. Ganesa*, oblique antero-lateral view, one-thirteenth of natural size.

Fig. 2.—Ditto, ditto, front view.

Plate XXIV.

Figs. 1 and 1 *a*.—*Elephas Ganesa*. Fragment of right upper jaw with first true molar. The tooth has six ridges and a heel; five ridges worn. From Baker's collection.

Length of molar, 5·1 in. Width in front at second ridge, 2·5 in. Width behind, 3· in.

Figs. 2 and 2 *a*.—*E. Ganesa*. Fragment of upper jaw with second? true molar presenting seven ridges.

Length of molar, 7·5 in. Width in front, 3·1 in. Width behind, 3·4 in.

Figs. 3 and 3 *a*.—*E. Ganesa*. Upper jaw, right side, with three ridges of first true molar, and entire penultimate. The latter has seven ridges and a heel; no cement; plates unworn. Closely resembles *E. insignis*.—B.M.

Length of penultimate molar, 9 in. Width, 4

Figs. 4 and 4 *a*.—*E. Ganesa*. Fragment of last molar, upper jaw, right side. Fangs confluent; six ridges and a heel; discs of wear very large; the last ridge has seven denticles.—B.M.

Length of molar, 9·2 in. Width, 4·2 in.

Figs. 5 and 5 *a*.—*E. Ganesa*. Fragment of upper last? molar, right side, very large; shows six ridges, or five and a heel, very compressed; nine denticles on fourth ridge.—B.M.

Length of molar fragment, 7·4 in. Width, 4·3 in.

Figs. 6 and 6 *a*.—*Elephas insignis*. This is a very instructive specimen, consisting of the palate, with penultimate and antepenultimate true molars on both sides, from an animal of medium size. The antepenultimate has seven ridges, all worn but the last, and a small heel. The penultimate or second true molar is entirely in germ; it consists of eight main ridges and a front ridge, but has no heel. This is a characteristic type of true *E. insignis*, with the ridges very high and compressed. There are about ten points or denticles to the fifth ridge of the penultimate tooth, this being about the average; this tooth has no cement between the plates, only matrix. The front, or antepenultimate, tooth has plenty of cement. There are small tusks on both sides. Compare with Plate XIX. 5.

Length of antepenultimate, 6·8 in. Width, 3·2 in. Length of penultimate, 8·5 in. Width, 3·5 in.

Plate XXIV. A.

Figs. 1 and 1 *a*.—*Elephas Ganesa*. Fragment of skull with palate and back molars on both sides. This is a most remarkable specimen. I have called it *E. Ganesa* (H. F.), and it much resembles the molar of the big *Ganesa* specimen (Plate XXII. fig. 2) in form and in the compression of the ridges, but the ridges are few.[1]—B.M.

[1] Another specimen of Mr. Cunliffe's in Geological Society, not figured, is also very remarkable. Shows the palate with two last molars on both sides *in situ*. The front tooth has four plates, much worn and very crimped. The

Length of back molar, 9·7 in. Width, 3·8 in. Width of palate in front, 2· in. Width behind, 2·8 in.

Figs. 2, 2 *a*, and 2 *b*.—*Elephas insignis*. Small broken head. This is a very remarkable specimen. The teeth, although small, are assuredly the first and second true molars. The front tooth has six ridges and a heel; the penultimate has only seven ridges and a large heel, with a distinct talon in front; all the ridges of the front tooth worn; very little cement; plates deep. The tusks, if any, have dropped out; two large sub-orbitary foramina.—B.M.

Extreme length of skull, 18· in. Length of incisives, 15·8 in. Width between orbits measured to lachrymal tubercle, 7·8 in. Contraction of muzzle at suborbitaries, 11·9 in. Width of muzzle at tip, 9·2 in. Width between outer surfaces of maxillaries at the back molar (beginning), 8·4 in. Length from diasteme to tip of tusk-sheaths, 9·3 in. Depth from pterygoid to front, 14·7 in. Length of anterior molar, 4·9 in. Width, 2·7 in. Width of palate between front molars anteriorly, 1·5 in. Ditto behind, 2·2 in. Length of penultimate molar, 7·4 in. Width, 3· in.

Figs. 3 and 3 *a*.—*E. insignis*. Lower jaw, with first and second true molars. Five ridges remaining of front molar; other molar has twelve main ridges and a heel. Besides the characters shown in the figure, the diastemal portion is very much flattened in front of the anterior molar. This remarkable specimen is in the Museum of the College of Surgeons; the drawing is taken from a cast.

Extreme length of fragment of jaw, 24· in. Height to alveolus, 9· in. Width of jaw in front, 4·8 in. Width behind, 7·5 in. Length of ascending ramus, 12·8 in. Length of front molar, 5· in. Width, 3·5 in. Length of last molar, 11·5 in. Width, 4· in.

Figs. 4 and 4 *a*.—*Elephas Namadicus* (Falc. and Caut.). From the Nerbudda. Small head with two molars *in situ*; one worn, but the back one in germ; probably the first and second true molars. The right tusk is present; is very large for size of head; is nearly circular in outline, and diverges greatly in front. The tusk-sheaths are long, as in *E. Indicus* and *E. primigenius*. The brow-ridge, &c., are exactly as in the large head of *E. Namadicus* (Plate XII. A.). The space between the tusk-sheaths is very shallow, as in *E. planifrons*. Is probably a young male head.—B.M.

Extreme length from broken occiput to broken incisive, 29· in. From groove of brow to tip of nasals, 6·1 in. Across nasal opening, 12·5 in. Height of nasal opening at sides, 3·6 in. Width of muzzle (incisive sheaths) at orbital foramen, 13· in. From top of incisive sheath at fissure to diasteme, 9·8 in. Antero-posterior diameter of left orbit, 5·9 in. Transverse diameter of right tusk, 3·6 in.; vertical, nearly the same. Width of palate in front, 1·6 in. Width of palate behind, 2·7 in. Width of front tooth, 2·6 in.

Plate XXV.

Figs. 1 and 1 *a*.—*Elephas Ganesa*. Lower jaw, with last lower molar. Shows two mentary foramina on either side; is very sharp in

last tooth has ten ridges, or nine and a large heel; only the two front ridges are worn; the tooth is very convex from back to front, and the ridges are very high and convex across, with a large quantity of cement. Looks very like (!) the *E. bombifrons* fragment, Pl. xxix. fig. 4.

Length of anterior molar, 4·5 in. Width, 4· in. Length of last molar (very much curved), 10·4 in. Greatest width, 3·9 in. Interval between front teeth, 1·9 in. Interval behind at niche of palate, 4·5 in.

front at diasteme, and high with an edge; ascending ramus is inclined forward and does not shelve out. Molar has seven or eight ridges remaining, but is imperfect in front; enamel very much crimped (*Vide* Plate XXV. A. fig. 2).—B.M.

Extreme length of jaw, 19·3 in. Height to alveolus, 8· in. Thickness in front, 4·1 in. Thickness behind, 6·3 in. Length of right molar, 8·9 in. Width at middle, 4·7 in.

Figs. 2 and 2 *a*.—*Elephas bombifrons* (Falc. and Caut.). From the Sewalik hills. Fragment of lower jaw, showing the united symphysis, parallel rami, and three large mentary foramina on outside. Only a fragment of last molar seen on both sides.—B.M.

Extreme length, 17·3 in. Height to alveolus, 7·8 in. Width of jaw in front, 3·6 in. Width of jaw behind, 6·1 in.

Figs. 3 and 3 *a*.—*E. bombifrons*. Magnificent specimen of lower jaw; fault in jaw; two large mentary foramina; beak very thick; right molar has nine ridges and a heel; enamel very thick; hardly any cement.—B.M.

Extreme length of jaw, 23·6 in. Height to alveolar margin, 9· in. Thickness in front, 4·2 in. Thickness behind, 8·3 in. Length of right molar, 12·9 in. Greatest width at fifth ridge, 4·4 in.

Figs. 4 and 4 *a*.—*Elephas insignis*. Lower jaw, partly distorted by pressure, and containing two molars on either side. The anterior (first true) molar is entire, though mutilated, and has seven ridges and a large heel. The back (second) molar is fragmentary.—B.M.

Extreme length of jaw, 15· in. Height to alveolus, 5·8 in. Thickness in front, 3·5 in. Thickness behind, 5·5 in. Length of front molar, left side, 6·5 in. Width at middle, 2·5 in.

Plate XXV. A.

Figs. 1 and 1 *a*.—*Elephas Ganesa* (Falc. and Caut.). Fragment of lower jaw, thick behind, with last lower molar, showing seven ridges and a heel, and great crimping, but no characteristic feature.—B.M.

Length of right molar, 8·8 in. Greatest width, 3·8 in.

Figs. 2 and 2 *a*.—*E. Ganesa*. Fragment of lower jaw, very old, with last molar much worn. Resembles Plate XXV. fig. 1.—B.M.

Height of jaw at alveolus, 7·8 in. Length of right molar, 10·2 in. Width, 4· in.

Figs. 3 and 3 *a*.—*E. Ganesa*. A dumpy, small-sized lower jaw, with imperfect molar; seven ridges remaining; the back ridges curved and much crimped.

Length of molar, 8·4 in. Width behind, 3·8 in. Width in front, 3·4 in.

Figs. 4 and 4 *a*.—*E. Ganesa*. This little lower jaw is very remarkable in being high and narrow; the ascending ramus is much bent forward. It contains three teeth, one in front worn out; a second with seven ridges and a heel, and a third in germ.—B.M.

Extreme length of jaw, 18·4 in. Height to alveolus, 6· in. Height at front tooth, 2·5 in. Height behind, 4· in. Length of ramus (antero-post.), 8·7 in. Length of front tooth, 2·5 in. Length of second tooth, 5·2 in.; width in front, 2· in.; width behind, 2·3 in.

Figs. 5 and 5 *a*.—*E. Ganesa*. Angle of lower jaw, left side, with portions of ascending and horizontal rami, and posterior five and a half ridges of last true molar.—B.M.

Length of fragment of molar, 7· in. Width, 3·9. in.

Figs. 6 and 6 *a*.—*E. Ganesa*. Portion of lower jaw, left side, with fragment of last true molar, showing anterior 9 ridges.

Length of tooth fragment, 9·3 in.; greatest width, 3·8 in.

Figs. 7 and 7 *a*.—*E. Ganesa*. Lower jaw, right side, with last molar. Shows the back part of the tooth, on to the anterior large fang.—B.M.

Length of fragment of jaw, 18· in. Length of fragment of tooth, 8·5 in.; width, 3·3 in.

Plate XXVI.

Elephas bombifrons (Falc. and Caut.). From the Sewalik hills. Anterior view of large head.—B.M.

Extreme length from occipital to broken incisive, 34·2 in. Length from occipital to commencement of diasteme, 32·2 in. Occiput to tips of nasals, 16·2 in. Middle of naso-maxillary fissure, 14·7 in. Semi-diameter of brow at the post-orbitary, 12·2 in. Width of brow at post-orbitary, 24·4 in. Width of muzzle at contraction near orbitary foramen, 16·8 in. Width of inter-incisive fossa, 5·3 in.; depth of fossa below incisive sheaths, 6· in. Greatest contraction of brow, 13·3 in. Antero-posterior diameter of orbit, 6· in. Width of palate in front, 2· in. Width of palate at middle, 4·5 in. Width of palate behind, 4·6 in. Height of pterygoid, 11·2 in. Transverse diameter of left tusk, 3·3 in.

Plate XXVII.

Elephas bombifrons (Falc. and Caut.). Very fine and perfect skull, anterior view. Four other views of same skull are given in Plate XXVIII. This head is very marked; it is convex from occiput to front and also across, and is very narrow at the temporal contraction. The bounding ridges sweep round by a bold curve into the post-orbitary processes, as in *E. meridionalis*. There is a deep furrow between the tusks. The nasal opening for the trunk is above the line (or nearly so) of the post-orbitary processes of the frontal bone. Above the infra-orbitary foramen on the right side there is another smaller opening. (On a proof copy of the plate this species is designated *Elephas intermedius*, or *Mastodon Elephantoïdes* of Clift.)—B.M.

Extreme length from occiput to broken incisives, 27· in. From occipital condyles to anterior border of alveolus of molar, 23·2 in. Vertical length of head from broken condyle to tip of occiput, 17·7 in. Greatest width of occiput, 25·5 in. Interval between auditory foramina, 21·5 in. From anterior margin occipital foramen to the posterior surface palate, 14· in. Length of palate from niche to the downward bend of tusk-sheaths, 12·5 in. Interval between outer surface of teeth, behind, 9·8 in. Int. between outer surf. teeth, in front, 9· in. Length of right molar, 10·2 in. Width in front of molar, 3·7 in. Width behind, 3·4 in. Interval between molars, in front, 1· in. Interval behind, extremely divergent, 4·2 in.; number of ridges 9 and a heel, 8 front worn. From occiput (middle) to tip of nasals, 13·8 in. Width of brow across post-orbitary processes, 22·4 in. Greatest contraction temporal fossa, 10·8 in. Transverse diameter nasal opening, 11·3 in. Depth of nasal opening at sides, 2·5 in. Interval between middle of orbits, 19·5 in. Vertical height of orbit, 4·6 in. Height from posterior surface palate to the middle of bulge of frontal, 23·5 in. From the anterior margin orbit to surface of occiput, 20· in. Width across incisive sheaths at base, 12·5 in.; interval between, about middle, 2·8 in. Depth of fossa between inc. sh., 4· in. Vertical diameter left tusk, 3·6 in. Transverse diameter of left tusk, 3·3 in.

Plate XXVIII.

Fig. 1.—*Elephas bombifrons*. Lateral view of same skull, as figured in Plate XXVII.—B.M.

Fig. 2.—*E. bombifrons*. Palate view of same skull, showing sections of tusks, and last? true molar on either side, with 9 ridges and a heel;

the 8 front ridges worn. The interval between the molars in front is very narrow; behind they are extremely divergent.—B.M.

Fig. 3.—*E. bombifrons*. Antero-lateral view of same skull, with large infra-orbitary foramen.—B.M.

Fig. 4.—*E. bombifrons*. Posterior view of same skull, showing occiput, occipital foramen and condyles, and pterygoids.—B.M.

Fig. 5.—*E. bombifrons*. Detached specimen of occiput.—B.M.

Greatest width, 25·in. Vertical height, 17·2 in. Diameter across occipital condyles, 7·5 in. Transverse diameter of occipital foramen, 2·5 in. Vertical diameter of occipital foramen, 2·4 in.

Plate XXIX.

Fig. 1.—*Elephas bombifrons*. Broken cranium, palatal surface, with last true molar on either side, that on the right side presenting 8 ridges and a heel, and very fine.—B.M.

From anterior margin of occipital foramen to niche of palate, 14·in. Width of skull across occipital foramen, 8·in. Length of palate from niche to commencement of diasteme, 10·7 in. Width of palate between molars in front, 2·in. Width behind, 3·in. Length of right molar, 10·in. Width of other molar, 4·in. Width of incisive sheaths at muzzle, 13·in.

Figs. 2 and 2 *a*.—*E. bombifrons*. Broken cranium with last? true molar on either side of palate. The right molar has 8 ridges, of which the five anterior ones are much worn. The molars are approximated in front, and very divergent behind (*Vide* Plate XIX. A., 5).—B.M.

Figs. 3 and 3 *a*.—Second milk molar, upper jaw, left side of *Elephas insignis*. (Misnamed *E. bombifrons* on Plate.)

Figs. 4 and 4 *a*.—*E. bombifrons*. Upper last true molar, right side. This is a beautiful specimen, with a continuous transverse heel in front; 8 plates remaining; the points are very numerous; no mesial division. The tooth is convex across (See note to Plate XXIV. A., 1.) —B.M.

Length of fragment, 9·in. Width in front, 4·in.; width behind, 3·7 in.

Figs. 5 and 5 *a*.—*E. bombifrons*. Portion of upper jaw with a magnificent fragment of the last upper molar, right side, very large, discs very wide; shows 7 ridges and a heel. Very like the *Ganesa* specimen formerly in India House collection.—B.M.?

Length of fragment of molar, 10·4 in. Width in front, 3·8 in. Width behind, 3·8 in.

Figs. 6 and 6 *a*.—*E. bombifrons*. A magnificent palate specimen, with portion of cranium and last molar, right side, showing 9 ridges and a heel.—B.M.

Length of last molar, 10·9 in. Width in front, 3·8 in. Width behind, 3·8 in. Greatest width in middle, 4·3 in.

Plate XXIX. A.

Figs. 1 and 1 *a*.—*E. bombifrons*. A mutilated lower jaw, short and thick in its build, with what is probably the third milk molar, and having the first true molar appearing in germ behind. The milk molar shows 6 ridges and a heel. Baker's collection.—B.M.

Thickness of jaw in front, 2·8 in. Thickness of jaw behind, 5·in. Height at alveolus, 5·in. Length of anterior tooth, 4·in. Width, 2·in.

Figs. 2 and 2 *a*.—*E. bombifrons*. Fragment of lower jaw, right side, with what is certainly the first true molar, showing 7 ridges and a heel; all the

ridges worn but the last; the two first worn out; a long sloping diasteme; two outer mentary foramina.—B.M.

Height of jaw to alveolus, 7·in. Thickness in front, 3·4 in. Thickness behind, 6·in. Length of molar, 6·4 in. Width in front, 2·3 in. Width behind, 2·9 in.

Figs. 3 and 3 *a*.—*E. bombifrons*. Portion of lower jaw, left side, with one large outer mentary foramen, and penultimate true molar, showing 7 ridges and a large heel.—B.M.

Extreme length of fragment of jaw, 15·in. Height to alveolus, 7·3 in. Length of molar, 8·5 in. Width in front, 2·8 in. Width behind, 3·2 in.

Figs. 4 and 4 *a*.—*E. bombifrons*. Fine specimen of anterior portion of lower jaw, both rami with symphysis. Contains the penultimate true molar of either side, with 7 ridges and a heel. Shows also the commencement of the last tooth behind, and proves the tooth (fig. 2) to be the first true molar. Jaw is deficient on both sides behind the penultimate.—B.M.

Length of fragment, 14·3 in. Height to alveolus, 7·in. Thickness behind, 7·in. Interval between rami in front, 2·7 in. Interval behind, 3·3 in. Length of right molar, 8·in. Width in front, 2·9 in. Greatest width, 3·4 in.

Fig. 5.—*E. bombifrons ?* Fragment of molar, from lower jaw, right side, with four ridges.—B.M.

Length, 5·8 in. Width, 4·5 in.

Fig. 6.—*E. bombifrons ?* Fragment of molar with three ridges and a heel. 'Doubtful what figs. 5 and 6 are.'—H.F.

Length, 4·4 in. Width, 4·5 in.

Figs. 7 and 7 *a*.—*E. bombifrons*. Portion of lower jaw, with molar showing 7 ridges, counting the last; no heel; another tooth in germ behind; is apparently the first true molar, with the second, or penultimate, coming behind it.—B.M.

Length of anterior molar, 6·5 in. Width, 2·7 in.

Figs. 8 and 8 *a*.—*E. bombifrons*. Lower jaw, right side, of a small variety, but old. It is figured chiefly for its small size. The tooth is certainly the last molar; it is wide behind and very thick; the discs of wear are peculiar.—Specimen in Geol. Soc. Museum.

Height of jaw to alveolus, 7·5 in. Width behind, 6·5 in. Width in front, 4·5 in. Length of tooth, 7·8 in. Width behind, 3·in.

Plate XXIX. B.

Figs. 1 and 1 *a*.—*Elephas insignis*. Fragment of anterior half of second milk molar, of left lower jaw, with two ridges and a front talon.

Length of fragment, 1·7 in. Extreme width, 1·4 in. Height, 1·2 in.

Figs. 2 and 2 *a*.—*Elephas Ganesa*. Fragment of lower jaw, right side, with the third milk molar entire, presenting 7 ridges and a heel.

Length, 4·6 in. Width in front, 1·4 in. Width behind, 2·2 in.

Fig. 3.—*E. Ganesa*. Fragment of lower jaw, with three molars (second and third milk, and posterior 5 ridges of first true).

Figs. 4 and 4 *a*.—*E. Ganesa*. Fragment of lower jaw, right side, with fifth or penultimate molar, presenting 8 ridges.

Length, 7·25 in. Width in front, 3·1 in. Width behind, 2·9 in.

Figs. 5 and 5 *a*.—*Elephas bombifrons*. Fragment of lower jaw, right

side, showing third milk molar with 5 ridges and an anterior and posterior talon. The three anterior ridges are worn into a common disc.

Length, 3·6 in. Width in front, 1·4 in. Width behind, 1·8 in.

Figs. 6 and 6 *a*.—*Elephas bombifrons*. Fragment of lower jaw, right side, with the antepenultimate or first true molar, presenting 7 ridges and a heel.—B.M.

Length of molar, 5·9 in. Width in front, 2·1 in. Width at antepenultimate ridge, 2·7 in.

Figs. 7 and 7 *a*.—*E. bombifrons*. Last molar, lower jaw, left side, presenting 9 ridges and a heel; 3 front ridges abraded.—B.M.

Extreme length, 13·4 in. Extreme breadth of crown, 4·2 in. Breadth at posterior ridge, 3·2 in. Breadth of grinding surface, 3·2 in. Extreme height, 6·4 in.

Figs. 8 and 8 *a*.—*Elephas insignis*. Fragment of lower jaw, right side, with portions of penultimate and last true molars. Shows 4 ridges and a large posterior talon of penultimate, and 3 ridges and anterior talon of last molar. Two large outer mentary foramina.—B.M.

Length of grinding surface of penultimate, 6·3 in. Extreme breadth posteriorly, 3·7 in. Breadth across anterior ridge, 3·2 in.

Plate XXX.

Figs. 1 and 1 *a*.—*Elephas Cliftii*[1] (Falc. and Caut.). *Mastodon Elephantoïdes* of Clift. Palate, with third upper milk molar, and the three anterior ridges of the antepenultimate or first true molar.[2] The third milk molar is entire on one side, but worn down to the common base of ivory, so that the divisions of the crown have entirely disappeared, leaving no certain data for determining the ridge formula. Behind it the three anterior ridges of the antepenultimate true molar are seen *in situ*, the posterior half being broken off. The plane of the palate, on to the diasteme, is very flat. The mesial line of division of the ridges in first true molar is not very distinct. This very interesting specimen was brought from Ava by Colonel Burney, and presented to the British Museum.

Extreme length of fragment, 10·6 in. Length of anterior tooth, 3·3 in. Width, 2· in. Length of second tooth, 3· in. Width, 3·4 in. Interval between teeth in front, 3·2 in.

Figs. 2 and 2 *a*.—*E. Cliftii*. This is the first or antepenultimate

[1] Mr. Clift, in his excellent memoir, includes the Ava fossil Proboscideans under two species, *Mastodon latidens* and *Mastodon Elephantoïdes*. In the 'Fauna Antiqua Sivalensis,' the former name is retained for the specimens of the *Tetralophodon* type, figured by Mr. Clift in the Geol. Trans., vol. ii. 2nd ser., Plate xxxvii. figs. 1 and 4; Plate xxxviii. fig. 1; and Plate xxxix. figs. 1, 2, and 3. Of the others, the palate specimen, Plate xxxvi. (*Mastodon latidens*, Clift), together with the detached molar, Plate xxxviii. fig. 6 (*Mastodon Elephantoïdes*, Clift), are referred to *E.* (*Stegodon*) *Cliftii*; and the lower jaw specimen, Plate xxxviii. fig. 2 (also *M. Elephantoïdes*, Clift), is referred to *E. Stegodon*) *insignis*. The specimens regarded by him as of his *M. Elephantoïdes* being here considered to belong more properly to the genus *Elephas*, it became necessary to resort to another specific designation. Hence the origin of *E.* (*Stegodon*) *insignis*.—H.F.

[2] In the Museum of the Royal College of Surgeons (Cat. No. 664) is another fine palate specimen of *E. Cliftii* with the penultimate and last true molars on both sides.

true molar, upper jaw, left side, entire, detached, and beautifully preserved. It has six ridges and a small hind talon. The tooth is nearly oblong. The enamel is somewhat fluted, and there is very little cement. There is very little convexity of the tooth across, and no distinct indication of the mesial dividing line. There are as many as eleven to twelve denticles or points. The tooth is compressed and angular in front, and the three front ridges are worn. This tooth is also represented by fig. 6 of Plate XXXIX. of Mr. Clift's Memoir (Geol. Trans., vol. ii., 2nd series). It is there described as *Mastodon Elephantoïdes*, under which title Mr. Clift included specimens referred by Dr. Falconer to two distinct forms.[1] Its elephantine affinities are indicated by the absence of a longitudinal line of division along the crown, and by the great number of points that enter into the composition of the ridges.—Cast in B.M.

Length, 6·1 in. Width in front, 3· in. Width behind, 3·3 in.

Figs. 3 and 3 *a*.—*Elephas Cliftii*. Superb palate specimen containing the penultimate true molar *in situ* on both sides. The tooth is proved to be the penultimate by its large dimensions, and by the circumstance that two or three ridges of another tooth (third true molar) is seen behind it.[2] The crown ridges are all more or less worn and partly damaged by fracture, but enough remains to show that the tooth was composed of six ridges and a hind talon. The palate is very flat, and the teeth on either side (in the erect position of the skull) slope upwards from without inwards. The teeth have very little cement. The diastemal ridges are wide apart. The right ridge shows the tusk-sheath; there is very little verticality of the tusk. The slope of grinding surface from without inwards is a mastodontoid character, which is very notably seen in Mr. W. Ewer's specimen of *M. Sivalensis* (Plate XXXIV. fig. 1). In the *Elephas insignis* the tendency of the grinding surface is to shelve upwards from the inside outwards, being the reverse of what holds in *E. Cliftii*.[3] This very important specimen is from Burmah, and is now in the Museum of the Geological Society. It is also represented by Clift in Plate XXXVI. of his Memoir in the Geological Transactions, vol. ii., 2nd series. The remaining portion of the upper jaw containing the last true molar is believed to be in the Museum of the Asiatic Society of Bengal (See *antea*, p. 114).

Extreme length of specimen, 19·in. Width of jaw at middle of molar, 8· in., doubled = 16· in Length of anterior molar, 8·2 in. Width, 4· in. Width of palate in front, 2·5 in. Width of palate between diastemal ridges, 4·8 in.

Figs. 4, 4 *a*, and 4 *b*.—*Elephas Cliftii*. A fragment of the penultimate molar, upper jaw, right side, with five ridges, shown also in section (fig. 4 *b*). Made out approximately to be *E. Cliftii*. Cement in moderate quantity.—B.M.

Length, 6·6 in. Width, 3·8 in.

Figs. 5 and 5 *a*.—*E. Cliftii*. Last true molar, lower jaw, left side, consisting of eight ridges and a talon. Five ridges are touched by wear, and the two anterior ridges are nearly worn out. The anterior large fang has been absorbed, but the portion of crown sustained by it

[1] See note 1, page 41.

[2] See note 2, page 41.

[3] In Col. Farquhar's specimen of the Indian Elephant, the plane of wear in the upper molars is as markedly from the inside outwards and upwards, as it is the reverse from outside inwards in *Mastodon Sivalensis*.

remains. The six posterior ridges have their fang elements confluent into a continuous plate or shell, thus maintaining the elephantine affinity indicated by the crown characters. The crown is very flat; the points are large and few in number, and there is no very distinct mesial dividing line, but little cement. This magnificent specimen was brought from Burmah by Col. Burney, and presented by him to the British Museum.

Length, 12·7 in. Width at middle, 4·5 in.

Figs. 6 and 6 *a*.—*Mastodon latidens* [1] (Clift). Fragment of lower jaw, left side, with last or third true molar. This is one of the most enormous specimens ever seen, the greatest girth over the molar being no less than 27·5 inches. There is one mental foramen; no appearance of tusk. The molar has five ridges and a double heel; the points are very large, and the discs of wear very broad; the mesial line of division is distinct; there is no cement. The plane of wear in front shelves from the inside out. There is a very similar specimen in the Museum of the Asiatic Society of Bengal.

Extreme length of fragment, 16·2 in. Height of jaw at anterior end of alveolus, 10·2 in. Greatest thickness, 6·8 in. Length of molar, 11·3 in. Greatest width, 4·5 in.

Plate XXXI.

Figs. 1 and 1 *a*.—*Mastodon latidens*. Upper milk molar.—B.M.

Length, 2·7 in. Width, 2·4 in.

Figs. 2 and 2 *a*.—*M. latidens*. Upper milk molar (third?).—Cast in B.M.

Length, 3·8 in. Width, 2·6 in.

Figs. 3 and 3 *a*.—*M. latidens*. Fragment of upper jaw, right side, with two molars (third milk and first true?).—B.M.

Length of posterior molar, 5·6 in. Width, 2·9 in. Length of anterior molar, 3·7 in. Width, 2·6 in.

Figs. 4 and 4 *a*.—*M. latidens*. Portion of palate, with two upper molars left side.—B.M.

Length of anterior tooth, 3·9 in. Width, 2·8 in. Length of posterior tooth, 4·2 in. Width, 3·4 in.

Figs. 5 and 5 *a*.—*M. latidens*. Fragment of upper molar.—Cast in B.M.

Length of fragment, 3·4 in. Width, 4·2 in.

Figs. 6 and 6 *a*.—*M. latidens*. Upper true molar, very perfect.—B.M.

Length, 8·5 in. Width, 4·5 in.

Figs. 7 and 7 *a*.—*M. latidens*. Fragment of lower molar with fang.—B.M.

Length, 5· in. Width, 3·3 in. Length of crown fang, 5·3 in.

Figs. 8 and 8 *a*.—*M. latidens*. Lower molar well worn.—B.M.

Length, 6·4 in. Width, 3·3 in. Height of crown fang, 6·4 in.

Mastodon latidens, like the *M. longirostris* of Eppelsheim, presents a Dinotherian type, in so far as the crowns of the molar teeth are concerned; and in this respect it contrasts with *M. Sivalensis* and *M. Arvernensis*, in which the molars have a hippopotamoid type. In *M. latidens* the crown is broad, the mammillæ are thicker in proportion

[1] See note 1, page 41.

to their height; the ridges are less elevated, and consist of a greater number of coronal points, and the valleys are more open and transverse (or interrupted only by an insignificant number of warty tubercles) than in *M. Sivalensis*.

Figs. 9 and 9 *a*.—*Mastodon Perimensis* (Falc. and Caut.). From Perim Island. Portion of upper jaw, right side, with molar, presenting characters similar to those of *M. Sivalensis* and *M. Arvernensis*. —B.M.

Length, 6·3 in. Width, 3·3 in.

Figs. 10 and 10 *a*.—*M. Perimensis*. Portion of lower jaw, left side, with penultimate and last true molars. Presented by Miss Pepper to B.M.

Length of anterior molar, 4·8 in. Width, 2·6 in. Length of fragment of posterior molar, 2·1 in. Width, 2·8 in.

Figs. 11 and 11 *a*.—Fragment of lower jaw, with molar.

Length of tooth, 8·4 in. Width, 3·5 in.

Plate XXXII.

Mastodon Sivalensis (Falc. and Caut.). From the Sewalik hills; anterior view. Three other views of same cranium in Plate XXXIII. The brow is a little crushed between the temporals. The left tusk-sheath is present, the right is withered; there is distortion of the tusk-sheaths in consequence. There is an enormous and peculiar projection of the lips of incisive anterior end of naso-maxillary fissure, so as to project over the trunk, or inter-incisive fossa. This fossa is very deep, enormously so. The depressions for the condyles of the lower jaw are very vaulted. There are two infra-orbitary foramina on the right side. The grinders are very much worn. On the left side there would be five ridges, with a very complicated heel-series. Posteriorly, the teeth show well the peculiar characters of *Mastodon Sivalensis*.—B.M. (Reproduced in Plate X.)

Extreme length from occipital bulge to tips of incisives, 28·3 in. Width of occiput, 22·4 in. Height of occiput from plane of condyles, 19·0 in. Interval between outer edge of condyles, 6·6 in. Vertical diameter of occipital condyle, 4·0 in. Transverse diameter occipital condyle, 2·7 in. Width of base of occiput, 21·0 in. Transverse diameter occip. foram. 2·9 in. Vertical diameter occip. for. 2·5 in. From occiput to broken tips of nasals, 14·0 in. From occiput to anterior margin of orbit, 21·0 in. From anterior margin nasal opening to the tips of the incisive, 14·0 in. Width of brow between post-orbitary processes, 25·5 in. Width at contraction between temporals, 11·6 in. Width of naso-maxillary (trunk) opening, 12·0 in. Depth of naso-max. op., lateral, 3·0 in. Vertical diameter orbits (nearly circular), 4·3 in. Transverse diameter orbits, 4·3 in. Interval between orbitary processes of one orbit, 2·7 in. Width of forehead at anterior margin of orbit, 20·6 in. Contraction of muzzle at orbitary foramen, 13·0 in. Depth of trunk fossa below brow, 9·8 in. Greatest interval between zygomatic arches, 22·0 in. From base of zygomatic to top of occiput, 20·5 in. Depth of anterior orbitary process of maxillary, 4·5 in. Height of skull from palate to top of occiput, 25·0 in. From posterior surface condyles to posterior surface palate, 16·0 in. From pterygoid processes to anterior margin of palate, 12·2 in. Height of pterygoid, 10·3 in. Distance from molar to posterior surface of pterygoid, 4·2 in. Width of pterygoid above, 6·0 in. Width of pterygoid below, 7·5 in. Width of fissure (between pterygoids), 2·3 in. Length of palate at middle, 9·6 in. Width of palate between molars in front, 2·8 in. Width of palate between molars behind, 2·6 in. Length of left molar, 7·8 in. Width of left molar in front, 3·2 in. Width of left molar behind, 3·3 in. Length of articulating condyles for lower jaw, 4·8 in. Greatest width of condyles for lower jaw, 3·0 in.

Plate XXXIII.

Fig. 1.—*Mastodon Sivalensis.* Lateral view of same skull as is figured in Plate XXXII. Shows temporal fossa and left zygomatic arch entire.—B.M.

Fig. 2.—Palate view, showing palate, one molar on each side, both zygomatic arches entire, occipital condyles, &c. Same cranium as fig. 1. —B.M.

Fig. 3.—Occipital view of same cranium, showing occipital condyles and foramen, pterygoids, &c.—B.M.

Fig. 4.—Lateral view of another cranium of *M. Sivalensis*, with lower jaw *in situ*. The left zygomatic arch is broken away.—B.M.

Plate XXXIV.

Fig. 1.—*Mastodon Sivalensis.* Portion of skull showing palate with two molars on either side, the posterior molar on right side imperfect. In this specimen there are two large orbitary foramina and there is only a tusk on the right side; the left tusk-sheath is withered. The tusk-sheaths are very divergent, with an enormous deep trough between, and there is great concavity of the brow, as in *E. insignis.* The teeth diverge anteriorly, as in *Mastodon Ohioticus*, but in a less degree. The molars are excessively like Smith's specimen of the last molar upper jaw, right side, of *Mastodon Arvernensis* (Plate XXXVI. fig. 8). The slope of grinding surface from without inwards is very notably seen (see Plate XXX. fig. 3). The anterior molar of both sides is worn, but shows four ridges with a heel, the ridges so advanced in wear as to exhibit the characteristic alternating discs of wear, so remarkable in this species. The last molar is perfect, except the heel ridge, on the left side. The front ridge is barely touched by wear, while the four back ridges are intact. The drawing does not show the characters very perfectly. The front ridge has two confluent ridges on the inside and two on the outside, to the inner of which the intermediate pillar is attached, joining on with the innermost large point of the third ridge. This third ridge shows but one thick point on the inner division and two on the outer, with the intermediate pillar connecting the outer division of the third with the inner division of the fourth ridge, and so with the last ridge. This diagonal connection of the posterior surface of the outer division with the anterior surface of the inner points of the next following ridge cause in wear the alternate-like discs of detrition, which characterize the teeth of *Mastodon Sivalensis.* The same kind of arrangement holds in Smith's specimen of *Mastodon Arvernensis.* The points in *M. Sivalensis* are very high and obtuse, and the apex of the ridges is high as compared with the specimen in Mr. W. Ewer's collection. (See also *antea*, p. 117.)

Length of two molars, right side, 9·2 in. Length of front molar, left side, 4·7 in.; width, 2·8 in. Length of last left molar minus heel, 6·4 in.; width, 3·0 in. Interval between teeth in front, 3·4 in.; interval between teeth behind, 2·7 in. Height of enamel crown, 2·3 in. Height of inner mammilla of second ridge, 1·8 in. Length of palate from niche to diastema, 9·0 in. Antero-posterior diameter right tusk, 3·0 in.; transverse, 2·7 in. Width of base of muzzle at orbitary foramen, 14·0 in. Interval between the middle of the orbits, 19·2 in. Antero-posterior diameter or height of left orbit, 4·8 in.

Figs. 2 and 2 *a.*—*M. Sivalensis.* Fragment of upper jaw with molar presenting six ridges, with same characters as in fig. 1. The two anterior ridges only are touched by wear. The tooth is now cut into sections. —B.M.

Figs. 3 and 3 *a*.—*M. Sivalensis*. Fragment of lower jaw with portion of molar, four ridges and part of a fifth.—B.M.

Extreme length, 5·4 in. Breadth in front, 2·5 in.

Figs. 4 and 4 *a*.—*M. Sivalensis*. Fragment of lower jaw, with three ridges of a molar.—B.M.

Figs. 5 and 5 *a*.—*M. Sivalensis*. Fragment of molar.—B.M.

Plate XXXV.

Figs. 1 and 1 *a*.—*Mastodon Sivalensis*. Fine specimen of lower jaw, with one molar on either side. A portion of the right ramus deficient, but restored in the drawing. The teeth show well the alternating discs of wear characteristic of the species, and two outer mentary foramina.—B.M.

Fig. 2.—*Mastodon longirostris* (Kaup), from Eppelsheim; lower jaw in outline, profile view; from a cast.

Figs. 3 and 3 *a*.—*Mastodon Andium* (Cuv.). Perfect lower jaw of an adult with two last molars *in situ*, from Buenos Ayres. The anterior tooth confirms what is shown by the Canterbury specimen (Plate XL. fig. 15) respecting the penultimate. It is in an advanced stage of wear, but exhibits distinctly the discs of three ridges. The crown is nearly rectangular in form; the dimensions being 5·1 in. in length, 2·85 in. of width in front, and 3· in. behind. The posterior tooth, which is the last or third true molar, has the crown composed of four principal ridges, and a complex sub-triangular heel of several points. The three anterior ridges are partly worn and exhibit well the characteristic complex trefoil discs of wear. The two posterior ridges are intact, and the sinuous hollows between them show the very considerable layer of cement which is present in a greater quantity in this than in any other species of true *Mastodon*. The dimensions of this tooth are about 8 in. in length by 3·5 in. of width in front, whence it narrows gradually towards the posterior end.—B.M.

Fig. 4.—*Mastodon Ohioticus* (Blumb.), from North America. Fine specimen of lower jaw with two last molars, viewed from above. The anterior or penultimate tooth consists of three ridges separated by transverse uninterrupted valleys; all the ridges are slightly affected by wear. The posterior tooth consists of four main ridges and a subordinate talon ridge; all untouched by wear.—B.M.

Fig. 5.—*M. Ohioticus*. Profile view of same jaw. One large and one small mentary foramen.—B.M.

Figs. 6 and 6 *a*.—*Dinotherium Indicum* (Falc.). Superb fragment of lower jaw, left side, with molars, brought from Perim Island by Miss Pepper. The specimen contains nearly the whole of the adult series of five molars *in situ*. The contour of the body of the jaw is shown in the most perfect state of preservation, the fossil having fortunately been mineralized by means of a very hard siliceo-ferruginous infiltration. But it has evidently been long rolled about on the sea-beach as a boulder, so that the crowns of the whole series of molars have been hammered off nearly level with the alveolar margin of the jaw; the surface of the fossil is jet black, and almost all of the matrix has been cleared away, probably by the long-continued action of the sea, which has given it a semi-vitreous polish. Patches of recent marine shells are also found on the surface. The symphysis of the jaw is broken off about $2\frac{1}{2}$ in. in front of the anterior premolar, and the bone is truncated

behind exactly opposite the point where the coronoid margin of the ramus begins to rise up, the fracture passing through the middle of the last molar, the anterior ridge of which is visible *in situ* in the jaw. A detailed description of the points of distinction between this fossil and the *Dinotherium giganteum* of Kaup is given in the memoir on Perim Island fossils.—B.M.

Length of fragment, 17· in. Length of four front teeth, 13·5 in. Length of first premolar, 3·5 in. Width of first premolar behind, 2·2 in. Length of second premolar, 2·9 in. Width of second premolar behind, 2·6 in. Length of third or first true molar, 4· in. Width behind, 2·8 in. Length of fourth tooth (second true molar), 3·9 in. Width, 3·5 in. Depth of jaw to alveolar margin at the second premolar, 9·2 in. Depth at third tooth or first true molar, 8·7 in. Width of jaw at second premolar, 5·1 in. Width at middle of fourth tooth, 6·4 in. Distance between the upper margin of mentary foramen and alveolus of first premolar, 3·6 in. Distance from inferior margin to first premolar, 4·75 in.

Plate XXXVI.

Figs. 1 and 1 *a*.—*Mastodon Sivalensis*. Fragment of upper jaw with (second) milk molar.

Length of tooth, 2·6 in.

Figs. 2 and 2 *a*.—*M. Sivalensis*. Fragment of upper jaw with two milk molars. (Second and third).—B.M.

Length of anterior tooth, 2·6 in. Width, 1·8 in. Length of posterior tooth, 4· in. Width, 2·3 in.

Figs. 3 and 3 *a*.—*M. Sivalensis*. Portion of upper jaw, with fragment of molar. (First or second true m.).—B.M.

Length of fragment of crown, 4· in. Width,2·9 in.

Figs. 4 and 4 *a*.—*M. Sivalensis*. Fragment of upper jaw, with second ? true molar, presenting five ridges, with alternately disposed crown mammillæ.—B.M.

Length of molar, 5·6 in. Width, 2·9 in.

Figs. 5 and 5 *a*.—*M. Sivalensis*. Fragment of upper jaw, with penultimate true molar. Five ridges and a hind talon.—B.M.

Length of molar, 6·5 in. Width, 2·9 in.

Figs. 6 and 6 *a*.—*Mastodon Sivalensis*. Last molar, upper jaw, left side in plan and profile. It has six ridges and a hind talon, and in this respect it differs from both *M. Arvernensis* and *M. longirostris*, but it most resembles the former in so far as the alternate disposition of the crown mammillæ is concerned. The complexity of pattern is even greater than in the English Crag Mastodon.—Cast in B.M.

Length of tooth, 7·8 in. Width, 3·3 in.

Figs. 7 and 7 *a*.—*Mastodon Arvernensis*, or the English Crag Mastodon. Left upper jaw of a calf, with the last milk molar beautifully preserved *in situ*, and the remains of the empty alveolus of the penultimate milk molar in front of it. The crown is composed of four ridges with a front and hind talon, and a well-pronounced basal 'bourrelet.' The three anterior divisions are more or less worn, especially along the inner side; the last ridge is nearly intact. The ridges are connected by one or two stout conical mammillæ, interrupting their transverse continuity, and alternating with the divisions of the main ridges. The vertical furrowing of the enamel at *b* and *c*,

presenting the appearance of a reeded column or of a number of cords pressed close together, is remarkable. This character is not present in the corresponding young molars of *Mastodon longirostris*, Pl. XL. fig. 6, in which the enamel is irregularly wrinkled but never presents the symmetrical fluting observed in the 'Crag' Mastodon. This difference indeed is sufficient to distinguish the young teeth of the two species. Discovered in the 'Crag' at Postwick by Mr. Wigham, and figured by Lyell, 'Manual of Elementary Geology,' 5th ed. 1855, p. 166, fig. 133.

Length of tooth, 2·9 in. Width anteriorly, 1·7 in. Width posteriorly, 1·8 in. Width of grinding surface, 1·2 in.

Figs. 8 and 8 *a*.—*Mastodon Arvernensis*. Last true molar, upper jaw, right side, composed of five ridges with an anterior talon, and a strong back talon. The crown is obscurely divided longitudinally by a shallow cleft along its axis. Deep clefts or valleys intervene between the ridges; but the valleys, instead of being transverse, are interrupted in the middle by one or more large accessory conical mammillæ, interposed between the ridges and alternating with the outer and inner divisions. This is the famous Whittingham tooth forming the frontispiece of Mr. W. Smith's 'Strata Identified,' and of which a woodcut (reversed) is given in Owen's 'British Fossil Mammalia,' p. 276.

Length of tooth, 7· in. Width, 2·9 in.

Figs. 9 and 9 *a*.—*Mastodon Arvernensis*. Another specimen of last true molar, upper jaw, left side. This is Captain Alexander's specimen dredged up between Southwold and Easton, and of which there is a cast in the Museum of the Geological Society. The specimen is very black with a sandy matrix and no vertical pillaring. The crown consists of five ridges and a heel ridge of four points. The anterior edge is broken. The enamel is very thick. There are three sub-alternate mammillæ in the first valley. The second and third ridges are very closely approximated, with but one intermediate mammilla. The third and fourth are wide apart with three mammillæ in the valley. The fourth and fifth have but one intermediate mammilla.

Figs. 10 and 10 *a*.—*Mastodon longirostris*. Antepenultimate true molar, upper jaw. From Eppelsheim. Cast in B.M.

Length, 4·5 in. Width, 2·5 in.

Figs. 11 and 11 *a*.—*Mastodon longirostris*. Penultimate true molar from Eppelsheim. Cast in B.M.

Extreme length, 5·4 in. Width anteriorly, 3· in. Width posteriorly, 3·3 in.

Figs. 12 and 12 *a*.—*Mastodon longirostris*. Last true molar, upper jaw. Shows five ridges and a talon. The crown is broader, and the mammillæ thicker in proportion to their height, than in *M. Arvernensis*. The ridges also are less elevated, and consist of a greater number of coronal points. The valleys are either entirely open and transverse, or interrupted only by an insignificant number of warty tubercles. From Eppelsheim. Cast in B.M.

Length, 9· in. Width, 3·8 in.

Figs. 13 and 13 *a*.—*Mastodon longirostris*. Last true molar, upper jaw, presenting some characters as fig. 12. From Eppelsheim. Cast in B.M.

Length, 6·8 in. Width, 2·9 in.

Plate XXXVII.

Figs. 1 and 1 *a*.—*Mastodon Sivalensis*. Portion of lower jaw, right side, with first (*x*) and second milk molars.—B.M.

Length of fragment of jaw, 4·7 in. Greatest breadth, 2·6 in. Height opposite posterior border of second milk molar, 2·1 in. Length of first molar, ·6 in. Greatest breadth, ·4 in. Length of second milk molar, 1·8 in. Greatest width, 1·1 in.

Figs. 2 and 2 *a*.—*M. Sivalensis*. Portion of lower jaw, left side, with symphysis and two outer mentary foramina, and containing first (*x*) and second milk molars.—B.M.

Length of symphysis (oblique), 2· in. From first molar to anterior margin of symphysis, 2·5 in. Length of anterior or first molar, ·4 in. Greatest width, ·4 in. Length of second molar, 1·9 in. Greatest width, 1·2 in. Length of fragment of jaw, 6·6 in. Greatest breadth, 2·1 in. Height at anterior margin of second molar, 2·3 in.

Figs. 3 and 3 *a*.—*M. Sivalensis*. Portion of lower jaw, right side, with symphysis and third milk, and fragment of fourth, or first true, molars.[1]—B.M.

Length of fragment, 12· in. Length of symphysis (ant. post.), 4·4 in. Greatest width of fragment, 3·8 in. Height at posterior margin of third molar, 4·2 in. Length of third molar, 3·5 in. Greatest width, 2· in.

Figs. 4 and 4 *a*.—*M. Sivalensis*. Fragment of lower jaw, left side, with first ? true molar, imperfect anteriorly.—B.M.

Breadth of jaw, 5·7 in. Height, 5·4 in. Length of tooth (imperfect), 8· in. Width, 3·2 in.

Figs. 5 and 5 *a*.—*M. Sivalensis*. Fragment of lower jaw with portion of true molar well worn. Shows well the alternate discs of wear.

Figs. 6 and 6 *a*.—*M. Sivalensis*. Fragment of lower jaw, left side, with penultimate ? true molar, imperfect behind.[2]—B.M.

Width of fragment of jaw, 6·1 in. Height, 6·1 in. Length of fragment of tooth, 6· in. Width, 3·2 in.

Figs. 7 and 7 *a*.—*M. Sivalensis*. Fragment of lower jaw, right side, with last true molar, much worn, and imperfect in front.—B.M.

Length of molar (imperfect), 8·4 in. Width, 3· in.

[1] In the Museum of the Royal College of Surgeons (Cat. No. 669) is a beautiful specimen of ramus of right lower jaw of a young *M. Sivalensis*, with the third milk and first true molar. The anterior tooth is a little broken and worn out in front; it shows six discs of wear and a large talon ridge. The talon and 4 last ridges are quite distinct, the 5th and 6th are worn out, and probably an anterior talon was included with front ridge. This would make 6 ridges and a back and front talon, or 8 in all. The tooth has little cement, the ridges are low, and there is great plaiting of the enamel plates in wear. Length of tooth, 4·2 in.; width at last big ridge, 2·4 in.; width at fourth ridge, 2·05 in.; width at second ridge, 1·9 in. The posterior tooth has 5 emerged ridges with a talon in front, extending only from the outside, half way across, but thick. The rest of the tooth is concealed. The two front ridges and talon are slightly touched by wear. Width of tooth at first ridge, 2·2 in. Width at second, 2·3 in. Length from middle of first ridge to middle of fifth (excluding talon), 3· in. The third ridge shows 11 little points. No. 670 is the left side of the same jaw with corresponding teeth. The mentary foramen is very much in advance of the fourth tooth, and placed low.—H.F.

[2] Another specimen of left lower jaw of *M. Sivalensis*, with what is probably the penultimate true molar, is in the Museum of the Royal College of Surgeons (Cat. No. 690). It has four transverse ridges and a heel of two points, not 5 ridges as stated in catalogue. Length of tooth, 5·9 in.; width at first ridge, 2·4 in.; at fourth, 2·5 in.—H.F.

Figs. 8 and 8 *a*.—*M. Sivalensis*. Fragment of lower jaw, left side, containing a very perfect specimen of the last lower molar. The alternate disposition of the mammillæ of the crown is finely exhibited. Cast in B.M.

Length of tooth, 8·8 in. Width, 2·9 in.

Figs. 9 and 9 *a*.—*Mastodon Arvernensis*. Fragment showing posterior half of the last inferior true molar. The mammillæ form two alternate rows as in *M. Sivalensis*, each ridge being composed of a pair of points. From a cast in Museum of Geological Society.

Length of fragment of tooth, 5·6 in. Width, 3.8 in.

Plate XXXVIII.

Mastodon Perimensis (Falc. and Caut.), from Perim Island. Front view of skull. Other views of same skull are given in Plate XXXIX. figs. 1, 2, and 3.

This cranium is in many respects singularly perfect, although it has suffered from a crushing force, which has forced in the temples, so as to have contracted to a few inches the inter-temporal portion of the forehead. The ascending ramus of the lower jaw on either side is *in situ* with the coronoid process and condyle, and, what is more remarkable, the greater part of the hyoid bone lies upon the sphenoid. The atlas also was found attached to the condyles. The teeth are completely hammered down to the margin of the alveoli. The most remarkable character of all about this head is the low height of the pterygoid processes of the sphenoid, which are very little higher than the condyles, and the comparatively little elevation of the condyles above the palate. The interval between the plane of the lower surface of the condyles and that of the palate is only 5 inches, the height of the occiput being 22 inches. This is very much as in the North American Mastodon, and even more so, so that the plane of the grinder does not differ much from that of the condyles, thus showing a tendency in the direction of *Dinotherium* and the Trilophodon *Mastodon Ohioticus*. The pterygoids rise with a sharp posterior border, and do not spread out into a flap over the posterior border of the maxillary. They are not rugous as *M. Ohioticus*, nor are they so far (proportionally) extended behind. There are two large palatine foramina near the end of the molar. The molars (allowing perhaps for some distortion from pressure) run parallel, and do not at any rate diverge in the remarkable way exhibited by *M. Ohioticus*; perhaps they are less divergent even than in *M. Sivalensis*. The palate looks long. On either side are two molars, the penultimate and last true. The tusks exhibit an oval outline on section. Both zygomatic arches are entire. Presented by Captain Fulljames to B.M.

Extreme length from occiput to broken incisives, 27· in. From posterior surface of occipital condyles to commencement of diasteme, 25·5 in. Extreme width of occiput, 20· in. Height of occiput from condyles, 22·2 in. From occiput to broken tips of nasals, 13· in. From tips of inter-incisives (anterior end of nasal opening) to commencement of diasteme, 14·5 in. Width of nasal opening (approximate) 9·8 in.; antero-post. diameter of nasal opening, 4·3 in. Estimated width of brow at post. orbitaries, 19· in. Width of brow at middle of orbits, 15· in. Width of inter-incisive fossa, 2·2 in. Depth of inter-incisive fossa, 3·4 in. Contraction of muzzle at orbitary foramen, 11·6 in. Vertical diameter of right orbit, 4·8 in. From the auditory foramen to the anterior border of the orbit, 16·5. Transverse

diameter of left tusk, 2·9 in. Vertical diameter of left tusk (approximate), 4· in. Width across the condyles, 7·6 in. Antero-post. diameter of condyle, 3·5 in.; transverse diameter of condyle, 2·5 in. Vertical height of condyle, 2·6 in. Antero-post. diameter of occipital foramen, 2·8 in.; transverse diameter of occipital foramen, 2·9 in. From anterior border of occipital foramen to niche of palate, 10·9 in. From niche of palate to beginning of diasteme, 12·7 in. Height of the pterygoids above the body of the sphenoid, 5·5 or 6· in. Width of outer surface of pterygoids, 7·7 in. Length of two broken molars (surface), 11·7 in. Length of anterior or penultimate, 4·4 in.; width, 3·1 in. Length of back molar, 7·4 in.; width, 3·2 in. Width of palate between anterior molars, 1·6 in. Width of palate, behind, 3·5 in.

Plate XXXIX.

Fig. 1.—*Mastodon Perimensis.* Lateral view of same skull as figured in Plate XXXVIII., described above.—B.M.

Fig. 2.—*Mastodon Perimensis.* Palate view of same skull.—B.M.

Fig. 3.—*Mastodon Perimensis.* Occipital view of same skull.—B.M.

Figs. 4, 5, and 6.—*Mastodon Sivalensis.* Fragment of small black head, three different views. The specimen is very perfect in form, without crushing, so far as it goes. The plane of the occiput meets that of the frontal in a slightly rounded manner. The ligamentary depression is placed about the middle of the occiput, and is not deeply marked, consisting of a dividing crest, separating two diverging pits, having a heart-shaped outline. The occiput is slightly convex across and from base to top. The condyles do not project backwards as in *M. Perimensis.* The posterior boundary of the temple (edge of occiput) is inclined to be sharp. There is no tendency to occipital bosses as in Elephant. The occiput in some respects resembles that of *M. Ohioticus.* There is a very obtuse convexity or boss on the middle of the forehead between the temples.—B.M.

Greatest width of occiput (the half doubled) 22· in. Height of occiput from surface of condyles, 17· in. Contraction of brow between the temporals, 11·8 in. Interval across the condyles, 7·1 in. Antero-post. diameter of left condyle, 4·1 in. Transverse diameter of left condyle, 2·5 in.

Fig. 7.—*Mastodon Sivalensis.* Fragment of upper jaw with two molars, broken end of incisives, and anterior portion of zygoma. From a cast in B.M.

Plate XL.

Figs. 1 and 1 *a*.—*Mastodon latidens.* Second? upper milk molar with two ridges.—B.M.

Length, 1·9 in.; width, 1·4 in.[1]

Figs. 2 and 2 *a*.—*M. latidens.* Third? upper milk molar with four ridges.—B.M.

Length, 3· in.; width, 1·8 in.

[1] In the Museum of the Royal College of Surgeons is the left side of the upper jaw of a young *Mastodon latidens* containing the first and second milk molars. The anterior tooth is about 1· in. long, and ·8 in. wide, and has two ridges with a heel. The main ridge is transverse; the anterior one is an obtuse cusp. The tooth is oval, the sharp end being in front. The second milk molar is 2· in. long by about 1·5 in. wide. It has three main transverse ridges and a small bourrelet ridge in front, and a heel ridge behind. It expands very widely in the direction of the orbit. A vertical section shows something like the enamel of another small tooth, ½ inch long.—H.F.

Figs. 3 and 3 *a*.—*M. latidens*. Upper molar (first true ?) with four ridges and back and front heel.—B.M.

Length, 4· in.; width, 2·3 in.

Figs. 4 and 4 *a*.—*M. Perimensis*. Fragment of upper molar showing two ridges and part of a third. The valleys are transverse, but are interrupted in the middle by an accessory lobule in front of and behind each ridge, and the outer termination of each ridge is bounded by a large mammilla, exactly as in *Mastodon latidens*.—B.M.

Figs. 5 and 5 *a*. *M. Perimensis*. Fragment of lower jaw with portion of true molar, presenting a similar arrangement of mammillæ to that noted under fig. 4.

Length of fragment of molar, 5·4 in.; width, 3·2 in.

Figs. 6 and 6 *a*.—*Mastodon longirostris*. Fragment of right lower jaw of young calf showing the series of three milk molars *in situ*. The third milk molar is nearly intact; the four ridges of which it is composed are seen to be transverse, compressed, and composed of a number of little points; the valleys are open, with the exception of a tubercle in the first, and two or three minute tubercles in the last valley, which in no way interrupt their transverse continuity. The back talon forms a low transverse free ridgelet as in the *Mastodon latidens* of India. The enamel is irregularly wrinkled, but exhibits no vertical fluting, as in *M. Arvernensis* (See Plate XXXVI. fig. 7). The original specimen from Eppelsheim was formerly in the Earl of Enniskillen's collection, but is now in B.M. It is also figured by Kaup ('Oss. Foss. de Darmstadt,' Plate XX. fig. 2.)

Length of first tooth, 1·2 in. Width, ·9 in. Length of second tooth, 1·8 in. Width, 1·5 in. Length of third tooth, 2·6 in. Width, 2·1 in.

Figs. 7 and 7 *a*.—*Mastodon angustidens*. Third ? milk molar upper jaw, the crown consisting of three transverse ridges and an accessory talon of two tubercles. A single tubercle juts out into each of the hollows between the ridges alternately with the principal points, accounting for the trefoil-shaped discs, which the worn teeth present in this species, so different from the lozenge-shaped discs of *M. Ohioticus*. This specimen is from Mr. Edward Charlesworth's collection, but there is no history as to its origin.—B.M.

Length of tooth, 2·8 in. Width, 1·6 in.

Figs. 8 and 8 *a*.—*M. angustidens*. Antepenultimate or first true molar, having the crown divided into three distinct ridges, with a small back talon.

Length, 4·6 in. Width, 2·6 in.

Figs. 9 and 9 *a*.—*M. angustidens*. Penultimate molar of upper jaw, consisting of three ridges and a talon appendage of two tubercles behind. The two anterior ridges are affected by wear; the last is almost intact. The intervals, wide and deep, have only a single mammilla connecting the ridges, about the middle. The crown is very simple, each ridge consisting of two pairs of points. The tooth has a strong impression in front, is narrow in front and widens behind. The drawing is taken from a cast in B.M. The original specimen was what Cuvier commenced his account of the species, and it is figured by him in 'Divers Mastodontes,' p. 255, and Plate I. fig. 4. The dimen-

sions correspond exactly with those of Lartet's Gers specimen, viz.: Length, 4·5 in. Width in front, 2·1 in. Width behind, 2·6 in.

Figs. 10 and 10 *a*.—*Mastodon Andium*.[1] Fragment of upper true molar. Presented by Lord Shelburne. Shows four ridges and portion of a fifth.—B.M.

Length, 6· in. Width, 3·5 in.

Fig. 11.—*M. Andium*. Fragment of upper molar, with discs of three ridges much worn.—B.M.

Length, 5·2 in. Width, 3·2 in.

Figs. 12 and 12 *a*.—*M. Andium*. Last upper true molar with four ridges and a complicated heel.—B.M.

Length, 6·8 in. Width, 3·5 in.

Figs. 13 and 13 *a*.—*M. Andium*. Fragment of left lower jaw, with second and third milk molars *in situ*. The specimen is broken at the symphysis and coronoid process. From the relative size of the jaw and the development of the teeth, the animal corresponded to a sucking Indian elephant of about two years of age. The second milk grinder is fully protruded, but had barely come into use, the two front ridges being but slightly abraded. The third is in the state of an intact germ, and although fully formed, it had not penetrated the gum when the animal died. These teeth are both three-ridged, with a subordinate crest in front, and a small bi-tubercular talon behind. They are exactly alike in form, narrow in front, but broader backwards. The ridges, as in *M. angustidens*, consist of two pairs of principal points, which instead of being nearly simple, as in the latter species, are subdivided into a vast number of superficial warty tubercles, which jut into the valleys, forming a bridge or connection between the contiguous ridges, and interrupting the transverse continuity of the valleys. In this respect they more resemble the young teeth of *M. longirostris*. Specimen from Buenos Ayres in B.M.

Length of fragment of jaw, 7·6 in. Breadth, 2·7 in. Height, 2·9 in. Length of second milk molar, 2·6 in. Width, 1·4 in. Length of third milk molar, 3·5 in. Width, 1·7 in.

Figs. 14 and 14 *a*.—*Mastodon Andium*. Fragment of lower jaw with last true molar, exhibiting four ridges and a complicated heel. The three anterior ridges are touched by wear.

Length of tooth, 7·8 in. Width, 3·2 in.

Figs. 15 and 15 *a*.—*M. Andium*. Greater portion of lower jaw, left side, with the first and second true molars (penultimate and antepenultimate) *in situ*, showing also the empty alveolus of the last true grinder and of the third milk tooth. The ternary number holds in the ridges, there being three collines in each tooth, with an aggregate nest of tubercles in the intervals. There are no remains of cement. The anterior tooth is somewhat worn, the discs taking the form of a quadrifoil. This specimen is from Chili, and was presented to the Museum at Canterbury by General Miller; there is a cast of it in the

[1] Memorandum of head of *M. Andium* in British Museum, not figured. Shows palate with molars.

Length of the anterior or inter-maxillary portion of palate, 15· in. Interval between teeth in front, 4·4 in.; interval between teeth behind, 3·4 in. Length of last molar, left side, 8·75 in.; width in front, 3·75 in.; width behind, 3·25 in.

British Museum. It is of an age intermediate between the specimens figured in Plate XXXV. 3, and Plate XL. 13. It is very valuable, and is believed to be at present unique in Europe.

Length of fragment of jaw, 15· in. Breadth, 4·3 in. Height, 4·1 in. Length of first molar, 4· in. Breadth, 2·6 in. Length of second molar, 5·5 in. Breadth, 2·7 in.

Fig. 16.—*Mastodon Ohioticus.* Fragment of upper jaw, with three ridges and fangs of last upper molar, also empty cavity in jaw for fang of fourth ridge.—B.M.

Length, 5·1 in. Width, 4· in. Height of crown and fang, 7· in.

Fig. 16 *a.*—*M. Ohioticus.* Last true molar, upper jaw, with four main ridges and a heel; the first ridge only very slightly touched by wear. In *Mastodon Ohioticus* the upper teeth are distinctly cleft lengthwise into two divisions, each division being indistinctly composed of a pair of confluent points. The plane of the tooth is oblique, sloping from the outside, which is higher, to the inside, which is lower, and this relation continues during the wear, the inside being the most worn. The inner division, both anteriorly and posteriorly, throws off the decurrent talon crests, but in the first two milk teeth the inner division is smaller than the outer. Precisely the reverse is seen in lower jaw, the inner ridge being the highest and remaining so during detrition, while the outer is the lowest but least complex.—B.M.

Length, 7·3 in. Width, 4· in.

Plate XLI.

Tusks of Proboscidea.[1] Fragments and sections.

Figs. 1 and 1 *a.*—Twisted fragment.—B.M.

Length measured along great curvature, 40· in. Direct length or chord of curvature, 28· in. Circumference at proximal end, 12·7 in. Circumference at distal end, 13·2 in.

Fig. 2.—B.M.

Length, 56· in. Circumference at proximal end, 13·5 in.

Figs. 3 and 3 *a.*—B.M.

Length of fragment, 12·2 in. Circumference, 12·2 in. Greatest diameter, 3·7 in.

Figs. 4, 4 *a*, and 4 *b.*—B.M.

Length of fragment, 12·7 in. Greatest diameter, 7·7 in. Smallest diameter, 5· in.

Fig. 5.—B.M.

Greatest diameter, 9·8 in. Smallest diameter, 7·2 in.

Figs. 6 and 6 *a.*—Fragment of tusk in socket.

Length of socket, 13·5 in. Circumference of tusk, 6·2 in. Breadth of incisive alveolar margin, 6·2 in.

Figs. 7 and 7 *a.*—B.M.

Length, 68· in. Circumference at proximal end, 11· in.

Figs. 8 and 8 *a.*—B.M.

Length of fragment, 33· in. Circumference at smaller end, 16·5 in.

[1] There is no evidence of any attempt made by Dr. Falconer to determine the species to which any of these specimens belonged. All the specimens figured in the plate (with the exception of figs. 6 and 25) are collected in one place in the British Museum.

Figs. 9 and 9 *a*.—B.M.

Length, 11·6 in. Great diameter, 7·4 in. Small diameter, 5·9 in

Figs. 10 and 10 *a*.—B.M.

Length of fragment, 12·4 in. Circumference, 16·6 in.

Figs. 11 and 11 *a*.—B.M.

Length of fragment, 14·7 in. Circumference at upper end, 21·2 in.

Figs. 12 and 12 *a*.—B.M.

Length along great curvature, 23· in. Greatest circumference, 12· in. Least circumference at tip, 4·8 in.

Figs. 13 and 13 *a*.—B.M.

Length, 20· in. Greatest circumference, 17· in.

Figs. 14 and 14 *a*.—B.M.

Length of fragment, 12·7 in. Great diameter of section, 5· in. Smaller diameter of section, 4·4 in.

Figs. 15 and 15 *a*.—B.M.

Length of fragment, 11·8 in. Greatest circumference, 11·5 in.

Figs. 16 and 16 *a*.—B.M.

Length of fragment, 7·8 in. Greatest circumference, 9·2 in.

Figs. 17 and 17 *a*.—B.M.

Length, 9·6 in. Greatest circumference, 7·8 in.

Figs. 18 and 18 *a*.—B.M.

Length, 10·3 in. Greatest circumference, 13·5 in.

Figs. 19 and 19 *a*.—B.M.

Length, 9·2 in. Circumference, 13·5 in.

Figs. 20 and 20 *a*.—B.M.

Length, 9· in. Circumference, 19·2 in.

Figs. 21 and 21 *a*.—Matrix with fragments of two tusks.—B.M.

Length of fragment, 22·5 in. Proximal end of left tusk, 5·1 by 4·1 in. Proximal end of right tusk, 5·1 by 4·8 in. Distal end of left tusk, 3·9 by 3· in. Distal end of right tusk, 4·3 by 4·2 in.

Figs. 22 and 22 *a*.—B.M.

Length, 14·5 in. Circumference, 13·5 in.

Figs. 23 and 23 *a*.—Fragment of jaw with alveolus of left tusk, and part of right tusk.—B.M.

Length of fragment of jaw, 13·7 in. Between external alveolar margins of incisors, 20·4 in. Great diameter of tusk, 6·7 in. Lesser diameter of tusk, 5·7 in.

Fig. 24.—B.M.

Length of fragment of upper jaw, 14·2 in.

Figs. 25 and 25 *a*.—Unequal fragments of two tusks joined together.

Length of great fragment, 10·2 in. Length of small fragment, 7·8 in. Circumference of great fragment, 16· in. Circumference of smaller fragment, 15·3 in.

Plates XLII. and XLIII.

Anterior views of skulls of Proboscidea, restored, in outline.

Plates XLIV. and XLV.

Profile views of skulls of Proboscidea, restored, in outline.

In these four plates[1] the skulls are classified, and are arranged in a series forming a transition from one to the other, as follows : [2]

I. Trilophodontes.

1.—*Dinotherium giganteum* (after Kaup), with two large deflected tusks in lower jaw.

2.—*Dinotherium Indicum* (not figured).

3.—*Mastodon Tapiroïdes* (not figured).

4.—*Mastodon Ohioticus* [3] (copied from American Phil. Transactions, 1838, vol. viii. Plate III., adding a tusk to lower jaw).

5.—*Mastodon angustidens* (De Blainville's Ostéographie, Plate III.).

6.—*Mastodon Andium* (British Museum specimen).

II. Tetralophodontes.

7.—*Mastodon Perimensis* (Indian collection, see Plates XXXVIII. and XXXIX.).

8.—*Mastodon Sivalensis* (Indian collection, see Plates XXXII., XXXIII., and XXXIV.).

9.—*Mastodon Arvernensis* (after Nesti, imperfect).

10.—*Mastodon longirostris* (after Kaup, imperfect).

11.—*Mastodon latidens* (not figured).

III. Stegodontes.

12.—*Elephas Cliftii*, Clift's specimen, very imperfect.

13.—*Elephas bombifrons* (Indian collection, see Plate XXVII.).

14.—*Elephas Ganesa* (Col. Baker's huge cranium in British Museum, see Plate XXI.).

[1] Reproduced in vol. ii.

[2] *Note by Dr. F. in* 1857.—'The views which we entertain were fully elucidated in 1847 in the four plates of outline-heads, from Plate xlii. to xlv. of the "Fauna Antiqua Sivalensis," where a synopsis is given of all the species, fossil and recent, then known. The forms included under the nominal species of *M. angustidens* of Cuvier, are there ranged as four distinct species, viz. :—*M.* (*Triloph.*) *angustidens*, *M.* (*Triloph.*) *Andium*, *M.* (*Tetraloph.*) *longirostris*, and *M.* (*Tetraloph.*) *Arvernensis*. The only change which subsequent investigation on fresh materials has led us to make is to transfer *M. Andium* from the subgenus *Trilophodon* into that of *Tetralophodon*.' In 1863, however, Dr. F. expressed the opinion that *M. Andium* would, after all, prove to belong to the Trilophodon group (Memoir on *Elephas Columbi* in "Nat. Hist. Rev." 1863.)

[3] *Memorandum by Dr. F. on broken head of Mastodon Ohioticus.*—'The occiput forms a vertical plane, the condyles being right under the base, and not projecting behind. The crista galli is not very large, and the ligamentary depression is shallow with divergent lobes, broad above and narrow below. The pterygoid alæ of the sphenoid, instead of overlapping the maxillaries by a conical lamina, rise up in a rough rugous stem, and are much behind the last teeth, which are very divergent. The pterygoids are low, but not more so than (if so much as) in *M. Perimensis*.

'Extreme length of cranium from occiput to incisive tips, 34·2 in. Width of brow at post orbitaries, 19·6 in. Width at contraction of muzzle near sub-orbitary foramen, 15·2 in. Width of nasal opening, 5·4 in. Antero-posterior diameter of orbit, 5·6 in. From anterior margin of orbit to occipital plane, 22· in. Width across occipital condyles, 8·7 in. From anterior margin of occipital hole to niche of palate, 11·5 in. Height of the pterygoid alae from Vidian hole, 8·5 in. From back of molar to edge of pterygoid, 4·2 in. Length of molar with four ridges and a heel, 6·7 in. Width of palate in front of penultimate teeth, 3·9 in. Width behind, 3·9 in. Length of palate from niche to diasteme, 13· in. Interval between diastemal ridges at commencement, 4·5 in. Interval between tips of divergence, 5·6 in.!'

15 *a*.—*Elephas insignis*, old (Indian collection, see Plate XV.).
15 *b*.—*Elephas insignis* (Indian collection, see Plate XVII., fig 1).
15 *c*.—*Elephas insignis*, young (Indian collection, see Plate XVIII. fig. 3).

IV. Loxodontes.

16.—*Elephas planifrons* (Indian collection, see Plate IX.).
17.—*Elephas Africanus* (recent head).
18.—*Elephas priscus* (not figured).

V. Elasmodontes.[1]

19.—*Elephas meridionalis*[2] (after Nesti).
20 *a*.—*Elephas Hysudricus* (Indian collection, see Plate IV.).
20 *b*.—*Elephas Hysudricus*, young (Indian collection, see Plate VI.).
21.—*Elephas antiquus*[3] (not figured).
22.—*Elephas Namadicus* (Indian collection, see Plate XII. A.).
23 *a*.—*Elephas Indicus*[4] (Dauntela var.).

[1] The designation of *Elasmodus* having been preoccupied by Sir Philip Egerton for a series of fossil fish, Dr. F., in 1857 substituted the term *Euelephas* for *Elasmodon*.

[2] This is erroneously designated *E. antiquus* in the plate (see note, page 23). The illustration is taken from Nesti's figure. The skull is nearly perfect in the frontal and occipital regions, condyles, maxillaries, and molars, but imperfect in the facial portion, the border of the nasal opening being broken, together with the terminal portion of the incisive alveoli and zygomatic arches. The line formed by the posterior border of the vertex is transverse, the fossa being overarched by a produced fold of the vertex.

[3] *Elephas meridionalis* in Plate (see note, page 23).

[4] Comparison between *Mukna* and *Dauntela* varieties of *Elephas Indicus*.

	Mukna (big head). Inches	Dauntela. Inches
Extreme length of cranium	40·5	41·5
Width between zygomatics	29·5	29·75
Ditto post-orbitary processes	22·5	24·0
Length from niche of occiput to tips of nasals	22·0	21·0
Greatest width of occiput	31·0	30·5
Width of nasal opening	14·0	15·0
Depth of ditto	5·75	5·75
Width of tusk-sheaths	14·25	17·5
Narrow width of brow	13·5	13·25
Depth of orbit	6·5	6·5
Height from condyles to occiput	22·25	22·0
Across condyles	8·75	8·5
From condyles to tip of tusk-sheath	33·0	35·25
From ditto to anterior margin of molar alveolus	22·5	22·25
From anterior margin occipital hole to posterior border palate	12·0	11·5
Length of palate	8·0	9·5
Depth of head from condyles to frontal surface at middle, opposite nasal opening	23·5	23·5
Height from diastemal surface to bulge of occiput	30·75	31·25
Length of condyloid surface	6·5	6·25
From ear-hole to top of occiput	19·0	19·0
Length of anterior tooth, upper jaw	8·37	dropped out
Width ditto ditto	3·5	dropped out
Number of plates, about ten		dropped out

23 *b*.—*Elephas Indicus* (Mukna var.).
23 *c*.—*Elephas Indicus* (young).
24.—*Elephas primigenius* (Fischer's drawing).

Plate XLVI.[1]

Figs. 1 to 11.—Atlases of Proboscidea.

Figs. 1, 1 *a*, and 1 *b*.

Between extreme points of transverse processes, 16·7 in. Between extreme points of anterior articular surfaces, 8·5 in. Height, 9·3 in. Length of inferior arch, under surface, 2·8 in.

Figs 2, 2 *a*, and 2 *b*.

Between extreme point of anterior articular surfaces, 8·6 in. Height, 8·7 in. Length of inferior arch (inferiorly), 2·7 in. Height of orifice, 4·3 in. Breadth of spinal canal, 3·2 in. Narrowest part, 2·1 in. Breadth of fossa for odontoid process, 2·5 in.

Figs. 3, 3 *a*, and 3 *b*.

Between extreme points of anterior articular surfaces, 9·0 in. Height, 8·1 in. Height of orifice, 3·8 in. Breadth of odontoid fossa, 2·5 in. Breadth of spinal canal, 3·8 in.

Figs. 4, 4 *a*, and 4 *b*.

Between extreme points of transverse processes, 14·8 in. Between extreme points of anterior articular surfaces, 7·5 in. Height, 7·7 in. Length of inferior arch (below) antero-posterior, 2·5 in. Great diameter of vertebral foramen, 1·2 in. Length of superior arch (antero-posterior), 3·2 in.

Fig. 5.

Height, 7·7 in.

Fig. 6.

Between extreme points of anterior articular surfaces, 7·8 in. Height, 6·6 in.

Figs. 7, 7 *a*, and 7 *b*.

Between extreme points of transverse processes, 14·7 in. Between extreme points of anterior articular surfaces, 8·7 in. Height, 7·6 in. Antero-posterior of lower arch (inferiorly), 2·6 in.

Fig. 8.

Between extreme points of transverse processes, 17·4 in. Height, 8·6 in.

Comparison between *Mukna* and *Dauntela*—*continued*.

	Mukna (big head). Inches	Dauntela. Inches
Length of anterior tooth, lower jaw	9·	dropped out
Width ditto ditto	3·37	
Length of lower jaw from tip to posterior edge at middle of height	22·5	25·
Height of jaw to alveolus	6·5	6·5
Thickness of jaw (diam.)	6·37	6·
Height of condyles	20·	18·
Height to coronoids	15·5	12·5
Antero-posterior diameter leaf	13·5	10·25
Interval between condyles, inside	14·	14·
Ditto ditto outside		21·5

The plates of teeth in the *Mukna* variety slope greatly backwards and are excessively and finely crimped; those of *Dauntela* are much less crimped.

[1] The specimens figured in Plates xlvi. to lvi. inclusive, are mostly in the British Museum, except where the contrary is stated. Except in a few instances, no attempt was made by Dr. F. to determine the species of Proboscidean to which the bone belonged.

Fig. 9.

Between extreme points of anterior articular surfaces, 7·8 in. Height, 7·7 in.

Fig. 10.

Between extreme points of anterior articular surfaces, 10·4 in. Height, 10· in. Length antero-posterior of superior arch, 3·6 in. Length antero-posterior of inferior arch, 3·1 in.

Fig. 11.

Between extreme points of anterior articular surfaces, 9·2 in. Height, 6·9 in. Antero-posterior of superior arch, 2·8 in. Antero-posterior of inferior arch, 2·1 in.

Fig. 12.—Basilar process of occipital bone with condyles and foramen magnum of a Proboscidean.

Between extreme points of occipital condyles, 10·0 in. Vertical diameter of condyle, 4·5 in. Transverse diameter of foramen magnum, 3·5 in. Vertical diameter of foramen magnum, 3·1 in.

Plate XLVII.

Axes and other vertebræ of Proboscidea.

Figs. 1 and 1 *a*.—Axis.

Length of body inferiorly, including the odontoid, 6·0 in. Breadth of body posteriorly, 6·5 in. Height of the posterior surface of body, 5·1 in. Height of spinal canal, 2·6 in. Breadth of spinal canal, 2·2 in. Height of upper surface of spine from inferior surface of the body, posteriorly, 10·6 in. Antero-posterior diameter of spinal platform, 4·5 in.

Figs. 2 and 2 *a*.—Axis.

Length of body inferiorly, including the odontoid, 7·4 in. Breadth of body posteriorly, 6·8 in. Height of posterior surface of body, 6·3 in. Height of spinal canal, 2·8 in. Breadth of spinal canal, 2·8 in. Height of upper surface of spine from inferior surface of the body posteriorly, 13·5 in. Antero-posterior diameter of spinal platform, 5·3 in. Between extreme points of transverse processes, 12· in.

Figs. 3 and 3 *a*.—Axis.

Length of body, 4·6 in. Breadth of body posteriorly, 4·5 in. Height of body, 4·5 in.

Figs. 4 and 4 *a*.—Axis.

Length of body, 6·8 in. Breadth of body posteriorly, 6·3 in. Height of body, 5·7 in.

Figs. 5 and 5 *a*.—Axis.

Length of body, 6·4 in. Breadth of body posteriorly, 5·5 in. Height of body, 5·3 in.

Figs. 6 and 6 *a*.—Axis.

Length of body, 4·0 in. Breadth of body posteriorly, 4·4 in. Height of body, 3·6 in.

Figs. 7 and 7 *a*.—Axis.

Length of body, 6·3 in. Breadth of body posteriorly, 7·0 in. Height of body, 6·0 in.

Figs. 8 and 8 *a*.—Axis.

Length of body, 5·6 in. Breadth of body posteriorly, 6·4 in. Height of body, 5·5 in.

Figs. 9 and 9 *a*.—Axis.

Length of body, 6·0 in. Breadth of body posteriorly, 6.3 in.

Fig. 10.—Eight vertebræ conjoined. They are the posterior cervical and anterior dorsal.

Fig. 11.—Fragment of dorsal vertebra.

Height of posterior surface of body, 5·6 in. Breadth of posterior surface at inferior angles of costal pits, 5·6 in. Length of body inferiorly, 2·7 in.

Fig. 12.—Dorsal vertebra.

Between extreme points of transverse processes, 12·7 in. Height of body posteriorly, 5·5 in. Breadth of body posteriorly, 6·7 in. Length of body inferiorly, 2·8 in.

Fig. 13.—Dorsal vertebra.

Between extreme points of transverse processes, 13·2 in. Height of body posteriorly, 5·6 in. Breadth of body posteriorly, 6·2 in. Length of body inferiorly, 3·1 in.

Fig. 13 *a*.—Dorsal vertebra.

Between extreme points of transverse processes, 14· in. Height of body posteriorly, 6·7 in. Length of body inferiorly, 3·7 in.

Fig. 14.—Lumbar vertebra.

Height of body posteriorly, 5· in. Breadth of body posteriorly, 5·5 in. Length of body inferiorly, 3· in. Between extreme points of transverse processes, 8·5 in.

Fig. 15.—Lumbar vertebra.

Height of body posteriorly, 3·7 in. Breadth of body posteriorly, 4·2 in. Length of body inferiorly, 3·2 in. Between extreme points of transverse processes, 6·5 in.

Fig. 16.—Portion of sacrum, comprising three upper sacral vertebra and portion of a fourth.

Length of fragment, 13·3 in. Length of three upper sacral vertebræ, 10·2 in. Between extreme points of transverse processes, 10·4 in. Height of body (upper, right), 3·5 in. Transverse of body (upper), 6·1 in.

Plate XLVIII.

Bones of anterior extremity of Proboscidea.

Figs. 1, 1 *a*, and 1 *b*.—*Elephas Namadicus*, from the Nerbudda. Upper end of shaft, and articulating extremity of left humerus.

Length of fragment, 29·6 in. Transverse diameter of upper extremity, 14·4 in. Antero-posterior diameter of great tuberosity, 12·2 in. Antero-posterior diameter of head (articular surface), 11·8 in. Transverse diameter, 8· in. Smallest transverse diameter of shaft in centre, 10·3 in. Smallest antero-posterior diameter of shaft, in centre, 3·7 in.

Figs. 2, 2 *a*, and 2 *b*.—*E. Namadicus*. Fragment of shaft and upper articulating extremity of united radius and ulna, left side. Specimen formerly in United Service Museum.

Extreme length, 40· in. Extreme width below sigmoid cavity in fig. 2 *a*, 10· in. Depth from upper and back part of olecranon to anterior angle of sigmoid cavity, fig. 2 *b*, 14·5 in.

Figs. 3, 3 *a*, and 3 *b*.—Fragment of shaft and upper end of left humerus of a Proboscidean.

Length of fragment, 18·8 in. Transverse diameter of upper extremity, 12·2 in. Antero-posterior diameter of great tuberosity, 11· in.

Fig. 4.—Upper articulating end of left humerus.

Length, 13·5 in. Transverse diameter, 10·5 in. Antero-posterior diameter of great tuberosity, 11· in.

Fig. 5.—Upper articulating end of left humerus.

Length of fragment, 18·2 in. Transverse diameter of upper end, 13· in. Antero-posterior diameter of great tuberosity, 10·5 in. Antero-posterior diameter of articular surface of head, 9·8 in. Transverse diameter of articular surface of head, 6·4 in.

Fig. 6.—Upper articulating end of left humerus.

Length. 13· in. Transverse diameter of upper end, 12· in. Antero-posterior diameter of great tuberosity, 10·5 in.

Fig. 7.—Upper articulating end of right humerus.

Length, 15· in. Transverse diameter of upper end, 12·7 in. Antero-posterior diameter of articular surface, 9·2 in. Transverse diameter of articular surface, 7·5 in.

Fig. 8.—Upper articulating end of left humerus.

Length, 11·6 in. Transverse diameter of upper end, 9· in. Antero-posterior diameter of great tuberosity, 8·5 in.

Fig. 9.—Upper articulating end of right humerus.

Length, 9·5 in. Transverse diameter of upper end, 9·5 in. Antero-posterior diameter of great tuberosity, 9·5 in. Antero-posterior diameter of articular surface, 7·9 in. Transverse diameter of articular surface, 6·2 in.

Fig. 10.—Upper articulating end of left humerus.

Length, 11·4 in. Transverse diameter of upper end, 9·4 in. Antero-posterior diameter of great tuberosity, 7·7 in. Antero-posterior diameter of articular surface, 6·8 in. Transverse diameter of articular surface, 5·5 in.

Figs. 11, 11 *a*, and 11 *b*.—Lower end of shaft and articular surface of left humerus.

Length of fragment, 21·5 in. Breadth of inferior extremity, including external condyloid ridge, 11· in. Breadth of trochlear surface, 9·5 in. Smallest antero-posterior diameter of trochlear surface, 4·4 in. Circumference at broken extremity, 18·7 in.

Figs. 12, 12 *a*, and 12 *b*.—Lower end of shaft and articular surface of left humerus.

Length, 14·3 in. Breadth of inferior extremity, including external condyloid ridge, 10·2 in. Breadth of trochlear surface, 8·6 in. Smallest antero-posterior diameter of trochlear surface, 4·1 in.

Figs. 13, 13 *a*, and 13 *b*.—Lower end of shaft and articular surface of right humerus.

Length. 17·3 in. Breadth of inferior extremity, including external condyloid ridge, 12· in. Breadth of trochlear surface, 9·3 in. Smallest antero-posterior diameter of trochlear surface, 4·7 in.

Figs. 14, 14 *a*, and 14 *b*.—Lower end of shaft and articular surface of left humerus.

Length, 14· in. Breadth of inferior extremity, including external condyloid ridge, 14·7 in. Breadth of trochlear surface, 11·9 in. Smallest antero-posterior diameter of trochlear surface, 4·4 in.

Fig. 15.—Lower articulating end of left humerus.

Breadth of inferior extremity, including external condyloid ridge, 13· in. Breadth of trochlear surface, 10· in. Smallest antero-posterior diameter of trochlear surface, 4·5 in.

Fig. 16.—Lower articulating end of left humerus.

Breadth of inferior extremity, including external condyloid ridge, 9· in. Breadth of trochlear surface, 7·3 in. Smallest antero-posterior diameter of trochlear surface, 3·3 in.

Fig. 17.—Lower articulating end of right humerus.

Length, 13·5 in. Breadth of inferior extremity, including external condyloid ridge, 11· in. Breadth of trochlear surface, 9·8 in. Smallest antero-posterior diameter of trochlear surface, 5· in.

Fig. 18.—Lower articulating end of left humerus.

Breadth of inferior extremity, including external condyloid ridge, 9·7 in.

Breadth of trochlear surface, 8·5 in. Smallest antero-posterior diameter of trochlear surface, 3·5 in.

Fig. 19.—Lower articulating end of right humerus.

Length, 15· in. Breadth of inferior extremity, including external condyloid ridge, 12·4 in. Breadth of trochlear surface, 9·7 in. Smallest antero-posterior diameter of trochlear surface, 4· in.

Fig. 20.—Lower articulating end of right humerus.

Breadth of inferior extremity, including external condyloid ridge, 12· in. Breadth of trochlear surface, 9·6 in. Smallest antero-posterior diameter of trochlear surface, 4·7 in.

Fig. 21.—Lower articulating end of right humerus.

Length, 15·7 in. Breadth of inferior extremity, including external condyloid ridge, 12·4 in. Breadth of trochlear surface, 10·1 in. Smallest antero-posterior diameter of trochlear surface, 4·3 in.

Figs. 22, 22 *a*, and 22 *b*.—Upper end of shaft and articular surface of united radius and ulna, left side.

Length, 22·4 in. Width of upper end or head (fig. 22 *a*), 7·4 in. Depth (fig. 22 *b*), 10·5 in.

Figs. 23 and 23 *b*.—Upper end of shaft and articular surface of united radius and ulna, right side.

Length, 17· in. Width of upper end or head, 7·5 in. Depth (*b*), 12·2 in.

Fig. 24.—Upper articular surface of radius and ulna, right side.

Width of upper end or head, 9·6 in. Depth, 12·7 in.

Fig. 25.—Upper articular surface of radius and ulna, left side.

Width of upper end or head, 7· in. Depth, 10·8 in.

Fig. 26.—Upper articular surface of radius and ulna, left side.

Width, 7·8 in. Depth, 10·2 in.

Fig. 27.—Upper articular surface of radius and ulna, left side.

Width, 6·8 in. Depth, 10· in.

Fig. 28.—Upper articular surface of radius and ulna, left side.

Depth to internal angle of ulna, 10·7 in.

Figs. 29 and 29 *a*.—Upper articular surface of radius and ulna, right side.

Length, 12·5 in. Depth to internal angle of ulna, 11·3 in.

Plate XLIX.

Bones of anterior extremity of Proboscidea.

Fig. 1.—Fragment of right scapula, showing spine, glenoid cavity, &c.

Length of fragment, 22·7 in. Breadth of fragment (greatest), 13· in. Greatest height of spine above infra-spinous fossa, 7·2 in. Greatest diameter of glenoid cavity, 7·5 in. Lesser diameter of glenoid cavity, 5· in.

Figs. 2 and 2 *a*.—Fragment of right scapula, showing spine and glenoid cavity.

Length of scapula, 31· in. Breadth of fragment, 11·2 in. Height of spine, 7·5 in.

Fig. 3.—Fragment of right scapula, including glenoid cavity.

Length of fragment, 14· in. Greatest diameter of glenoid cavity, 6·6 in. Lesser diameter of glenoid cavity, 3·6 in

Figs. 4 and 4 *b*.—Fragment of right scapula, including glenoid cavity.

Length of fragment, 14·8 in. Greatest diameter of glenoid cavity, 9·4 in. Lesser diameter of glenoid cavity, 5·5 in.

Figs. 5, 5 *a*, and 5 *b*.—Upper end of shaft and articular head of right humerus.

Extreme length, 22· in. Transverse diameter of upper extremity, 9·7 in. Antero-posterior of great tuberosity, 8·5 in. Antero-posterior of articular surface of head, 7·3 in. Transverse surface of head, 4·2 in. Smallest transverse diameter of shaft, 4·7 in. Smallest antero-posterior diameter of shaft, 3·2 in.

Figs. 6, 6 *a*, and 6 *b*.—Lower end of shaft and articular surface of left humerus.

Length, 17·6 in. Breadth of inferior extremity, including condyloid ridge, 12· in. Transverse diameter of trochlea, 9 3 in. Smallest antero-posterior diam. of trochlea, 4·2 in.

Figs. 7, 7 *a*, and 7 *b*.—Lower end of shaft and articular surface of left humerus.

Length, 14· in. Breadth of inferior extremity, including condyloid ridge, 10· in. Transverse diameter of trochlea, 8·6 in. Smallest antero-posterior diameter of trochlea, 4·3 in.

Figs. 8, 8 *a*, and 8 *b*.—Upper articulating extremity of left radius and ulna.

Length, 19·2 in. Breadth of sigmoid cavity, 9·7 in. Depth or greatest oblique diameter from before backwards (*a*), 12·9 in.

Fig. 9.—Lower end of right radius and ulna.

Length, 14· in. Width of united extremities, 11· in. Width of ulna, 7·3 in.

Figs. 10 and 10 *a*.—Lower end of left radius and ulna.

Length, 12·5 in. Width of united extremities, 11·4 in. Width of ulna, 6·2 in. Width of radius, 4·6 in.

Figs. 11 and 11 *a*.—Lower end of right radius and ulna. This specimen is from Perim Island.

Extreme length, 14·2 in. Width of conjoined ends, 10· in. Width of ulna, 4·5 in. Width of radius, 6· in.

Figs. 12 and 12 *a*.—Lower end of right radius and ulna.

Length, 10·4 in. Breadth of inferior extremity, 6·3 in.

Figs. 13 and 13 *a*.—Lower end of left ulna.

Length, 13·5 in. Breadth of inferior extremity, 5·9 in. Antero-posterior diameter of inferior extremity, 5·3 in.

Figs. 14 and 14 *a*.—Lower end of right ulna.

Length, 8·5 in. Breadth of inferior end, 6·4 in. Antero-posterior diameter of inferior end, 5·6 in.

Fig. 15.—Lower end of right radius and ulna. The radius is to right of figure.

Length, 12·2 in. Breadth of conjoined extremities, 10·5 in.

Fig. 16.—Lower end of right radius and ulna.

Breadth of conjoined extremities, 9·4 in. Breadth of ulna, 5·5 in. Breadth of radius, 4·3 in.

Fig. 17.—Lower end of right ulna.

Breadth, 5·3 in.

Fig. 18.—Lower end of right ulna.

Breadth, 6·2 in.

Fig. 19.—Lower end of right radius.
Length, 11·8 in. Breadth of inferior extremity, 6·4 in.

Fig. 20.—Lower end of left radius.
Breadth, 4·2 in. Antero-posterior diameter, 5·8 in.

Fig. 21.—Lower end of right radius.
Breadth, 5·5 in.

Fig. 22.—Lower end of left ulna.
Breadth, 5·6 in.

Fig. 23.—Lower end of right radius.
Breadth, 3·9 in.

Fig. 24.—Lower end of right radius.
Breadth of inferior extremity, 4·3 in. Extreme length, 8·8 in. Antero-posterior diameter of inferior extremity, 5·2 in.

Fig. 25.—Lower end of left ulna.
Length, 10·5 in. Breadth of inferior extremity, 5·8 in. Antero-posterior diam. of inferior extremity, 5·4 in.

Fig. 26.—Lower end of left radius.
Breadth, 3·4 in.

Fig. 27.—Lower end of left radius.
Length, 17·7 in. Breadth of inferior extremity, 4· in.

Fig. 28.—Lower end of left radius.
Breadth, 4·8 in.

Fig. 29.—Lower end of left ulna.
Breadth of inferior extremity, 5·3 in. Antero-posterior of inferior extremity, 4·3 in.

Fig. 30.—Lower end of left ulna.
Breadth, 4·8 in.

Fig. 31.—Lower end of left ulna.
Breadth, 5·5 in. Antero-posterior diameter, 5·5 in.

Fig. 32.—Lower end of right ulna.
Breadth, 4· in.

Fig. 33.—Lower end of left ulna.
Breadth, 7·1 in. Antero-posterior diameter, 4·4 in.

Fig. 34.—Lower end of right ulna.
Breadth, 7· in. Antero-posterior diameter, 6· in.

Fig. 35.—Lower end of left ulna.
Breadth, 7·1 in. Antero-posterior diameter, 6·4 in.

Fig. 36.—Lower end of right ulna.
Breadth, 7·4 in. Antero-posterior diameter, 6·8 in.

Plate L.

Bones of anterior extremity of Proboscidea.

Fig. 1.—Lower end of right radius and ulna, with bones of carpus (semilunar, trapezoid, os magnum and unciform) and metacarpus (second, third, and fourth).
Length of fragment of ulna, 10·9 in. Length of fragment of radius, 9·2 in. Breadth of semilunar, 4·7 in. Vertical diameter of semilunar in centre, 2·5 in. Vertical diameter of trapezoid, 2·6 in. Transverse diameter of trapezoid, 3·2 in. Transverse diameter of os magnum, 3· in. Vertical diameter of os magnum, 2·9 in.

Transverse diameter of unciform, 4· in. Vertical diameter of unciform, 3· in. Length of second metacarpal, 4·5 in. Breadth of second metacarpal, 2·5 in. Length of third metacarpal, 4·2 in. Breadth of third metacarpal, 3·3 in. Length of fourth metacarpal, 2·5 in. Breadth of fourth metacarpal, 2·5 in. Breadth of inferior extremity of radius, 4·8 in. Breadth of inferior extremity of ulna, 7· in.

Figs. 2, 2 *a*, and 2 *b*.—Lower end of left ulna (*a*), with bones of carpus (scaphoid (1), semilunar (2), cuneiform (3), pisiform (4), trapezium (5), trapezoid (6), os magnum (7), and unciform (8)), and middle metacarpal (9).

Breadth of lower extremity of ulna, 5·5 in. Vertical diameter of scaphoid, 5·1 in. Antero-posterior diameter of scaphoid, 3·9 in. Transverse diameter of scaphoid, 2·1 in. Vertical diameter of semilunar, 2·9 in. Antero-posterior diameter of semilunar, 5·2 in. Transverse diameter of semilunar, 5·6 in. Vertical diameter of cuneiform, 2·8 in. Antero-posterior diameter of cuneiform, 4·7 in. Transverse diameter of cuneiform, 7· in. Vertical diameter of pisiform, 5·3 in. Transverse diameter of pisiform, 3·4 in. Antero-posterior diameter of pisiform, 2·1 in. Vertical diameter of trapezium, 3·7 in. Transverse diameter of trapezium, 4·6 in. Antero-posterior diameter of trapezium, 3·3 in. Vertical diameter of trapezoid, 2·3 in. Transverse diameter of trapezoid, 3·3 in. Antero-posterior diameter of trapezoid, 3·5 in. Vertical diameter of os magnum, 3·1 in. Transverse diameter of os magnum, 3·2 in. Antero-posterior diameter of os magnum, 4·8 in. Vertical diameter of unciform, 3·3 in. Transverse diameter of unciform, 5· in. Antero-posterior diameter of unciform, 4·3 in. Transverse diameter of medius metacarpal, 2·7 in. Antero-posterior diameter of medius metacarpal, 4· in.

Figs. 3 and 3 *a*.—Right scaphoid.

Figs. 4 and 4 *a*.—Left scaphoid.

Length, 5·6 in. Breadth, 3·8 in. Thickness, 2·6 in.

Figs. 5 and 5 *a*.—Left scaphoid.

Length, 4·9 in. Breadth, 4·1 in. Thickness, 2·3 in.

Figs. 6, 6 *a*, and 6 *b*.—Right semilunar.

Height, 2·8 in. Breadth, 5·3 in. Antero-posterior diameter, 5· in.

Figs. 7, 7 *a*, and 7 *b*.—Left semilunar.

Height, 2·8 in. Breadth, 4·2 in. Antero-posterior diameter, 4·6 in.

Figs. 8, 8 *a*, and 8 *b*.—Right semilunar.

Height, 2·5 in. Breadth, 4·4 in. Antero-posterior diameter, 4·5 in.

Figs. 9, 9 *a*, and 9 *b*.—Right semilunar.

Height, 2·7 in. Breadth, 4·4 in. Antero-posterior diameter, 4·5 in.

Figs. 10, 10 *a*, and 10 *b*.—Right semilunar.

Height, 3· in. Breadth, 5·4 in. Antero-posterior diameter, 5·8 in.

Figs. 11, 11 *a*, and 11 *b*.—Right semilunar.

Height, 2·7 in. Breadth, 4·4 in. Antero-posterior diameter, 4·8 in.

Figs. 12, 12 *a*, and 12 *b*.—Left semilunar.

Height, 2·7 in. Breadth, 4·6 in. Antero-posterior diameter, 4·2 in.

Figs. 13, 13 *a*, and 13 *b*.—Right semilunar.

Height, 3· in. Breadth, 5·5 in. Antero-posterior diameter, 5· in.

Figs. 14, 14 *a*, and 14 *b*.—Left semilunar.

Height, 2·2 in. Breadth, 4·3 in. Antero-posterior diameter, 4·2 in.

Figs. 15, 15 *a*, and 15 *b*.—Right semilunar.

Height, 2·6 in. Breadth, 4·8 in. Antero-posterior diameter, 5·1 in.

Figs. 16, 16 *a*, and 16 *b*.—Right cuneiform.

Height, 2·1 in. Transverse diameter, 5·3 in. Antero-posterior diameter, 4·3 in.

Figs. 17, 17 *a*, and 17 *b*.—Right cuneiform.
Height, 1·7 in. Transverse diameter, 4·8 in. Antero-posterior diameter, 3·3 in.

Figs. 18, 18 *a*, and 18 *b*.—Right cuneiform.
Height, 2·6 in. Transverse diameter, 5·8 in. Antero-posterior diameter, 4·4 in.

Figs. 19, 19 *a*, and 19 *b*.—Right cuneiform.
Height, 2·8 in. Transverse diameter, 6·4 in. Antero-posterior diameter, 4·4 in.

Figs. 20, 20 *a*, and 20 *b*.—Right cuneiform.

Figs. 21, 21 *a*, and 21 *b*.—Left cuneiform.
Height, 2·5 in. Transverse diameter, 5·2 in. Antero-posterior diameter, 4·3 in.

Figs. 22 and 22 *a*.—Left pisiform.
Height, 5·3 in. Breadth, 3·5 in. Thickness, 2·3 in.

Figs. 23 and 23 *a*.—Left pisiform.
Height, 5·1 in. Breadth, 2·8 in. Thickness, 2· in.

Figs. 24 and 24 *a*.—Left pisiform.
Height, 4·6 in. Breadth, 3· in. Thickness, 2· in.

Figs. 25 and 25 *a*.—'Figured by mistake. Ought to have been erased.'—[H.F.]

Figs. 26, 26 *a*, 26 *b*, and 26 *c*.—Left trapezoid.
Height, 2·5 in. Breadth, 3· in. Antero-posterior diameter, 4·1 in.

Figs. 27, 27 *a*, 27 *b*, and 27 *c*.—Right trapezoid.
Height, 2·5 in. Breadth, 3·2 in. Antero-posterior diameter, 4·3 in.

Plate LI.

Bones of anterior extremity of Proboscidea.

Figs. 1, 1 *a*, 1 *b*, 1 *c*, and 1 *d*.—Left os magnum.

Figs. 2, 2 *a*, 2 *b*, 2 *c*, and 2 *d*.—Left os magnum.
Antero-posterior diameter, 5·3 in. Transverse, 3·6 in. Vertical, 4·4 in.

Figs. 3, 3 *a*, 3 *b*, 3 *c*, and 3 *d*.—Left os magnum.
Antero-posterior diameter, 5·1 in. Transverse, 3·8 in. Vertical, 4·4 in.

Figs. 4, 4 *a*, 4 *b*, 4 *c*, and 4 *d*.—Left os magnum.
Antero-posterior diameter, 5·2 in. Transverse, 3·3 in. Vertical, 4·4 in.

Figs. 5, 5 *a*, 5 *b*, 5 *c*, and 5 *d*.—Right os magnum.
Antero-posterior diameter, 5·6 in. Transverse, 4·3 in.

Figs. 6, 6 *a*, 6 *b*, 6 *c*, and 6 *d*.—Left os magnum.
Antero-posterior diameter, 6·4 in. Transverse, 5·8 in. Vertical, 5·7 in.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—Right unciform.
Antero-posterior diameter, 4·7 in. Transverse, 4·4 in. Vertical, 4·7 in.

Figs. 8, 8 *a*, 8 *b*, and 8 *c*.—Left unciform.
Antero-posterior diameter, 5·6 in. Transverse, 5· in. Vertical, 5·1 in.

Figs. 9, 9 *a*, 9 *b*, and 9 *c*.—Left unciform.
Antero-posterior diameter, 5· in. Transverse, 4·6 in. Vertical, 3·8. in.

Figs. 10, 10 *a*, 10 *b*, and 10 *c*.—Right unciform.
Antero-posterior diameter, 5·2 in. Transverse, 5· in. Vertical, 4·7 in.

Figs. 11, 11 *a*, 11 *b*, and 11 *c*.—Left unciform.
Antero-posterior diameter, 4·7 in. Transverse, 4·5 in. Vertical, 4·2 in.

Figs. 12, 12 *a*, 12 *b*, and 12 *c*.—Left unciform.
Antero-posterior diameter, 4· in. Transverse, 3·6 in. Vertical, 3·5 in.

Figs. 13, 13 *a*, and 13 *b*.—Left pollex metacarpal.
Length, 5·2 in. Height of posterior surface, 3·8 in. Breadth ditto, 2·3 in.

Figs. 14, 14 *a*, and 14 *b*.—Right index metacarpal.
Length, 8·3 in. Breadth of posterior surface, 2·9 in.

Figs. 15, 15 *a*, and 15 *b*.—Left index metacarpal.
Length, 6·8 in. Height of posterior surface, 3·3 in. Breadth ditto, 2·5 in.

Figs. 16, 16 *a*, and 16 *b*.—Left index metacarpal.
Length, 6·9 in. Height of posterior surface, 4·3 in. Breadth ditto, 2·6 in.

Figs. 17, 17 *a*, and 17 *b*.—Right medius metacarpal.
Length, 7·8 in. Height of posterior surface, 4· in. Breadth ditto, 2·8 in.

Figs. 18, 18 *a*, and 18 *b*.—Right medius metacarpal.
Length, 8·5 in. Height of posterior surface, 4·9 in. Breadth of ditto, 3·8 in.

Figs. 19, 19 *a*, and 19 *b*.—Right medius metacarpal.
Length, 8·6 in. Height of posterior surface, 4·8 in. Breadth of ditto, 3·4 in.

Figs. 20, 20 *a*, and 20 *b*.—Right medius metacarpal.
Length, 10· in. Height of posterior surface, 5· in. Breadth of ditto, 4·5 in.

Figs. 21, 21 *a*, and 21 *b*.—Left annular metacarpal.
Length, 7·1 in. Height of posterior surface, 3·9 in. Breadth of ditto, 3·4 in.

Figs. 22, 22 *a*, and 22 *b*.—Left annular metacarpal.
Length, 8· in. Height of posterior surface, 3·8 in. Breadth of ditto, 3·5 in.

Figs. 23, 23 *a*, and 23 *b*.—Left annular metacarpal.
Length, 7·3 in. Height of posterior surface, 3·6 in. Breadth of ditto, 3· in.

Figs. 24, 24 *a*, and 24 *b*.—Right minimus metacarpal.
Length, 6· in. Height of posterior surface, 2·9 in. Breadth of ditto, 2·6 in.

Figs. 25, 25 *a*, and 25 *b*.—Right minimus metacarpal.
Length, 7·4 in. Height of posterior surface, 4·1 in. Breadth of ditto, 4·4 in.

Figs. 26, 26 *a*, and 26 *b*.—Left minimus metacarpal.
Length, 7·3 in. Height of posterior surface, 3·6 in. Breadth of ditto, 3·7 in.

Figs. 27, 27 *a*, and 27 *b*.—Right medius first phalanx.
Length, 4·3 in. Height of posterior surface, 2·6 in. Breadth of ditto, 3·9 in.

Figs. 28, 28 *a*, and 28 *b*.—Left annular first phalanx.
Length, 4· in. Height of posterior surface, 2·6 in. Breadth of ditto, 3·6 in.

Figs. 29, 29 *a*, and 29 *b*.—Right medius metacarpal.
Length, 3·7 in. Height of posterior surface, 2·3 in. Breadth of ditto, 3·3 in.

Figs. 30, 30 *a*, and 30 *b*.—Left medius metacarpal.
Length, 2·7 in. Height of posterior surface, 1·8 in. Breadth of ditto, 2·6 in.

Plate LII.

Bones of posterior extremity of Proboscidea.

Fig. 1.—Head, neck, and great trochanter of left femur.
Length of fragment, 20· in. Breadth of upper extremity, including great trochanter, 15·7 in. Antero-posterior diameter of head, 7·5 in. Transverse diameter of broken extremity, 7·5 in. Antero-posterior diameter of broken extremity, 3·6 in.

Fig. 2.—Head, neck, and great trochanter of right femur.

Length, 17·5 in. Breadth of upper end, 15· in. Antero-posterior diameter of head, 7· in.

Fig. 3.—Head, neck, and upper part of shaft of right femur.

Length, 17· in. Breadth of upper end, 12· in. Antero-posterior diameter of head, 6· in.

Fig. 4.—Head, neck, and upper part of shaft of right femur.

Length, 18·3 in. Breadth of upper end, 13· in. Antero-posterior diameter of head, 6·6 in.

Fig. 5.—Head, neck, and upper part of shaft of left femur.

Length, 15· in. Breadth of upper end, 11·3 in. Antero-posterior diameter of head (imperfect), 6· in.

Fig. 6.—Head, neck, and upper part of shaft of right femur.

Length, 14·3 in. Breadth of upper end, 14·7 in. Antero-posterior diameter of head, 6·4 in.

Fig. 7.—Head, neck, and upper part of shaft of right femur.

Length, 18· in. Breadth of upper end, 12· in. Antero-posterior diameter of head, 6·4 in.

Fig. 8.—Head, neck, and great trochanter of left femur.

Length, 13· in. Breadth of upper end, 15· in. Antero-posterior diameter of head, 7·2 in.

Figs. 9, 9 *a*, 9 *b*, and 9 *c*.—Lower end of right femur with articulating surface.

Length, 17·6 in. Transverse diameter of lower end, 9· in. Antero-posterior diameter internally, 8·5 in. Ditto, externally, 8·5 in.

Figs. 10, 10 *a*, 10 *b*, and 10 *c*.—Lower end of right femur with articulating surface.

Length, 21·4 in. Transverse diameter of lower end, 8·3 in. Antero-posterior diameter internally, 8·6 in. Circumference at fractured end, 13·7 in.

Figs. 11, 11 *a*, 11 *b*, and 11 *c*.—Lower end of right femur with articulating surface.

Length, 13· in. Transverse diameter of lower end, 9·4 in.

Figs. 12, 12 *a*, 12 *b*, and 12 *c*.—Lower end of left femur with articulating surface.

Length, 13·7 in. Transverse diameter of lower end, 9·2 in. Antero-posterior diameter internally, 9·6 in. Ditto, externally, 8·5 in. Transverse diameter of rotular surface, 4·2 in. Height in centre of ditto, 4·1 in.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—Lower end of right femur with articulating surface.

Length, 11·5 in. Transverse diameter of lower end, 7·9 in. Antero-posterior diameter externally, 7·1 in. Transverse diameter of rotular surface, 3·7 in. Height in centre of rotular surface, 3·6 in.

Figs. 14, 14 *a*, and 14 *b*.—Lower end of left femur, with articulating surface.

Length, 14· in. Transverse diameter of lower end, 7·7 in.

Fig. 15.—Lower end of right femur with articulating surface.

Length, 17· in. Transverse diameter of lower end, 9·6 in. Antero-posterior diameter internally, 10·4 in.

Fig. 16.—Lower end of left femur with articulating surface.

Length, 8·6 in. Transverse diameter of lower end, 8·3 in. Antero-posterior diameter internally, 7·8 in. Ditto, externally, 7·1 in. Transverse diameter of rotular surface, 3·8 in. Height in centre of rotular surface, 3·8 in.

Fig. 17.—Lower epiphysis of left femur.

Transverse diameter, 8· in. Transverse diameter of rotular surface, 3·7 in. Vertical diameter of rotular surface in centre, 3·8 in.

Fig. 18.—Lower articulating surface of right femur.

Length, 9·3 in. Transverse diameter, 8·2 in. Antero-posterior diameter internally, 9·8 in. Antero-posterior diameter externally, 8·4 in. Transverse diameter of rotular surface, 3·8 in. Vertical diameter of rotular surface in centre, 4·1 in.

Fig. 19.—Lower articulating surface of right femur.

Length, 13· in. Transverse diameter of lower end, 9· in. Antero-posterior diameter, externally, 8· in.

Fig. 20.—Lower end of left femur.

Length, 11· in. Transverse diameter of lower end, 7· in. Antero-posterior diameter internally, 7·1 in. Antero-posterior diameter externally, 6·4 in. Transverse diameter of rotular surface, 3·1 in. Vertical diameter of rotular surface in centre, 3·8 in.

Fig. 21.—Lower end of left femur.

Transverse diameter, 8·7 in. Antero-posterior diameter internally, 8·7 in. Antero-posterior diameter externally, 7·9 in. Transverse diameter of rotular surface, 4·1 in. Vertical diameter of rotular surface in centre, 4·1 in.

Fig. 22.—Lower end of right femur.

Length, 15·4 in. Transverse diameter of lower end, 10·3 in.

Fig. 23.—Lower end of right femur.

Length, 11·5 in. Transverse diameter of lower end, 9·2 in Antero-posterior diameter internally, 9·4 in. Antero-posterior diameter externally, 8·3 in. Transverse diameter of rotular surface, 4· in. Vertical diameter of rotular surface, 4·6 in.

Fig. 24.—Lower end of right femur.

Length, 10·8 in. Transverse diameter of lower end, 8·1 in. Antero-posterior diameter internally, 8·3 in. Antero-posterior diameter externally, 7·5 in. Transverse diameter of rotular surface, 4·2 in. Vertical diameter of rotular surface, 4·1 in.

Fig 25.—Lower end of right femur.

Length, 11· in. Transverse diameter of lower end, 8· in. Antero-posterior diameter internally, 8·3 in. Antero-posterior diameter externally, 7·6 in. Height of rotular surface, 3·7 in.

Fig. 26.—Lower end of right femur.

Transverse diameter of lower end, 9·5 in. Antero-posterior diameter internally, 9·8 in. Ditto, externally, 8·7 in.

Fig. 27.—Lower end of left femur.

Length, 11·2 in. Transverse diameter of lower end, 10· in. Antero-posterior diameter internally, 10·1 in. Ditto externally, 9· in. Transverse diameter of rotular surface, 5·1 in. Vertical diameter of rotular surface, 5· in.

Fig. 28.—Lower end of right femur.

Length, 13·5 in. Transverse diameter of lower end, 9·4 in. Antero-posterior diameter internally, 10·6 in. Ditto externally, 9·2 in.

Fig. 29.—Lower end of left femur.

Length, 11·4 in. Transverse diameter of lower end, 8·8 in. Antero-posterior diameter internally, 9·2 in. Ditto externally, 7·6 in. Transverse diameter of rotular surface, 3·7 in. Vertical diameter of rotular surface in centre, 4· in.

Fig. 30.—Lower end of left femur.

Length, 15· in. Transverse diameter of lower end, 7·5 in.

Plate LIII.

Bones of trunk and posterior extremity of Proboscidea.

Fig. 1.—Fragment of pelvis, right side, showing acetabulum.

Length of fragment, 19· in. Great diameter of acetabulum 7· in. Lesser ditto, 6·5 in.

Figs. 2 and 2 *a*.—Fragment of pelvis showing acetabulum.

Length of fragment, 17· in. Great diameter of acetabulum, 6· in.

Fig. 3.—Fragment of pelvis, showing acetabulum.

Length of fragment, 15· in. Great diameter of acetabulum, 7·6 in. Lesser ditto, 7·4 in.

Fig. 4.—Fragment of pelvis, showing acetabulum.

Length of fragment, 17· in. Great diameter of acetabulum, 8·2 in. Lesser ditto, 7·6 in.

Fig. 5.—Fragment of pelvis, showing acetabulum.

Length of fragment, 13·7 in. Great diameter of acetabulum, 6· in. Lesser ditto, 5·4 in.

Fig. 6.—Fragment of pelvis, showing acetabulum.

Length, 14· in. Great diameter of acetabulum, 7· in. Lesser ditto, 6·8 in.

Fig. 7.—Fragment of pelvis, showing acetabulum.

Length, 16·2 in. Great diameter of acetabulum, 7·5 in. Lesser ditto, 7· in.

Fig. 8.—Fragment of pelvis, showing acetabulum.

Length, 13· in. Great diameter of acetabulum, 7·3 in. Lesser ditto, 6·9 in.

Fig. 9.—Head, neck, and upper part of shaft of right femur.

Length of fragment, 35·5 in. Breadth of upper extremity, including great trochanter, 13· in. Antero-posterior diameter of articular surface, 7·1 in. Smallest transverse diameter, 5·6 in. Antero-posterior diameter of shaft, 3·5 in.

Figs. 10 and 10 *a*.—Head of femur.

Greater diameter, 8·5 in. Lesser ditto, 7·8 in.

Figs. 11 and 11 *a*.—Lower end of right femur and articular surface of *Elephas primigenius*.

Length of fragment (longer than the figure), 34· in. Breadth of lower end, 7·2 in. Antero-posterior diameter internally, 7·9 in. Ditto externally, 6·6 in. Height of rotular surface in centre, 3·2 in. Breadth of ditto, 3·1 in.

Figs. 12 and 12 *a*.—Lower articulating end of right femur.

Breadth of lower extremity, 10·7 in.

Fig. 13.—Lower end of right femur of *Elephas antiquus*, from Walton in Essex.

Breadth, 10· in. Antero-posterior diameter internally, 9·5 in. Ditto externally, 8·8 in. Height of rotular surface in centre, 4·1 in. Breadth of ditto, 4·5 in.

Figs. 14 and 14 *a*.—Upper end of left tibia.

Length of fragment, 10·7 in. Transverse diameter of upper end, 9·5 in. Greatest antero-posterior diameter of ditto, 5·6 in.

Figs. 15 and 15 *a*.—Upper end of right tibia.

Length, 13·5 in. Transverse diameter of upper end, 9·7 in. Greatest antero-posterior diameter of ditto, 7·3 in.

Figs. 16 and 16 *a*.—Upper end of right tibia.

Length, 15 6 in. Transverse diameter of upper extremity (imperfect), 9·3 in. Greatest antero-posterior diameter of ditto, 7· in.

Figs. 17 and 17 *a*.—Upper end of right tibia.

Length, 12·7 in. Transverse diameter of upper extremity, 8·2 in.

Fig. 18.—Upper articulating surface of right tibia.

Transverse diameter, 9·7 in. Greatest antero-posterior diameter, 7·3 in.

Fig. 19.—Upper articulating surface of right tibia.

Transverse diameter, 9·6 in. Greatest antero-posterior ditto, 6·8 in.

Fig. 20.—Upper articulating surface of right tibia.

Transverse diameter, 6·8 in. Greatest antero-posterior ditto, 5· in.

Fig. 21.—Upper articulating surface of right tibia.

Transverse diameter, 7·4 in. Greatest antero-posterior ditto, 5·2 in.

Fig. 22.—Upper articulating surface of right tibia.

Transverse diameter, 7·3 in. Greatest antero-posterior ditto, 5·7 in.

Fig. 23.—Upper articulating surface of left tibia.

Transverse diameter, 8· in. Greatest antero-posterior ditto, 6·5 in.

Fig. 24.—Upper articulating surface of right tibia.

Transverse diameter, 7·8 in. Greatest antero-posterior ditto, 6· in.

Fig. 25.—Upper articulating surface of left tibia.

Transverse diameter, 8· in. Greatest antero-posterior ditto, 5·5 in.

Fig. 26.—Upper articulating surface of left tibia.

Transverse diameter, 10· in. Greatest antero-posterior ditto, 7·2 in.

Figs. 27 and 27 *a*.—Upper end of left tibia.

Length, 9·6 in. Transverse diameter of upper surface, 9·4 in. Greatest antero-posterior diameter of ditto, 7· in.

Fig. 28.—Upper articulating surface of right tibia.

Transverse diameter, 7·4 in. Greatest antero-posterior diameter, 6· in.

Fig. 29.—Upper articulating surface of left tibia.

Transverse diameter, 8·7 in. Greatest antero-posterior diameter, 5·6 in.

Fig. 30.—Upper articulating surface of left tibia.

Transverse diameter, 10· in. Greatest antero-posterior diameter, 6·5 in.

Fig. 31.—Lower articulating surface of left tibia.

Transverse diameter, 8·7 in. Greatest antero-posterior diameter, 6·7 in.

Figs. 32 and 32 *a*.—Lower end of left tibia.

Length of fragment, 9·5 in. Transverse diameter of lower end, 6·9 in. Antero-posterior diameter of ditto, 5·3 in.

Figs. 33 and 33 *a*.—Lower end of right tibia.

Length, 7·7 in. Transverse diameter of lower end, 7·7 in. Antero-posterior diameter of ditto, 6·1 in.

Figs. 34 and 34 *a*.—Lower end of left tibia.

Length, 10·7 in. Transverse diameter of lower end, 6·5 in. Antero-posterior diameter of ditto, 4·8 in.

Figs. 35 and 35 *a*.—Lower end of right tibia.

Length, 7·5 in. Transverse diameter of lower end, 7·7 in. Antero-posterior diameter of ditto, 6· in.

Figs. 36 and 36 *a*.—Lower end of right tibia.

Length, 10·7 in. Transverse diameter of lower end, 5·6 in. Antero-posterior diameter of ditto, 4· in.

Fig. 37.—Lower articulating surface of right tibia.

Transverse diameter, 7·3 in. Antero-posterior diameter, 5·4 in.

Fig. 38.—Lower articulating surface of right tibia.

Transverse diameter, 6·1 in. Antero-posterior diameter, 5·3 in.

Fig. 39.—Lower articulating surface of left tibia.

Transverse diameter, 6·4 in. Antero-posterior diameter, 4·5 in.

Fig. 40.—Lower articulating surface of left tibia.

Transverse diameter, 6·2 in. Antero-posterior diameter, 5·4 in.

Fig. 41.—Lower articulating surface of right tibia.

Transverse diameter, 6·5 in. Antero-posterior diameter, 4·9 in.

Fig. 42.—Lower articulating surface of right tibia.

Transverse diameter, 7· in.

Plate LIV.

Bones of posterior extremity of Proboscidea.

Figs. 1, 1 *a*, and 1 *b*.—Right calcaneum.

Length, 11· in. Height of cuboid surface, 2·6 in. Breadth of ditto, 4·2 in.

Figs. 2, 2 *a*, and 2 *b*.—Left calcaneum.

Length, 10·1 in. Height of cuboid surface, 2·6 in. Projection of calcaneum, 5·2 in. Breadth of cuboid surface, 4·2 in. Length of fibular surface, 4·2 in. Breadth of ditto, 2·3 in.

Figs. 3, 3 *a*, and 3 *b*.—Left calcaneum.

Length, 9·8 in. Height of cuboid surface, 2·8 in. Breadth of ditto, 3·9 in. Projection of heel, 4·9 in.

Figs. 4, 4 *a*, and 4 *b*.—Right calcaneum.

Length, 9·5 in. Height of cuboid surface, 3·1 in. Breadth of ditto, 3·9 in. Projection of heel, 5·3 in.

Figs. 5, 5 *a*, and 5 *b*.—Right calcaneum.

Length, 8·8 in. Projection of heel, 5·5 in.

Figs. 6, 6 *a*, and 6 *b*.—Right calcaneum.

Length, 9· in. Height of cuboid surface, 2·7 in. Breadth of ditto, 3·5 in. Projection of heel, 5·5 in.

Figs. 7, 7 *a*, and 7 *b*.—Left calcaneum, imperfect.

Length of fragment, 8·1 in. Height of cuboid surface, 2·7 in. Breadth of ditto, 3·3 in.

Figs. 8, 8 *a*, and 8 *b*.—Left calcaneum.

Length, 7·6 in. Height of cuboid surface, 3·2 in. Breadth of ditto, 2·2 in. Projection of heel, 4·9 in.

Figs. 9, 9 *a*, and 9 *b*.—Right calcaneum.

Length, 7·7 in. Projection of heel, 4·8 in.

Figs. 10, 10 *a*, and 10 *b*.—Left calcaneum.

Length, 8·4 in. Height of cuboid surface, 2·1 in. Breadth of ditto, 3·2 in.

Figs. 11, 11 *a*, and 11 *b*.—Right calcaneum.

Length, 8·5 in. Height of cuboid surface, 2·5 in. Breadth of ditto, 3·4 in. Projection of heel, 4·7 in.

Figs. 12, 12 *a*, and 12 *b*.—Left calcaneum.

Length, 7·8 in. Projection of heel, 4·5 in.

Figs. 13, 13 *a*, and 13 *b*.—Right calcaneum.

Length, 8·7 in. Height of cuboid surface, 1·8 in. Breadth of ditto, 3·4 in. Projection of heel, 5·1 in.

Figs. 14, 14 *a*, and 14 *b*.—Left calcaneum.

Length, 8·1 in. Height of cuboid surface, 2·3 in. Breadth of ditto, 3·4 in. Projection of heel, 4·7 in.

Figs. 15, 15 *a*, and 15 *b*.—Right calcaneum.

Length, 8·3 in. Height of cuboid surface, 2·2 in. Breadth of ditto, 3·1 in. Projection of heel, 4·8 in.

Figs. 16, 16 *a*, and 16 *b*.—Right calcaneum of *Mastodon Ohioticus*, imperfect.

Length of fragment, 7 7 in. Height of cuboid surface, 3·1 in. Breadth of ditto, 3·6 in. Projection of heel, wanting epiphysis, 3·6 in. Length of fibular surface, 3·8 in. Breadth of ditto, 2·1 in.

Figs. 17, 17 *a*, and 17 *b*.—Right calcaneum of Dinotherium.

Length, 13· in. Projection of heel, 6·8 in. Length of fibular surface, 4·6 in. Breadth of ditto, 2·8 in.

Figs. 18 and 18 *a*.—Left astragalus.

Figs. 19 and 19 *a*.—Right astragalus.

Length, 6·3 in. Breadth, 7· in. Thickness, 4·4 in.

Figs. 20 and 20 *a*.—Left astragalus.

Length, 4·6 in. Breadth, 4·7 in. Thickness, 3·5 in.

Figs. 21 and 21 *a*.—Left astragalus.

Length, 4·4 in. Breadth, 4·7 in. Thickness, 2·8 in.

Figs. 22 and 22 *a*.—Left astragalus.

Length, 5·5 in. Breadth, 6·4 in. Thickness, 3·8 in.

Figs. 23 and 23 *a*.—Right astragalus.

Length, 5·5 in. Breadth, 6·4 in. Thickness, 4·4 in.

Figs. 24 and 24 *a*.—Left astragalus.

Length, 4·7 in. Breadth, 5·7 in. Thickness, 3·4 in.

Figs. 25 and 25 *a*.—Right astragalus.

Length, 5·2 in. Breadth, 5·4 in. Thickness, 3·6 in.

Figs. 26 and 26 *a*.—Right astragalus.

Length, 5· in. Breadth, 6·3 in. Thickness, 3·5 in.

Figs. 27 and 27 *a*.—Left astragalus.

Length, 5·3 in. Breadth, 6·3 in. Thickness, 4· in.

Figs. 28 and 28 *a*.—Right astragalus.

Length, 4·3 in. Breadth, 4·8 in. Thickness, 3· in.

Figs. 29 and 29 *a*.—Left astragalus.

Length, 5·1 in. Breadth, 5·5 in. Thickness, 3·5 in.

Figs. 30 and 30 *a*.—Right astragalus.
Length, 5·5 in. Breadth, 6·5 in. Thickness, 4· in.

Figs. 31 and 31 *a*.—Left astragalus.
Length, 5·3 in. Breadth, 6·4 in. Thickness, 4·1 in.

Plate LV.

Bones of posterior extremity of Proboscidea.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Left calcaneum.

Length, 9·5 in. Height of cuboid surface, 2·2 in. Breadth of cuboid surface, 4· in. Projection of heel (from posterior border of surface for astragalus to most projecting part of calcaneal tuberosity) oblique, 6·2 in. Projection direct, 3· in. Height from lower surface to astragalar surface (ext.), 6· 3 in. Breadth of fibular surface, 2·5 in. Length of fibular surface, 4·2 in. Length of astragalar surface, 4·7 in. Breadth of astragalar surface 2·7 in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—Left calcaneum of *Elephas antiquus*, from Grays in Essex.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Right calcaneum.

Length, 8· in. Height of cuboid surface, 2·2 in. Breadth of ditto, 3·4 in. Projection of heel (direct), 4·2 in. Height externally, 4·9 in.

Figs. 4 and 4 *a*.—Patella of *Elephas antiquus* from Grays in Essex.

Figs. 5 and 5 *a*.—Patella.
Length, 6·6 in. Breadth, 5·5 in. Thickness, 4·1 in.

Figs. 6 and 6 *a*.—Patella.
Length, 5· in. Breadth, 4·5 in. Thickness, 4· in.

Figs. 7 and 7 *a*.—Patella.
Length, 5·2 in. Breadth, 4·4 in. Thickness, 3·3 in.

Figs. 8 and 8 *a*.—Patella.
Length, 5·6 in. Breadth, 4·4 in. Thickness, 3·4 in.

Figs. 9 and 9 *a*.—Patella.
Length, 4·6 in. Breadth, 3·7 in. Thickness, 2·9 in.

Figs. 10, 10 *a*, and 10 *b*.—Left ecto-cuneiform bone.
Height, 4·3 in. Breadth, 4·5 in. Thickness, 2· in.

Figs. 11, 11 *a*, and 11 *b*.—Left ecto-cuneiform bone.
Height, 4·4 in. Breadth, 4·8 in. Thickness, 1·8 in.

Figs. 12, 12 *a*, and 12 *b*.—Left ecto-cuneiform bone.
Height, 4· in. Breadth, 3·8 in. Thickness, 1·9 in.

Figs. 13, 13 *a*, and 13 *b*.—Left ecto-cuneiform bone.
Height, 3·8 in. Breadth, 4·7 in. Thickness, 1·7 in.

Figs. 14, 14 *a*, and 14 *b*.—Right ecto-cuneiform bone.
Height, 3·9 in. Breadth, 4·4 in. Thickness, 2·1 in.

Figs. 15, 15 *a*, and 15 *b*.—Right ecto-cuneiform bone.
Height, 3·8 in. Breadth, 4·2 in. Thickness, 2·1 in.

Figs. 16, 16 *a*, and 16 *b*.—Right index metatarsal.
Length, 5·1 in. Height of posterior surface, 3· in. Breadth of ditto, 2·1 in.

Figs. 17, 17 *a*, and 17 *b*.—Right index metatarsal.
Length, 5· in. Height of posterior surface, 2·5 in. Breadth of ditto, 1·7 in.

Figs. 18, 18 *a*, and 18 *b*.—Left medius metatarsal.
Length, 4·5 in. Height of posterior surface, 1·8 in. Breadth of ditto, 2·3 in.

Figs. 19, 19 *a*, and 19 *b*.—Right index metatarsal.
Length, 5·2 in. Height of posterior surface, 2·6 in. Breadth of ditto, 1·7 in.

Figs. 20, 20 *a*, and 20 *b*.—Left medius metatarsal.
Length, 5·6 in. Height of anterior articular surface, 2·6 in. Breadth of ditto, 2·5 in.

Figs. 21, 21 *a*, and 21 *b*.—Left medius metatarsal.
Length, 5·5 in. Height of posterior surface, 2·4 in. Breadth of ditto, 2·2 in.

Figs. 22, 22 *a*, and 22 *b*.—Left medius metatarsal.
Length, 5· in. Height of posterior surface, 2·7 in. Breadth of ditto, 2·1 in.

Figs. 23, 23 *a*, and 23 *b*.—Right medius metatarsal.
Length, 5·5 in. Height of posterior surface, 3·1 in. Breadth of ditto, 2·4 in.

Figs. 24, 24 *a*, and 24 *b*.—Left annularis metatarsal.
Length, 4·3 in. Height of posterior surface, 2·4 in. Breadth of ditto, 1·7 in.

Figs. 25, 25 *a*, and 25 *b*.—Left annularis metatarsal.
Length, 5· in. Height of posterior surface, 2·7 in. Breadth of ditto, 2·5 in.

Figs. 26, 26 *a*, and 26 *b*.—Right index first phalanx.
Length, 3·5 in. Height of posterior surface, 2·8 in. Breadth of ditto, 3·3 in.

Figs. 27, 27 *a*, and 27 *b*.—Right index first phalanx.
Length, 2·8 in.

Figs. 28, 28 *a*, and 28 *b*.—Right index first phalanx.
Length, 2·2 in. Height of posterior surface, 1·7 in. Breadth of ditto, 1·9 in.

Figs. 29, 29 *a*, and 29 *b*.—Right index first phalanx.
Length, 2·9 in. Height of posterior surface, 2·1 in. Breadth of ditto, 2·8 in.

Figs. 30, 30 *a*, and 30 *b*.—Left index first phalanx.
Length, 3·3 in. Height of posterior surface, 2·5 in. Breadth of ditto, 3·2 in.

Figs. 31, 31 *a*, and 31 *b*.—Right index first phalanx.
Length, 2·5 in. Height of posterior surface, 2· in. Breadth of ditto, 2·4 in.

Figs 32, 32 *a*, and 32 *b*.—Right medius first phalanx.
Length, 2·3 in. Height of posterior surface, 1·6 in. Breadth of ditto, 2·1 in.

Figs. 33, 33 *a*, and 33 *b*.—Left annularis first phalanx.
Length, 2·7 in. Height of posterior surface, 2·1 in. Breadth of ditto, 2·5 in.

Figs. 34, 34 *a*, and 34 *b*.—Right annularis first phalanx.
Length, 3·1 in. Height of posterior surface, 2·2 in. Breadth of ditto, 2·4 in.

Figs. 35, 35 *a*, and 35 *b*.—Left annularis first phalanx.
Length, 3·5 in. Height of posterior surface, 2·3 in. Breadth of ditto, 2·9 in.

Figs. 36, 36 *a*, and 36 *b*.—Right annularis first phalanx.
Length, 4· in. Height of posterior surface, 2·9 in. Breadth of ditto, 3· in.

Plate LVI.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Elephas Namadicus*. Lower end of right femur with articulating surface. From the Valley of the Nerbudda River. This is the specimen figured by Dr. Spilsbury, in Journ. As. Soc., vol. x. p. 626, Plate A. fig. 3.—B.M.

Transverse diameter of inferior extremity, 10·7 in. Antero-posterior diameter of inner surface of ditto, 11·5 in. Antero-posterior diameter of outer surface of ditto,

9·7 in. (from posterior margins of respective condyles to anterior margins of rotular surface.) Length of rotular surface (in centre), 5·5 in. Breadth of rotular surface (in centre), 5·6 in. Circumference at commencement of fractured portion 13 in. above inferior articular surface, 22· in.

Figs. 2 and 2 *a*.—*Elephas Namadicus*. Lower end of right tibia, with articular surface; from the Nerbudda.—B.M.

Greatest transverse diameter of inferior extremity, 7·4 in. Greatest antero-posterior diameter of ditto, 6·1 in. Projection downwards of the internal malleolus, 1·4 in. Circumference at broken end 9 in. above inferior surface, 12·6 in.

Figs. 3 and 3 *a*.—*Elephas Namadicus*. Upper end of right radius; from the Nerbudda.—B.M.

Greatest transverse diameter, 6·2 in. Greatest antero-posterior diameter, 3·8 in.

Figs. 4, 4 *a*, and 4 *b*.—*Elephas Namadicus*. Dorsal vertebra; from the Nerbudda.—B.M.

Height of body, anteriorly, 5·8 in. Breadth of body, anteriorly, 5·6 in. Length of body, inferiorly, 2·4 in. Spinal canal, height, anteriorly, 2· in. Spinal canal, breadth, anteriorly, 3· in. Between extreme points of transverso processes, 12·8 in. Anterior costal surface, height, 2·6 in. Anterior costal surface, breadth, 1·8 in.

Fig. 5.—*Elephas Namadicus*. Left femur in three fragments. This figure is copied from an illustration of Mr. J. Prinsep's description of a fossil found by Dr. Spilsbury in the Nerbudda Valley, near Narsinhpoor (Journ. As. Soc., Aug. 1834, vol. iii. p. 396, Plate XXIV. fig. 3). The dimensions of the femur, while it remained whole and attached to the rocky matrix, were as follows:—

Greatest length, 63· in. Circumference of the head, 27· in.; diameter of ditto, 8·75 in. Breadth from tip of great trochanter to inner edge of head, 18· in. Circumference of shaft at centre, 19· in. Breadth of condyles, 11· in.

Fig. 6.—*Elephas Namadicus*. Fragments of right femur. The epiphysis of the head is lost, but its place is shown by a dotted line. This figure is copied from the same source as the last. (Journ. As. Soc., vol. iii. Plate XXIV. figs. 9 and 10. Fig. 6 *a*. is lower end of the left femur represented in fig. 5, and not of that in fig. 6, as might be inferred from dotted line in Plate.

Fig. 7.—*Elephas Namadicus*. Humerus; copied from the illustration of a paper by Dr. Spilsbury in Journ. As. Soc., June 1837, vol. vi. p. 487, Plate XXX. fig. 1.

Fig. 8.—*Elephas Namadicus*. Bones of pelvis with acetabulum, copied from same source as fig. 7. (Plate XXX. figs. 5 and 6.)

Fig. 9.—*Elephas Namadicus*. Lower jaw, with molar incomplete at left side. This specimen is also copied from an illustration of Mr. J. Prinsep's description of a fossil found by Dr. Spilsbury in the Nerbudda Valley (Journ. As. Soc., Nov. 1833, vol. ii. p. 583, Plate XX. fig. 1). The jaw is inverted in the drawing.

Length of tooth, 11·5 in. Breadth, 3·5 in. Length of grinding surface, 8·5 in. Girth of jaw-bone, 24· in. Probable length from chin to condyle, 26· in.

A description of the locality where the Nerbudda fossils were found, with sectional drawings, will be found in the paper above referred to.

Figs. 10 and 10 *a*.—*Elephas insignis*. Fragment of molar showing four plates. The specimen is remarkable as coming from the Valley of the Nerbudda.—B.M.

Length of molar, 4·7 in. Greatest breadth, 3·1 in. Height of fragment, 6· in.

Figs. 11 and 11 *a*.—*Elephas insignis.* Fragment of molar, remarkable as coming from the Valley of the Nerbudda.—B.M.

Length of fragment of grinding surface, 2·5 in. Breadth of tooth at centre of that fragment, 3· in.

Figs. 12 and 12 *a*—*Elephas* ——? Fragment of molar containing about nine plates; from the Nerbudda.—B.M.

Length, 5·2 in. Breadth, 2·3 in.

Figs. 13 and 13 *a*.—*Elephas* ——? Fragment of lower jaw, containing portion of molar with about seven plates; from the Nerbudda. —B.M.

Length of fragment of jaw, 11·3 in. Greatest breadth of ditto, 5·2 in. Height opposite posterior border of molar, 4·5 in. Length of tooth, 5·5 in. Greatest breadth of ditto, 2·7 in.

Figs. 14, 14 *a*, and 14 *b*.—*Elephas* ——? Fragment of molar with six plates; from the Nerbudda.—B.M.

Length, 6·4 in. Breadth, 4·1 in.

Plate LVII.

Fig. 1.—*Hippopotamus* (*Tetraprotodon*) *Palæindicus.* (Falc. and Caut.) Almost entire skull, viewed from above, with zygomatic arches complete. Specimen from the Nerbudda in B.M. It shows well the great saliency of the sagittal crest. There is a finer specimen in the Museum of the Asiatic Society of Bengal.

Fig. 1 *a*.—Lateral view of same skull, showing cavity of orbit, &c. The great projection of the orbit above the plane of the frontal, characteristic of the species, is well seen.

Fig. 1 *b*.—Same skull, palatine view, showing three molars, the furthest back intact, the two next ground down; also the three premolars on one side, and two on the other.

Fig. 1 *c*.—Occipital view of same skull, showing condyles and foramen magnum, and the great saliency of the occipital crest.

Figs. 2 and 2 *a*.—*H. Palæindicus.* Portion of upper jaw, right side, with three molars.—B.M.

Figs. 3 and 3 *a*.—*H. Palæindicus.* Portion of lower jaw, with teeth.—B.M.

Fig. 4.—*H. Palæindicus.* Fragment of canine.—B.M.

Figs. 5 and 5 *a*.—*H. Palæindicus.* Anterior portion of jaw with alveoli of *four* incisors. The diameter of the alveoli of the central incisors is much less than that of the external incisors—a fact which refutes De Blainville's opinion that the Nerbudda Tetaprotodon is identical with the living African species. In the latter the middle incisors are the largest.

Figs. 6 and 6 *a*.—*H. Palæindicus.* Portion of lower jaw, with grinders (three molars and two premolars) worn down.—B.M.

Figs. 7 and 7 *a*.—*H. Palæindicus.* Portion of lower jaw, with two molars.—B.M.

Fig. 8.—*H. Palæindicus.* Lower canine.—B.M.

Fig. 8 *a*.—*H. Palæindicus.* Transverse section of canine, of ovoid shape.

Fig. 9.—*H. Palæindicus.* Last lumbar vertebra. Anterior view.—B.M.

Fig. 9 *a*.—*H. Palæindicus.* Last lumbar vertebra. Viewed from above.

Fig. 9 *b*.—*H. Palæindicus.* Last lumbar vertebra. Lateral view.

Figs. 10, 10 *a*, 10 *b*, and 10 *c*.—*Hippopotamus* (*Hexaprotodon*) *Iravaticus* (Falc. and Caut.), from Ava. Anterior portion of the lower jaw, different views. Shows the six incisor teeth characteristic of the subgenus.—B.M.

Figs. 11 and 11 *a*.—*H. Iravaticus.* Fragment of jaw with alveoli, &c.

Figs. 12 and 12 *a*.—*Hippopotamus* (*Hexaprotodon*) *Namadicus.* From the Nerbudda. Anterior portion of lower jaw, showing the six incisors.

Plate LVIII.

Fig. 1.—*Hippopotamus* (*Hexaprotodon*) *Namadicus* (Falc. and Caut.), from the Nerbudda. Lower jaw, viewed from above, showing molars, canines, and *six* incisors.—B.M.

Fig. 1 *a*.—*Hippopotamus* (*Hexaprotodon*) *Namadicus.* Right lateral view of same specimen.

Fig. 2.—*H. Namadicus.* Lower jaw, viewed from above. Showing molars and premolars complete on left side, with portions of both canines and of right outer incisor; also alveoli of five remaining incisors.—B.M.

Fig. 2 *b*.—*H. Namadicus.* Lateral view of same specimen.

Fig. 3.—*H. Namadicus.* Fragment of lower jaw viewed from above, showing molars and premolars on one side, and portions of left canine and all six incisors.—B.M.

Fig. 3 *b*.—*H. Namadicus.* Lateral view of same specimen.

Fig. 4.—*Hippopotamus* (*Tetraprotodon*) *Palæindicus.* Fine specimen of skull, incomplete; upper surface showing the zygomatic arches, and the great prominence of the sagittal ridge. There is a still more perfect specimen in the Museum of the Asiatic Society of Bengal.—B.M.

Fig. 4 *a*.—*Hippopotamus* (*Tetraprotodon*) *Palæindicus.* Lateral view of same specimen, showing the great projection of the orbit above the plane of the frontal.

Fig. 4 *b*.—*Hippopotamus* (*Tetraprotodon*) *Palæindicus.* Palatine view of same specimen, showing the three molars on both sides, well ground down, and the left posterior premolar.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—*Hippopotamus Palæindicus.* Four different views of first dorsal vertebra.—B.M.

Fig. 6.—*H. Palæindicus.* Head, neck, and upper portion of shaft of left femur, anterior view.—B.M.

Fig. 6 *a*.—*H. Palæindicus.* Posterior view of same specimen.

Fig. 6 *b*.—*H. Palæindicus*. Same specimen viewed from above.

Fig. 7.—*H. Palæindicus*. Lower end of shaft, with articulating extremity, of femur, posterior view.—B.M.

Fig. 7 *a*.—*H. Palæindicus*. Posterior view of same specimen.

Fig. 7 *b*.—*H. Palæindicus*. Same specimen viewed from below.

Figs. 8, 8 *a*, and 8 *b*.—*H. Palæindicus*. Upper end of tibia. Anterior, posterior, and upper views.—B.M.

Figs. 9, 9 *a*, 9 *b*, and 9 *c*.—*H. Palæindicus*. Entire tibia. Anterior, posterior, upper and lower views.—B.M.

Figs. 10, 10 *a*, 10 *b*, and 10 *c*.—*H. Palæindicus*. Entire radius. Anterior, posterior, upper and lower views.—B.M.

Plate LIX.

Fig. 1.—*Hippopotamus* (*Hexaprotodon*) *Sivalensis*. (Falc. and Caut.) Fine specimen of entire skull from the Sewalik hills. Upper surface, showing the zygomatic arches, sagittal crest, and muzzle. The hollow between the muzzle and the zygomatic arch is remarkably abrupt, and the occipital crest is very elevated.—B.M.

Fig. 1 *a*.—*H. Sivalensis*. Palatine view of same specimen, showing the three molars and four premolars, well ground, and the alveoli of the canines and *six* incisors. The line of molars is seen to curve slightly outwards towards the front and also behind. The space between the most advanced molar and the canine is much shorter than in the existing animal. There is a deep fissure in front between the incisive bones.

Fig. 1 *b*.—*H. Sivalensis*. Lateral view. The orbit projects but slightly above the plane of the frontal, and in this respect the species contrasts remarkably with that of the *H. Palæindicus*, Plate LVII. fig. 1 *a*, and Plate LVIII. fig. 4 *a*. The orbit is also much more advanced than in the existing Hippopotamus, and this accounts for the abrupt hollow between the muzzle and zygomatic arch. The incisors, drawn in outline, are seen to curve downwards.

Fig. 2.—*H. Sivalensis*. Another specimen of cranium, upper surface. The right zygomatic arch is imperfect; the nasal sutures are more distinct than in fig. 1.—B.M.

Fig. 2 *a*.—*H. Sivalensis*. Palate view of same specimen, showing three molars and four premolars on either side. Posteriorly the molar lines curve less out than in fig. 1, and the teeth are somewhat less worn.

Fig. 3.—*H. Sivalensis*. Another specimen of cranium, upper surface. Both zygomatic arches are imperfect.—B.M.

Fig. 3 *a*.—*H. Sivalensis*. Palate view of same specimen, showing three molars and four premolars on either side. The teeth are less ground than in figs. 1 and 2. The trefoil wear of the coronals of each pair of collines is well seen.

Plate LX.

Fig. 1.—*H. Sivalensis.* Fragment of posterior portion of skull; upper surface; showing occipital ridge and left zygomatic arch.—B.M.

Fig. 1 *a.*—Under surface of same specimen.

Fig. 1 *b.*—Lateral view of same specimen.

Fig. 2.—*H. Sivalensis.* Fine specimen of cranium, with occipital ridge, and nasal sutures distinct, and both zygomatic arches intact.—B.M.

Fig. 2 *a.*—Lateral view of same specimen, showing lower jaw *in situ.* The slight elevation of the orbit above the plane of the frontal is also seen.

Fig. 2 *b.*—Posterior view of same specimen, showing occipital ridge, condyles, and foramen magnum.

Fig. 3.—*H. Sivalensis.* Fragment of posterior part of another skull with both zygomatic arches.—B.M.

Fig. 3 *a.*—Palatine view of same specimen, showing posterior and part of middle molar, on either side.

Fig. 3 *b.*—Lateral view of same specimen.

Fig. 3 *c.*—Occipital, or posterior, view of same specimen.

Fig. 4.—*H. Sivalensis.* Another specimen of cranium deficient in muzzle and right zygomatic arch; upper surface.

Fig. 4 *a.*—Palatine view of same specimen, showing three molars and one premolar, on either side, much worn.

Fig. 4 *b.*—Lateral view of same specimen, showing the slight elevation of the orbit.

Fig. 4 *c.*—Posterior, or occipital, view of same specimen.

Plate LXI.

Fig. 1.—*H. Sivalensis.* Fragment of young skull, showing muzzle; under surface showing molars and canines and alveoli of premolars.—B.M.

Fig. 1 *a.*—Upper surface of same specimen.

Fig. 1 *b.*—Same specimen; lateral view.

Fig. 2.—*Hippopotamus Sivalensis.* Skull, imperfect; palatal view.—B.M.

Fig. 2 *a.*—Lateral view of same specimen.

Fig. 3.—*H. Sivalensis.* Fragment of lower jaw, right side, viewed from above. The molar line is seen to curve outwards, both in front and behind, as in the upper jaw.

Fig. 3 *a.*—Lateral view of same fragment. The condyle, coronoid process, and the descending process are broken off. The lower margin is straight.

Figs. 4 and 4 *a.*—*H. Sivalensis.* Fragment of lower jaw, upper and lateral surface. The alveolar ridge on right side is very perfect, and

shows three molars and three premolars, with a portion of the canine. The condyle, coronoid process, and descending process are wanting. The lower margin is straight.—B.M.

Figs. 5 and 5 *a*.—*H. Sivalensis*. Lower jaw, more perfect; viewed from above and also laterally. The alveolar ridges on both sides are perfect, and comprise three molars and three premolars, and also the alveolus of a fourth premolar. Both canines are broken off; but the right one is tolerably perfect, and is seen to curve back slightly at its tip. The incisive ridge is perfect, but the teeth are wanting. The width across the muzzle from the outer side of one canine alveolus to that of the other is greater, and the width of the jaw over the penultimate false molar is less, than in *H. amphibius*. The condyle, coronoid process, and descending ramus are wanting. The lower margin is straight.—B.M.

Figs. 6 and 6 *a*.—*H. Sivalensis*. Lower jaw, viewed from above and also laterally. The posterior molars on both sides are wanting; but the two anterior molars and three premolars, on either side, and the two canines and *six* incisors are present. The space between the anterior premolar and the canine is very contracted. The right canine is very perfect. The anterior angle of the jaw below the canines is more abrupt, and the depth of the body of the jaw more regular, than in *H. amphibius*. The coronoid process is present, but the condyle and descending portion are wanting. The coronoid process is not projected so much forward as in *H. amphibius*.

Figs. 7 and 7 *a*.—*H. Sivalensis*. Fragment showing symphysis of lower jaw, with canines and incisors remarkably perfect. The horizontal direction of the *six* incisors and the peculiar curve of the canines upwards and slightly backwards are well seen. The incisors are of nearly equal dimensions, and the two central ones are not larger, as in *H. amphibius*; they are cylindrical, and inclined outwards at an obtuse angle to the plane of the grinding surface; their ends are truncated. They are much larger than in the specimen shown in fig. 6, so that the animal was probably an adult male.—B.M.

Fig. 8.—*H. Sivalensis*. Large descending process of ramus of lower jaw, detached. This remarkable appendage for the attachment of the masseter and temporal muscles, peculiar to the genus, is even more developed than in *H. amphibius*; it is less tapering and more deep and massive in its proportions; the posterior margin is more round, and the anterior, which in *H. amphibius* is curved and pointed forwards, is here blunt and unmarked by any peculiarity of form. The process is inclined outwards, and its outer surface is as marked for the reception of muscles as in the living Hippopotamus.—B.M.

Fig. 9.—*H. Sivalensis*. Another specimen of descending process of ramus of lower jaw.

Fig. 10.—Anterior portion of palate, with *six* incisors, and with three premolars on right side, and two on left.—B.M.

Figs. 11 and 11 *a*.—Anterior portion of palate with canine and two premolars; viewed from above, and also laterally.—B.M.

Plate LXII.

Fig. 1.—*Hippopotamus* (*Hexaprotodon*) *Sivalensis*. Left side of lower jaw, viewed from above, with three molars and the three posterior premolars. The trefoil wear of the coronals of each pair of collines is well seen. The fragment is broken off in front of the second premolar. The drawing shows the descending process of the jaw.

Fig. 2.—*H. Sivalensis*. Right side of lower jaw, with three molars and four premolars. The specimen is remarkable as showing the first or foremost premolar, which in most of the specimens is wanting. The canine is absent, but the three right incisors are present. The teeth are less worn than in fig. 1, the posterior molar being intact.—B.M.

Fig. 3.—*H. Sivalensis*. Left side of lower jaw, viewed from above, showing the two anterior molars, and a portion of the third or posterior molar; also the four premolars, the fourth or posterior one being very small. Both the molars and premolars are well ground, so that the animal was probably old. The specimen also shows the canine tooth broken off, and the alveoli of the three left incisors.—B.M.

Fig. 4.—*H. Sivalensis*. Anterior margin of lower jaw, showing the six incisors, all about the same size, with the two canines incomplete. —B.M.

Fig. 4 *a*.—*H. Sivalensis*. Vertical section from side to side through anterior portion of lower jaw, with sections through the six incisors and two canines, showing the relative position of their alveoli.—B.M.

Fig. 5.—*H. Sivalensis*. Premolar from lower jaw.—B.M.

Fig. 6.—*H. Sivalensis*. Premolar from lower jaw.—B.M.

Figs. 7, 7 *a*, and 7 *b*.—*H. Sivalensis*. Upper canine deeply grooved along posterior surface and obliquely truncated in front. The transverse section (7 *b*) presents a reniform outline.—B.M.

Figs. 8 and 8 *a*.—*H. Sivalensis*. Fragment of upper canine with truncated anterior extremity and reniform outline on section.—B.M.

Figs. 9 and 9 *a*.—*H. Sivalensis*. Fragment of upper canine, with truncated anterior extremity and reniform outline on section.

Fig. 10.—*H. Sivalensis*. Lower canine, curved upwards and slightly backwards at tip. The point obliquely truncated on its posterior surface. The form of the tooth is such as to present a pyriform outline when cut across.—B.M.

Fig. 11.—*Hippopotamus* (*Tetraprotodon*) *Palæindicus*. Fragment of lower jaw, right side, with three molars and the three posterior premolars. The hindmost molar is intact; those in front are moderately worn. The fourth or hindmost premolar is very small—deciduous. —B.M.

Fig. 12.—*H. Palæindicus*. Fragment of lower jaw, with three molars and three posterior premolars. The teeth are more ground than in fig. 11.

Figs. 13 and 13 *a*.—*Hippopotamus* (*Tetraprotodon*) *major*. Upper canine, obliquely truncated at front, with cordate outline on section.

Figs. 14 and 14 *a*.—*Hippopotamus* (*Tetraprotodon*) *amphibius*. Upper canine, truncated in front, with reniform outline on section.

Fig. 15.—*Merycopotamus dissimilis*. (Falc. and Caut.) Lower jaw, right side, with three molars, four premolars, portion of canine, and alveoli of incisors. The teeth exhibit a ruminant-like pattern of wear in the crown which is characteristic of the genus.

Fig. 16.—*Merycopotamus dissimilis*. Lower jaw, right side. Larger specimen than fig. 15, with three molars, fourth molar, and canine. The alveoli of three anterior premolars and three incisors are seen. —B.M.

Figs. 17 and 17 *a*.—*Merycopotamus dissimilis*. Molars showing well the rugous surface of the enamel, the basal cingulum, and the ruminant-like pattern of wear characteristic of the genus.—B.M.

Fig. 18.—*Merycopotamus dissimilis*. Molar.

Figs. 19, 19 *a*, and 19 *b*.—This tooth was found in the Kalowala Pass by Capt. (now Sir Proby) Cautley, and is figured by Royle in 'Illustrations of Botany of the Himalayah Mountains' (vol. ii. Plate III. figs. 12. 13, 14, and 15), as the tooth of an *Anthracotherium*. In several of Dr. Falconer's published papers reference is made to the occurrence of Anthracotherium among the Sewalik fossils (See Synopsis of Sewalik Fossils, in Journ. As. Soc., vol. iv. p. 706, and first paper on Monkey, Geol. Trans., vol. v. 2nd series, p. 503; and also *note*, p. 88.) The specimen, however, is not named on the Plate, and differs from Anthracotherium.—B.M.

Plate LXIII.

Vertebræ of *Hippopotamus* (*Hexaprotodon*) *Sivalensis*.

Figs. 1 and 1 *a*.—Seven cervical vertebræ in position, viewed anteriorly and laterally.

Figs. 2, 2 *a*, and 2 *b*.—Atlas. Upper, lower, and anterior views. —B.M.

Figs. 3, 3 *a*, and 3 *b*.—Atlas. Upper, lower, and lateral views.—B.M.

Figs. 4, 4 *a*, and 4 *b*.—Atlas. Upper, lower, and anterior views.—B.M.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Axis. Four different views.—B.M.

Figs. 6, 6 *a*, 6 *b*, and 6 *c*.—Axis. Four different views.—B.M.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—Axis. Four different views.—B.M.

Figs. 8 and 8 *a*.—Axis. Anterior and lateral views.—B.M.

Figs. 9 and 9 *a*.—Axis. Anterior and lateral views.—B.M.

Figs. 10 and 10 *a*.—Axis? Upper and lateral views.—B.M.

Figs. 11, 11 *a*, and 11 *b*.—Sixth? cervical vertebra. Upper, lower, and lateral views.—B.M.

Figs. 12, 12 *a*, and 12 *b*.—Third cervical vertebra. Upper lower, and lateral views.—B.M.

Plate LXIV.

Hippopotamus (*Hexaprotodon*) *Sivalensis.*

Figs. 1 to 12.—Vertebræ, mainly dorsal and lumbar. Fig. 1 is a cervical vertebra; fig. 2 is the 5th cervical; fig. 3 is an anterior (1st?) dorsal; fig. 4 is the second dorsal; fig. 5 is the fourth dorsal; fig. 6 is the second dorsal; fig. 7 is the fifth dorsal; fig. 8 is the seventh dorsal; fig. 9 is the fourth and fifth dorsals, united, with a fragment of rib on each side; fig. 10 is the eighth dorsal; and figs. 11 and 12 are lumbar vertebræ.—B.M.

Figs. 13, 13 *a*, 14, and 14 *a*.—Bones of sacrum, different views.—B.M.

Figs. 15, 15 *a*, and 15 *b*.—Sacrum. Anterior and lateral view.—B.M.

Fig. 16.—Fragment of ilium.—B.M.

Figs. 17 and 17 *a*.—Portion of pelvis, showing acetabulum. Two different views.—B.M.

Figs. 18 and 18 *a*.—Portion of pelvis, showing acetabulum. Two different views.—B.M.

Plate LXV.

Hippopotamus (*Hexaprotodon*) *Sivalensis.* Bones of the anterior extremity.

Figs. 1, 1 *a*, and 1 *b*.—Fragment of scapula, three different views, showing spine, upper margin, and glenoid cavity.—B.M.

Figs. 2 and 2 *a*.—Fragment of scapula, less perfect, showing spine and glenoid cavity.—B.M.

Figs. 3 and 3 *a*.—Fragment of scapula with spine and glenoid cavity.—B.M.

Figs. 4 and 4 *a*.—Fragment of scapula with spine and glenoid cavity.—B.M.

Fig. 5.—Glenoid cavity of scapula.—B.M.

Figs. 6 to 8.—Three specimens of upper articulating extremity of humerus; three views of each.—B.M.

Figs. 9 and 9 *a*.—Shows the bones of the elbow joint, the lower end of the humerus, and the upper end of the radius and ulna.—B.M.

Figs. 10 to 13.—Show four different specimens of lower end of humerus; three views of each specimen.—B.M.

Figs. 14 and 15.—Two fragments showing upper articulating end of ulna; two views of each.—B.M.

Figs. 16, 16 *a*, 16 *b*, and 16 *c*.—Single bone of fore-arm, nearly perfect.—B.M.

Figs. 17 and 17 *a*.—Upper end of fore-arm.—B.M.

Fig. 18.—Lower end of fore-arm.—B.M.

Figs. 19 and 19 *a*.—Lower end of radius and ulna, with bones of carpus:—*a*. scaphoid; *b*. semilunar; *c*. cuneiform; *d*. pisiform in

outline ; *e.* trapezium in outline ; *f.* trapezoid in outline ; *g.* os magnum in outline ; *h.* cuneiform in outline.—B.M.

Figs. 20, 20 *a*, and 20 *b*.—Lower end of radius and ulna.—B.M.

Fig. 21.—Carpal bones *in situ* :—*a*. scaphoid ; *b*. semilunar in outline ; *c*. cuneiform ; *f*. trapezoid in outline ; *g*. os magnum ; *h*. cuneiform.

Figs. 22 to 26.—Carpal bones detached ; three views of each.

Fig. 22.—Right scaphoid.—B.M.

Fig. 23.—Right semilunar.

Fig. 24.—Right cuneiform.—B.M.

Fig. 25.—Right os magnum.—B.M.

Fig. 26.—Right cuneiform.

Figs. 27 to 32.—Metacarpal bones and phalanges.—B.M.

Figs. 33, 33 *a*, and 33 *b*.—Lower end of united radius and ulna, right side. This specimen is remarkable, as being from Ava.—B.M.

Plate LXVI.

Hippopotamus (*Hexaprotodon*) *Sivalensis*. Bones of posterior extremity.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Left femur, entire.—B.M.

Figs. 2, 2 *a*, and 2 *b*.—Upper end of left femur.—B.M.

Figs. 3, 3 *a*, and 3 *b*.—Upper end of right femur.—B.M.

Figs. 4, 5, and 6.—Three fragments showing lower end of femur ; three views of each specimen.—B.M.

Figs. 7, 8, and 9.—Three patellæ ; two views of each.—B.M.

Figs. 10, 11, and 12.—Fragments showing upper extremity of tibia ; three views of each.—B.M.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—Entire tibia.—B.M.

Figs. 14, 15, 16, and 17.—Fragments showing lower end of tibia ; three views of each.—B.M.

Figs. 18 and 18 *a*.—Lower end of tibia and fibula, with bones of tarsus :—*a*. astragalus ; *c*. calcaneum ; *e*. scaphoid.

Figs. 19 and 19 *a*.—Calcaneum.—B.M.

Figs. 20 to 25.—Bones of tarsus, detached.—B.M.

Figs. 20, 21, 22, 23, and 24.—Represent different specimens of astragalus ; three views of each.

Figs. 25, 25 *a*, and 25 *b*.—Left cuboid bone.

Figs. 26, 26 *a*, 26 *b*, 27, and 27 *a*.—Metatarsal bones.—B.M.

Plate LXVII.

Merycopotamus dissimilis. (Falc. and Caut.)

Fig. 1.—Var. *major*. Upper surface of cranium, the anterior portion, or muzzle, broken off.—B.M.

Fig. 1 *a*.—Lateral view of same specimen. The orbit is not elevated above the plane of the frontal.

Fig. 1 *b*.—Palatine view of same specimen, showing three molars and one premolar. The absence of the trefoil wear of the coronals is to be noted. Each pair of collines takes a crescentic form outwards, not unlike that of ruminants, and the grinding surface slopes outwards, as in the description given by Cuvier of *Hippopotamus minutus*.[1]

Fig. 1 *c*.—Posterior or occipital view of same specimen.

Figs. 2, 2 *a*, and 2 *b*.—*M. dissimilis* (var. *major*). Imperfect cranium including muzzle. Lateral, upper, and palatal views.—B.M.

Figs. 3, 3 *a*, and 3 *b*.—*M. dissimilis* (var. *major*). Cranium; upper, palatine, and lateral views, showing three molars, four premolars, and canines. The second left and first right premolars have dropped out. The left canine is seen to be remarkably curved downwards, first outwards and forwards, and then slightly backwards.—B.M.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—*M. dissimilis* (var. *major*). Lower jaw, right side; outer, upper, and inner views. The alveoli of three incisors and first three premolars are empty; the three molars and fourth premolar are present, but, excepting hindmost molar, are well worn; the canine is curved upwards and outwards and slightly backwards at the tip; it is pear-shaped on section, as in *Hipp. Sivalensis*. The descending process is well seen, and is separated from the horizontal ramus by a considerable indentation. The anterior extremity of the horizontal ramus is much more oblique than in *H. Sivalensis*, and the junction of the lower with the anterior margin, corresponding to the lower end of the symphysis, is marked by a distinct tuberosity or projection downwards (x). One large mentary foramen is seen on outer surface below the fourth molar, and between this and the canine the bone is deeply channelled; the molar ridges are almost parallel, and there is very little widening of the symphysial portion of the jaw. The great peculiarity of the jaw is the general slenderness of its proportions and the inequality of its depth. From the descending process it first becomes deeper, and then it gradually diminishes towards the symphysis. In *Hipp. Sivalensis* the jaw is straight, thick, and massive, as in Plate LXI. 3, 4, 5.—B.M.

Figs. 5, 5 *a*, and 5 *b*.—*M. dissimilis* (var. *minor*?). Cranium; upper,

[1] 'In the true molars of the *Merycopotamus*, the inner demi-cones are simply convex, and the two grooves on the outer arcs form a deep external depression, at the bottom of which is the convex ridge. The antero-posterior cleft, instead of being straight, as in the Hippopotamus, forms two bends convex inwards, and thus the symmetrical pattern of the Hippopotamic molar is converted into the double-crescentic arc of the Ruminant molar. The cement at the bottom of the valleys is thinner than in the Ruminants; the enamel is as rugose as in the Giraffe or Sivathere: but the strong ragged ridge along the inner half of the base of the crown forms the chief distinction between the molars of the Merycopotamus and those of the Ruminant. The teeth in the lower jaw make a similar approximation to the Ruminant type, but the anterior and posterior primary divisions are separated by a wider cleft; the last molar has a third hinder lobe; the lower molars are implanted by two roots. The forms, proportions, and relative position of the canines and incisors closely accord with the Hippopotamic type of these teeth.' Owen's 'Odontography,' i. 566.

palatine, and lateral views. The left zygomatic arch is almost complete; the right is absent. The molars, premolars, and right canine are well seen; the incisor ridge is mutilated. The molar ridges are parallel; the whole jaw tapers forward, and there is no widening of its anterior extremity, and no abrupt angle between the line of the jaw and the zygomatic arch.—B.M.

Fig. 6.—*M. dissimilis* (var. *minor*?). Lower jaw, right side, comprising the horizontal and part of the ascending ramus, with the expanded disc below. The three molars are *in situ*. The premolars have dropped out, but their alveoli are seen. The canine is also *in situ*, but broken off. The molars in the original exhibit well the rugous surface of the enamel, with the basal cingulum and the ruminant-like pattern of wear on the crown which are characteristic of the genus, which is nearly allied to Anthracotherium in the teeth. The colline apices of the molars are more widely separated than in other Hippopotami. The specimen from which this figure is taken is in the Museum of the Asiatic Society at Calcutta (Sewalik series, No. 246), and is described by Dr. Falconer in the Catalogue of the Museum. —Cast in B.M.

Figs. 7, 7 *a*, and 7 *b*.—*M. dissimilis* (Var. *minor*?). Fragment of lower jaw, right side, with molars and premolars *in situ*. The alveoli of the canine and three incisors are seen in the broken surface in front. The ascending ramus and descending process are broken off. The large mentary foramen and deep channel in front are very distinct.—B.M.

Figs. 8 and 8 *a*.—*M. dissimilis*. Fragment of anterior portion of lower jaw, left side, with very perfect canine.

Plate LXVIII.

Figs. 1 to 18.—*Merycopotamus dissimilis*.

Figs. 1 and 2.—Two fragments of pelvis with acetabulum; two views of each.—B.M.

Figs. 3, 3 *a*, and 3 *b*.—Upper end of right femur.—B.M.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—Lower end of femur.—B.M.

Figs. 5, 5 *a*, and 5 *b*.—Upper end of tibia.—B.M.

Figs. 6, 6 *a*, 6 *b*, and 6 *c*.—Fragment of calcaneum.—B.M.

Figs. 7, 7 *a*, 7 *b*, 7 *c*, and 7 *d*.—Calcaneum.—B.M.

Figs. 8, 8 *a*, 8 *b*, and 8 *c*.—Calcaneum.—B.M.

Figs. 9, 9 *a*, 9 *b*, 9 *c*, and 9 *d*.—Astragalus.—B.M.

Fig. 10.—Calcaneum and astragalus *in situ*.

Figs. 11 and 12.—Two specimens of upper end of humerus; three views.—B.M.

Figs. 13, 13 *a*, 13 *b*, 13 *c*, and 13 *d*.—Lower end of humerus.—B.M.

Figs. 14, 14 *a*, 14 *b*, and 14 *c*.—Four different views of radius of *Merycopotamus dissimilis*.—B.M.

Fig. 15.—Fragment of occiput, showing condyles and occipital crest. —B.M.

Fig. 16.—Fragment of lower jaw.

Figs. 17 and 17 *a*.—Lower jaw, anterior portion, both sides, showing absence of any widening of symphysis.—B.M.

Figs. 18 and 18 *a*.—Incisive ridge.—B.M.

Figs. 19, 19 *a*, 19 *b*, and 19 *c*.—*Hipp. Sivalensis*. Calcaneum.—B.M.

Figs. 20, 20 *a*, and 20 *b*.—*Hipp. Sivalensis*. Astragalus.—B.M.

Fig. 21.—*Hipp. Sivalensis*. Calcaneum and astragalus, placed *in situ*.

Figs. 22 and 22 *a*.—*Anthracotherium Silistrense*. Molars in Museum Geol. Soc.

Figs. 23 and 23 *a*.—*Anthracotherium Silistrense*. Molars in Museum Geol. Soc.

Fig. 24.—*Anthracotherium Velaunum*. Molars in Mus. Geol. Soc.

Fig. 25.—*Anthracotherium Velaunum*. Molars in Mus. Geol. Soc.

The Anthracotherium, like the closely allied Merycopotamus, formed a link connecting the Hippopotamus with the Ruminants. The molars, however, depart less from the Hippopotamic type than in Merycopotamus.[1]

Plate LXIX.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Sus giganteus* (Falc. and Caut.). Upper, palatal, lateral, and occipital views of skull. The zygomatic arches are perfect. There are three molars on either side, and also the last premolar. The specimen is broken off in front of the last premolar. The extreme distance between the zygomata is much greater than in *Sus scrofa*. The sub-orbital foramina are large, and the bone is deeply channelled in front. From the Sewalik hills.—B.M.

Length of fragment, 11·7 in. Between the most distant points of the zygomata, 8·5 in. Between the post-orbital processes, 5·1 in. Least breadth of cranium between temporal fossæ, 1·1 in. Height of occipital facet from lower border of occipital foramen, 6·5 in. Height of occipital foramen, ·9 in. Breadth of ditto, 1· in. Breadth of occipital condyle, 1·3 in. From lower border of occipital foramen to posterior border of palate, 3·8 in. Height of cranium at sub-orbital foramen from palate, 3·1 in. Breadth of ditto superiorly, 2·4 in. Least breadth of occipital facet, 3·5 in. Width of posterior nares, ·7 in. Length of three true molars, 3·2 in. Of ditto, including last premolar, 3·7 in. Width of palate, posteriorly, 1·7 in. Of ditto, anteriorly, 1·5 in. Greatest breadth of alveoli, 1·3 in. Height of posterior nares, 1·7 in. Greatest diameter of orbit, 1·7 in.

Figs. 2, 2 *a*, and 2 *b*.—*Sus giganteus*. Fragment showing anterior portion of skull broken off about the line of the sub-orbital foramina. Upper, lateral, and palatine views. The three molars and two last premolars are well seen, and are less ground than in fig. 1.—B.M.

Length of fragment, 9· in. Width superiorly at sub-orbital foramen, 2·2 in. Height, from palate, 4· in. Length of three true molars, 3·7 in. Of ditto, including two last premolars, 5·1 in. Width of palate posteriorly, 1·6 in. Of ditto, anteriorly, 1·4 in. Greatest width of alveoli, 1·3 in.

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[1] Dr. F. was at one time inclined to regard the Merycopotamus as identical in genus with the *Anthracotherium Velaunum* of Cuvier. On Dec. 6, 1843, he wrote thus to Capt. Cautley: 'What do you think! Our *Hippo. dissimilis* is identical in genus with Cuvier's *Anthracotherium Velaunum*; that is to say, he misnamed his specimen from imperfect materials. I have had the two heads chiselled out, and intend describing them under the name of a new genus *Merycopotamus* (*merico*, from the resemblance of the teeth to those of a Ruminant).'

Figs. 3, 3 *a*, and 3 *b*.—*Sus giganteus*. Cranium. Upper, palatal, and lateral views. The right zygoma is imperfect, and the left is almost absent; but, in other respects, the cranium is more perfect than in figs. 1 or 2. There are three molars and three premolars on either side. The incisive alveoli and the tuberosity and alveolus of the right canine are also present.—B.M.

Length of fragment, 14·3 in. Width of cranium superiorly at sub-orbital foramen, 1·8 in. Height of ditto from palate, 3·3 in. Length of canine tuberosity, 4· in. Length of molar series, 5·6 in. Length of three true molars, 3·5 in. From posterior border of palate to anterior margin of incisive alveolus, 7·6 in. From posterior border of palate to posterior angle of incisive foramen, 8·7 in. Diasteme between canine and external incisor, 1· in. Width of palate posteriorly, 1·2 in. Ditto between canines, 2· in. Greatest width of alveoli, 1·2 in.

Fig. 4.—*Sus giganteus*. Lower jaw, right side. The ascending ramus is mostly absent. Shows three molars and three premolars, with canine and incisive alveoli.

Length of fragment, 11·5 in. Height of horizontal ramus, 2· in. Thickness of ditto, 1·7 in. Length of symphysis superiorly, 3·3 in. Length of three true molars, 3·5 in. Length of ditto, with three posterior premolars, 5· in. Interval between first and second premolars, ·9 in. Interval between second premolar and canine, 1·5 in. Between canine tuberosities, 3·9 in. Width between molars posteriorly, 1·5 in. Between ditto anteriorly, 1·7 in.

Figs. 5 and 5 *a*.—*Sus scrofa* (var. *Indicus*). Entire skull, with lower jaw, not fossil. Upper and lateral views. One-third of the natural size.—B.M.

Plate LXX.

Figs. 1 and 1 *a*.—*Sus (Hippohyus) Sivalensis* (Falc. and Caut.).[1] Cranium. Upper and palatal views. Except that the zygomatic arches are absent, the specimen is very perfect. Shows three molars and two last premolars on either side, with alveoli of canines and six incisors. The sub-orbitary and incisive foramina are well marked.—B.M.

Extreme length of fragment, 9·2 in. From post. plane of occipital condyles to anterior margin of incisive alveolus, 9· in. From lower border of occipital foramen to post. border of palate, 2·3 in. From post. border of palate to posterior border of incisive foramen, 5·4 in. Width of palate between second molars, 1·1 in. Width of ditto between inner margins of canine alveoli, 1·05 in. Width of ditto between anterior angles of middle incisive alveoli, ·7 in. Greatest width of alveoli, ·8 in. Length of the molar series, 4·3 in. Length of the three true molars, 2·7 in. Dias-

[1] 'In this extinct genus of quadrupeds from the Himalayan tertiary deposits, the dental formula shows incisors $\frac{3-3}{3-3}$, and corresponds with that of the *Chœropotamus* in the number of canines, premolars and molars; but the true molars have a more complex crown, approaching nearer to those of the typical *Suidæ* in the depth and number of the secondary enamel folds. Each upper true molar has its crown cleft by the common or primary crucial valleys, the transverse one passing somewhat obliquely from within forwards and outwards. Each of the four principal lobes is subdivided, not by a vertical central depression, but by a fold penetrating its anterior and posterior margins. The enamel at first shows additional minor plications, but is worn down to the simpler pattern above described; the outer lobes are convex externally. The first premolar is very small and simple, separated by an interval of its own breadth from the second; both this and the third have transversely compressed crowns; the fourth has a sub-trihedral crown. The *Hippohyus* equalled in size the *Chœropotamus*, but exhibits as strong a tendency towards the Hippopotamoid family as that does towards the plantigrade Carnivora.'—Owen's 'Odontography,' vol. i. p. 562.

tema between first and second premolars, ·2 in. Length of incisor ridge on one side, 1·5 in. Breadth of nasal ridge at sub-orbital foramina, 1·2 in. Between post-orbital processes, 2·5 in.

Figs. 2 and 2 *a*.—*Sus Hysudricus* (Falc. and Caut.). From Sewalik hills. Anterior portion of skull broken off about sub-orbitary foramina. Shows three molars and three premolars and canine *in situ*.—B.M.

Length of fragment, 5·7 in. Height from palate opposite sub-orbital foramen, 2·2 in. Length of three true molars, 1·8 in. Length of ditto and three posterior premolars, 3·3 in. Diastema between first and second premolars, ·1 in. Length of whole molar series, 4· in.

Figs. 3 and 3 *a*.—*Sus Hysudricus*. Lower jaw. The ascending ramus and the incisive and canine alveoli are absent. Shows three molars and four premolars.—B.M.

Extreme length of fragment, 6·4 in. Height of jaw opposite second molar, 2· in. Length of three molars, 3· in. Ditto of entire molar series, 5·3 in.

Figs. 4, 4 *a*, and 4 *b*.—*Sus giganteus*. Superior, palate, and side views of cranium. The specimen is imperfect and mutilated. Posteriorly it is broken off behind the orbit. Anteriorly it is also fractured in front of the first molar, but the anterior fragment is joined on. The specimen shows the two anterior molars and the third molar in germ.—B.M.

Length of fragment, 8· in. Length of palate, 5·5 in. Height from palate at sub-orbital foramen, 1·8 in. Width of cranium superiorly at ditto ditto, 1· in. Length of exposed molar series, 3· in. Of first and second molars, 1·4 in. Between first premolar and external incisor, ·6 in. Between first premolar and internal incisor, 1·4 in. Width of palate posteriorly, ·8 in. Width of palate between canines, 1·3 in.

Fig. 5.—*Sus giganteus*.—Lower jaw, showing three molars and three premolars on either side. The left canine and the alveolus are also seen. The incisive alveoli are imperfect.—B.M.

Extreme length of fragment, 12· in. Length of three true molars, 3·8 in. Of ditto with two premolars, 5· in. Distance between canine and second premolar, 1·9 in. Width of symphysis between external margins of canine alveoli, 3·4 in. Length of symphysis, 5·2 in.

Fig. 6.—*Sus giganteus*. Imperfect specimen of lower jaw. Shows the molars and premolars on right side, and the premolars and canine alveolus on left; also the incisor alveoli.—B.M.

Length of fragment, 7·4 in. Height of ramus, 2·1 in. Width of ramus, 1·4 in. Length of symphysis, 2·8 in. Width between external alveolar margins of canines, 2·8 in. Alveolar margin of four incisors, 1·2 in.

Figs. 7 and 7 *a*.—*Sus giganteus*. Lower jaw, showing three molars, four premolars, canine, and three incisors. The last or posterior molar is intact. The ascending ramus is absent.—B.M.

Length of fragment, 10· in. Depth of ramus at anterior margin of third molar, 2· in. Width of ditto, 1·4 in. Length of symphysis, 2·8 in. Between external alveolar margins of canines, 2·3 in. Length of three posterior premolars and three true molars, 4·9 in. Of three true molars, 3·2 in. Between first and second premolars, ·5 in. Between first premolar and canine, ·3 in. Alveolar margin of three incisors, 1·3 in.

Figs. 8 and 8 *a*.—*Sus giganteus*. Another specimen of lower jaw, with molars, premolars, and canine on both sides; also the incisor alveoli. The third or last molar is only partly ground. The ascending ramus is absent. From the Nerbudda.—B.M.

Length of fragment, 10·1, in. Depth of ramus at anterior margin of last molar,

2·in. Width of ditto, 1·2 in. Length of symphysis, 3·5 in. Between external alveolar margins of canines, 2·7 in. Length of three last premolars and three true molars, 5·5 in. Length of true molar series, 3·1 in. Between first and second premolars, ·6 in. Between first premolar and canine, ·5 in. From anterior margin of canine alveolus to mesial line, 1·5 in. Width between rami posteriorly, 1·5 in.

Plate LXXI.

Fig. 1.—*Sus (Hippohyus) Sivalensis.* Left half of palate, natural size, showing three molars, three posterior premolars, and the alveoli of the first premolar, canine, and three incisors. The third or hindmost molar is not at all ground.—B.M.

Extreme length of palate, 6·3 in. Length of first molar, ·6 in.; of second, ·95 in.; of third, 1·15 in. Width of first molar, ·6 in.; of second, ·8 in.; of third, ·8 in. Length of third premolar, ·5 in.; of fourth, ·5 in. Width of third premolar, ·4 in.; of fourth, ·5 in.; between canine and first premolar, ·6 in.

Fig. 2.—*Sus* (*Hippohyus*) *Sivalensis.* Second and third molars, imperfect.—B.M.

Length of fragment of second molar, ·55 in.; of third, 1·45 in. Greatest width of third posteriorly, ·73 in.

Fig. 3.—*Sus* (*Hippohyus*) *Sivalensis.* First and second true molar and portion of fourth premolar.—B.M.

Length of first true molar, ·5 in.; of second ditto, 1· in. Width of first true molar, ·45 in.; of second, ·63 in.

Fig. 4.—*Sus* (*Hippohyus*) *Sivalensis.* Fourth premolar and first and second true molars.—B.M.

Length of first molar, ·55 in.; of second, ·85 in.

Fig. 5.—*Sus Hysudricus.* Three true molars and third and fourth premolars, upper jaw, left.—B.M.

Length of third premolar, ·5 in.; of fourth ditto, ·5 in.; of first molar, ·6 in.; of second, ·8 in.; of third, 1·1 in. Width of third premolar, ·35 in.; of fourth, ·53 in.; of first molar, ·55 in.; of second, ·66 in.; of third, ·7 in.

Fig. 6.—*Sus Hysudricus.* Three molars and three posterior premolars, lower jaw, left. The last molar is imperfect.—B.M.

Length of second premolar (at alveolar ridge), ·45 in.; of third, ·45 in.; of fourth, ·5 in.; of first molar, ·55 in.; of second, ·7 in. Width of fourth premolar, ·35 in.; of first molar, ·43 in.; of second, ·53 in.

Fig. 7.—*Sus Hysudricus.* Second and third true molars, upper jaw, right.—B.M.

Length of second molar, ·65 in.; of third, ·85 in. Width of second molar, ·7 in. Extreme width of third molar anteriorly, ·7 in.

Fig. 8.—*Sus Hysudricus.* Second and third true molars, well worn.—B.M.

Length of second molar, ·73 in.; of third, 1·4 in. Width of second, ·6 in.; of third anteriorly, ·65 in.

Fig. 9.—*Sus Hysudricus.* Canine, four premolars, and first and second molar, upper jaw, right.—B.M.

Length of first premolar, or retained milk molar, ·4 in.; of second, ·5 in.; of third, ·5 in.; of fourth, ·45 in.; of first molar, ·6 in.; of second, ·65 in.

Fig. 10.—*Sus Hysudricus.* Three molars, and two posterior premolars, lower jaw.—B.M.

Length of last premolar, ·5 in.; of first molar, ·5 in.; of second, ·66 in.; of third, 1· in. Width of last premolar, ·35 in.; of first molar, ·4 in.; of second, ·5 in.; of third ditto anteriorly, ·5 in.

Fig. 11.—*Sus Hysudricus.* Symphysis of lower jaw, with four premolars on left side, and second and third on right.—B.M.

Distance between inner margins of second premolars, 1·3 in. Length of second premolar, ·45 in.; of third, ·5 in.; of fourth, ·5 in.

Fig. 12.—*Sus giganteus.* Three true molars, upper jaw, left. The first is imperfect.—B.M.

Length of first molar, ·65 in.; of second, 1· in.; of third, 1·6 in. Width of first molar, ·75 in; of second, ·9 in.; of third anteriorly, 1· in.

Fig. 13.—*Sus giganteus.* Second and third true molars, upper jaw, right; large and perfect.—B.M.

Length of second molar, 1·4 in.; of third, 2·2 in. Width of second molar, ·8 in.; of third ditto, 1·1 in.

Fig. 14.—*Sus giganteus.* Lower jaw, right side, showing canine, four molars, and first two true molars. The second true molar is not at all ground down, and the third has not appeared.

Distance between canine and first premolar, ·36 in. Length of first premolar, ·36 in.; of second, ·5 in.; of third, ·5 in.; of fourth, ·5 in.; of first molar, ·85 in.; of second, 1·25 in. Width of first molar, ·7 in.; of second, ·8 in.

Fig. 15.—*Sus giganteus.* Lower jaw, right side, with first, second, and third true molars, all well ground.—B.M.

Length of first molar, ·55 in.; of second, ·95 in.; of third, 1·8 in. Width of first molar, ·55 in.; of second, ·7 in.; of third, ·7 in.

Fig. 16.—*Sus giganteus.* Last premolar and first molar, upper jaw.—B.M.

Length of last premolar, ·7 in.; of first molar, ·93 in. Width of last premolar, ·8 in.; of first molar posteriorly, ·9 in.

Figs. 17 and 17 *a*.—*Sus giganteus.* Anterior portion of lower jaw, showing canine and incisive alveoli. The outer incisor on both sides has dropped out; the two inner incisors and the canines are present; the latter are broken off.—B.M.

Distance between outer margins of outer incisive alveoli, 2·1 in.; between outer margins of middle ditto, 1·6 in.; antero-posterior diameter of middle incisor, ·36 in.; of inner ditto, ·4 in.

Figs. 18 and 18 *a*.—*Sus giganteus.* Symphysis of lower jaw, with six incisors very perfect. The canines are broken off.—B.M.

Length of symphysis measured inferiorly, 2·6 in. Distance between outer margins of outer incisors, 2· in.; between outer margins of second premolars, 1·8 in. Width of three incisors on one side, 1·2 in.

Figs. 19, 19 *a*, and 19 *b*.—*Sus giganteus.* Fragment of canine, slightly compressed and grooved on each side.—B.M.

Length of fragment, 2·4 in.; great diameter, 1·15 in.; lesser diameter, ·8 in.[1]

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[1] *Description by Dr. Falconer of Fossil Remains of Suidæ from the Sewalik Hills, in the Museum of the Asiatic Society of Bengal.*

No. 317. *Sus*—— ? Conglomerated specimen, consisting of a mass of bones cemented together by clay-marl and crossing each other in every direction: the principal object being the lower jaw, nearly entire, of a *Sus*, exposed so as to

Plate LXXII.

Figs. 1, 1 *a*, and 1 *b*.—*Rhinoceros platyrhinus*. (Falc. and Caut.) From the Sewalik hills. Mutilated cranium, anterior part, showing lateral, upper, and palate surfaces. The specimen is so worn that the teeth are scarcely distinguishable. The upper surface of the skull is broad and flat.—B.M.

Length of fragment, 17·in.; height posteriorly, 9·7 in.; height anteriorly, 8·in.; greatest breadth at anterior angles of orbits, 10·6 in.; depth of nasal notch, 6·in.; height of nasal notch anteriorly, 5·5 in.

In 1847 Dr. Falconer noted that *R. platyrhinus* partakes of the characters of both *R. leptorhinus* (*sic*) and *R. tichorinus*, and on the 9th of August, 1860, he made the following note:—

'Examined Baker's large skull of the Sewalik *Rhinoceros platyrhinus* in B.M. The molars are in fine condition, six on either side. The last true molar only just touched by wear. The last t. m. exactly like *Rh. hemitœchus*, in having a posterior basal funnel-shaped pit! while the penultimate and antepenultimate t. m. and the penultimate and antepenultimate milk m. have each three distinct fossettes, as in *Rhinoceros tichorhinus*! the vertical ridges of the anterior side very well pronounced in three valleys. Had two large incisors above and four below: of the latter, the two outer big; the two inner small, as in the existing Indian Rhinoceros.'

Figs. 2, 2 *a*, and 2 *b*.—*Rhinoceros platyrhinus*. Fragment showing posterior part of cranium, with foramen magnum, occipital condyles and crest, portion of right zygomatic arch, and condyle of lower jaw.—B.M.

Length of fragment, 10·6 in.; height of occipital facet from lower margin of occipital foramen to summit of occipital crest, 12·in. Breadth of occipital facet above, 8·4 in.; ditto below, 13·2 in. Height of occipital foramen, 2·5 in.; breadth of ditto, 2·in. Between extreme points of occip. condyles, 5·3 in. Least width of cranium, 3·3 in. Breadth of condyle of lower jaw, 6·7 in.; ditto of ascending ramus, 6·in. Between inner angles of glenoid facets, 2·5 in. Depth of zygomatic process, 3·3 in.

Fig. 3.—*Rhinoceros platyrhinus*. Fragment of skull, upper jaw, with molar ridge, and large sub-orbital foramen.—B.M.

Length of fragment, 13·2 in. From root of molar origin of zygoma to sub-orbital foramen, 7·5 in. Length of molar series, 10·8 in. Greatest breadth of molar alveoli, 2·8 in.

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show the two horizontal rami with the remains more or less of seven molars on either side, the bases of both canines and more or less of the six incisors. The specimen is still much covered with matrix; the four premolars on the left side show part of their crowns; on the right side the first premolar is close to the canine; the true molars are well worn; the canine on the left side shows a part of the tooth bending outwards, but the apex broken off. The other bones are so much covered by matrix as to be undeterminable.

No. 318. *Sus* —— ? Fragment comprising the posterior part of upper maxilla right side, containing the two last teeth *in situ*; the penultimate is well worn, showing a very complex pattern of crown; the last molar is half worn.

No. 319. *Sus* —— ? Fragment of lower jaw, right side, comprising posterior part of horizontal ramus, broken across horizontally near the base of the teeth, and containing the last two molars, the penultimate well worn with very flexuous enamel; the last molar in germ and of very large size.

No. 320. Mutilated fragment comprising part of the last true molar, much broken and cemented with matrix.

No. 321. Fragment comprising the posterior part of horizontal ramus lower jaw right side, containing the two last teeth *in situ*; they are in the same condition of wear as No. 319, but considerably smaller.

No. 54 (from Perim Island). Lower jaw, left side, fragment containing merely the last molar of *Sus Hysudricus*?

Fig. 4, 4 *a*, 4 *b*, and 4 *c*.—*Rhinoceros platyrhinus*. Fragment showing anterior portion of lower jaw, with symphysis and four anterior molars, and a portion of fifth; also a small inner and large outer incisor on both sides.—B.M.

Length of fragment, 13·5 in. Breadth of symphysis, 5·7 in. Length of symphysis inferiorly, 7· in. Depth of jaw, 4·7 in. Thickness of jaw, 3·3 in. Length of four anterior molars, 7·4 in. Between anterior premolar and external incisive alveolus, 3·1 in. Between incisive alveoli, ·6 in. Width between molars posteriorly, 4· in.; ditto anteriorly, 3·4 in.

Figs. 5, 5 *a*, and 5 *b*.—*Rhinoceros platyrhinus*. Small fragment of lower jaw, with two molars.—B.M.

Length of fragment, 6·7 in.; greatest depth, 5·7 in.; Thickness, 3·2; length of molar, 3·1 in.; breadth, 1·7 in.

Figs. 6 and 6 *a*.—*Rhinoceros platyrhinus*. Fragment of molar.—B.M.

Length, 2·3 in. Width, 3·4 in.

Figs. 7 and 7 *a*.—*Rhinoceros platyrhinus*. Molar.

Length, 3·2 in.; breadth, 2·8 in.; height of crown, 3·1 in.

Plate LXXIII.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Rhinoceros Palæindicus*. (Falc. and Caut.) Mutilated specimen of cranium. The zygomatic arches and the anterior portion of the palate are broken off. On the right side the three true molars and three posterior premolars are present; on the left there are three molars and one premolar. All the teeth are much worn. The upper surface of the skull is very concave.—B.M.

Length of fragment, 21·8 in. Height of occiput (imperfect) from basilar process, 8·1 in. From occipital surface to posterior border of palate (imperfect), 12·5 in. Between mastoid angles, greatest diameter of occiput, 9· in. Transverse diameter of occipital foramen, 1·9 in. Vertical ditto, 1·3 in. Breadth of cranium at anterior orbital angles, 8·7 in. Between anterior angles of orbital margin, 3·9 in. Between sub-orbital foramina (posterior border), 4·8 in. Chord of nasal notch, 4·5 in. Length of three true molars, 6·1 in. Length of three posterior premolars, 5· in. Width of palate between posterior molars, 2·2 in. Ditto between second premolars, 2·5 in. Greatest width of alveolus, 2·8 in. Length of palatine notch, 5·5 in. Width of ditto, 2· in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—*Rhinoceros Sivalensis* (Falc. and Caut.), from the Sewalik hills. Tolerably perfect specimen of cranium. The upper part of the occiput and the left zygoma are absent. The left maxilla shows three molars and three premolars, and also the alveolus of the first premolar. The teeth are well worn; the palate is narrow. The upper surface of the cranium is concave, and the tip of the nasal shows the gibbosity of the base of a very large horn. The species was evidently unicorned.—B.M.

Extreme length of fragment, 22·5 in. From posterior plate of occipital condyles to anterior margin of first premolar, 20·4 in. From lower border of occipital foramen to posterior border of palate, 11·9 in. Length of molar series, 11·1 in. Length of three true molars, 5·8 in. Width of palate between posterior molars, 2·5 in. Width of palate at anterior angle of first premolars, 2·2 in. Greatest width of alveoli, 2·6 in. Length of palatine notch, 5·3 in. Width of ditto, 1·9 in. Between inner angles of articular surfaces for lower jaw, 3·2 in. Between most distant points of zygomatic processes, 13·7 in. Depth of zygomatic fossa, 3·1 in. Height of occiput (imperfect) from lower border of occipital foramen, 9· in. Between outer angles of occipital condyles, 4·8 in. Between mastoid angles, or greatest transverse diameter of occiput, 8·6 in. Breadth of occipital foramen, 1·7 in. Height of ditto,

1·9 in. Breadth of cranium at anterior orbital angle, 8·3 in. Between posterior borders of sub-orbital foramina, 5·2 in. Between anterior angle of orbital margin and posterior border of sub-orbital foramen, 4·7 in. Breadth of rostrum, 2·8 in.

Figs. 3 and 3 *a*.—*Rhinoceros Sivalensis*. Fragment of skull, comprising upper jaw, portion of orbit and prolongation of nasals for horn.—B.M.

Length of fragment, 14·8 in. From anterior angle of orbit to tip of nasal protuberance, 9·8 in. From concavity of nasal notch to tip of ditto, 6·8 in.

Plate LXXIV.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Rhinoceros Palæindicus*. Very perfect specimen of cranium, with both zygomatic arches entire. Shows two molars and two posterior premolars on either side. The third molar is still in germ. The palate is deficient in front.—B.M.

Length of cranium (fragment), 18·2 in. Between most projecting points of zygomata, 9·8 in. Breadth of occiput (behind the auditory foramina), 6·1 in. Least breadth of cranium (between the temporal fossæ), 3·4 in. Breadth of cranium at anterior orbital angles, 5·3 in. From anterior margin of second premolar to posterior border of pterygoid process, 9·7 in. Length of palatine fissure, 3·7 in. Distance between the internal angles of the glenoid facets, 3· in. Length of alveolar margin of exposed molars, 6·1 in. Between external alveolar margins of last exposed molars, 6·4 in. Between external alveolar margins of anterior molars, 3·7 in. Height of cranium from alveolar margin at anterior margin of third molar, 6·1 in. Width of palate anteriorly, 2·3 in.; ditto, posteriorly, 2·3 in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—*Rhinoceros Palæindicus*. Skull of a larger and older animal than fig. 1. Both zygomatic arches are deficient, and the portion in front of the fourth premolar is also broken off.—B.M.

Length of fragment, 20·1 in. From lower margin of occipital foramen to posterior border of palate, 12·2 in. From ear (anterior margin) to sub-orbital foramen, 13·5 in. From ditto to anterior angle of orbit, 10·6 in. Height of occipital facet from lower margin of occipital foramen to occipital crest, 7·7 in. Height of cranium at anterior angle of orbit from alveolar border, 7·2 in. Height of occipital foramen, 1·2 in. Breadth of ditto, 1·2 in. Between internal angles of glenoid facets, 3·3 in. Width of palate posteriorly and anteriorly, 3·1 in. Between extreme points of external alveolar borders of molars, 10· in. Least breadth of cranium (between temporal fossæ), 4·3 in. Breadth of cranium at anterior orbital angles, 8·5 in. From centre of occipital crest to posterior border of nasal notch, 16·7 in. Length of alveolar border of three true molars, 6·5 in. Breadth of alveoli, 3·2 in.

Figs. 3 and 3 *a*.—*Rhinoceros Palæindicus*. Fragment of lower jaw, left side, with four posterior molars.—B.M.

Length of fragment, 15·8 in. Length of alveolar border of molars, 8·3 in. Breadth of ascending ramus, 6· in. Depth of jaw anteriorly, 3·1 in. Thickness of ditto, 3·2 in.

Figs. 4 and 4 *a*.—*Rhinoceros Palæindicus*. Fragment of symphysis of lower jaw, with incisive alveolar ridge and large outer left incisor.—B.M.

Between external alveolar borders of incisive alveoli, 4·5 in. Length of existing portion of symphysis, 4·4 in. Interval between anterior premolar and incisive alveolus, 2·6 in. Greatest thickness of alveolus, 1·7 in. Great diameter of incisor, 1·3 in. Lesser diameter of ditto, 1·1 in. Length of tusk (projection), 1·9 in.

Fig. 5.—*Rhinoceros Sivalensis*. Portion of cranium, showing palate with molar ridges and nasal projections. The portion behind the second molar is broken off.—B.M.

Length of fragment, 14·8 in. Width of palate between second molars, 2·3 in. Width of palate between first premolars, 1·6 in. Length of four premolars and first and second molar series, 8· in. Length of four premolar series, 4·9 in. Supposed depth of nasal notch, 6·6 in. Breadth of cranium between anterior angles of orbit, 7·7 in. Between external alveolar borders posteriorly, 7·3 in. Between ditto anteriorly, 2·5 in.

Figs. 6 and 6 *a*.—*Rhinoceros Sivalensis*. Fragment of lower jaw, with symphysis and five anterior molars.—B.M.

Length of fragment, 9·4 in. Length of existing portion of symphysis, 3·1 in. Length of molar series, 7· in. Width between the posterior molars, 2·7 in. Between anterior ditto, 2· in. Greatest depth of jaw, 3·6 in. Thickness of ditto, 2· in.

Plate LXXV.

Fig. 1.—*Rhinoceros Palæindicus*. Fragment of upper jaw, left side, with three true molars.

Length of first molar, 2· in.; of second, 2·15 in.; of third along anterior edge, 3·1 in. Width of first molar, 3· in.; of second, 3·2 in.; of third along anterior edge, 2·9 in.

Fig. 2.—*Rhinoceros Palæindicus*. Fragment of lower jaw, with three true molars and fourth premolar.—B.M.

Length of fourth premolar, 1·8 in.; of first molar, 2·15 in.; of second, 2·2 in.; of third, 2·2 in. Width of fourth premolar, 1·35 in.; of first molar, 1·3 in.; of second, 1·4 in.; of third, 1·3 in.

Fig. 3.—*Rhinoceros Palæindicus*.—Fragment of lower jaw, with four molars.—B.M.

Length of first tooth, ·65 in.; of second, 1·3 in.; of third, 1·75 in.; of fourth, 1·75 in.

Fig. 4.—*Rhinoceros Palæindicus*. Premolar tooth detached.—No. 39,648 B.M.

Length along outer edge, 2·5 in. Width of grinding surface anteriorly, 2·5 in.

Fig. 5.—*Rhinoceros Sivalensis*. Fragment of upper jaw, right side, with three true molars and third and fourth premolar.—B.M.

Length of third premolar, 1·6 in.; of fourth ditto, 1·5 in.; of first molar, 1·75 in.; of second ditto, 2· in.; of third ditto along outer edge, 2·3 in. Width of third premolar, 2·3 in.: of fourth ditto, 2·6 in.; of first molar, 2·6 in.; of second ditto, 2·6 in.; of third ditto along anterior edge, 2·5 in.

Fig. 6.—*Rhinoceros Sivalensis*. Lower jaw, right side, with second, third, and fourth premolars, and first and second true molars.—B.M.

Length of second premolar along outer edge, 1·2 in.; of third premolar at centre of grinding surface, 1·2 in.; of fourth ditto, 1·7 in.; of first molar, 1·6 in.; of second ditto, 1·9 in. Width of second premolar, ·75 in.; of third ditto, 1·0 in.; of fourth ditto, 1·15 in.; of first molar, 1·3 in.; of second ditto, 1·36 in. Width between anterior angles of second premolars, 2·4 in.

Fig. 7.—*Rhinoceros Sondaicus* (recent). Upper jaw, right side, with fourth premolar and three true molars.

Length of fourth premolar, 1·55 in.; of first molar, 1·6 in.; of second, 1·9 in.; of third along outer edge, 2·1 in.

Fig. 8.—*Rhinoceros Sondaicus* (recent). Lower jaw, right side, with third and fourth premolars and three true molars.

Length of third premolar, 1·2 in.; of fourth, 1·5 in.; of first molar, 1·6 in.; of second, 1·8 in.; of third, 1·7 in.

Fig. 9.—*Rhinoceros platyrhinus.* Upper jaw, right side, with third and fourth premolars and three true molars. The first true molar is imperfect.—B.M.

Length of third premolar, 1·6 in.; of fourth ditto, 1·8 in.; of fragment of first molar, extreme, 1·5 in.; of second molar, 1·9 in.; of third ditto along outer edge, 2·2 in. Width of third premolar, 2·7 in.; of fourth ditto, 2·8 in.; of second molar, 2·9 in.; of third ditto along anterior edge, 2·55 in.

Fig. 10.—*Rhinoceros platyrhinus.* Lower jaw, right side, and symphysis, containing very large outer and small inner incisor of both sides, second, third, and fourth premolars, and first two true molars of right side.—B.M.

Length of second premolar, ·7 in.; of third ditto, 1·4 in.; of fourth ditto, 1·65 in.; of first molar, 1·46 in.; of second ditto, 2· in. Width of second premolar, ·45 in.; of third ditto, ·85 in.; of fourth ditto, 1·1 in.; of first molar, 1·05 in.; of second ditto, 1·2 in. Width between second premolars, 3·5 in.; ditto between outer margins of external incisors, 3·65 in. Oblique width of external incisor, 1·5 in. Thickness externally of ditto, oblique, ·7 in. Length of exserted portion along outer edge, 2·1 in.

Fig. 11.—*Rhinoceros platyrhinus.* Penultimate true molar upper jaw, right side, detached, but shattered. Fig. 11 *a*.—Ditto, ditto, restored.—B.M.

Fig. 12.—Last true molar upper jaw, right side.—B.M.

Fig. 13.—*Rhinoceros* (*Acerotherium?*) *Perimensis* (from Perim Island). Fragment of lower jaw, with three true molars and first premolar.

Length of first true molar, 1·15 in.; of second, 1·4 in.; of third, 1·5 in.

Fig. 14.—*Rhinoceros Perimensis.* Premolar tooth, detached.

Fig. 15.—*Rhinoceros Perimensis.* Molar, detached and shattered.

Fig. 16.—*Rhinoceros Perimensis.* Molar, detached and shattered.

Plate LXXVI.

Divers Indian Fossil Species of Rhinoceros.

Figs. 1 and 1 *a*.—Fragment of left humerus, near upper end, from the Niti Pass.—B.M.

Length of fragment, 5·9 in. Breadth, 3·5 in. Greatest thickness of fractured surface, 2·3 in.

Fig. 2.—Fragment of left humerus, near upper end, from the Niti Pass.

Length of fragment, 5·2 in.; greatest breadth, 5·2 in.; thickness, 2·3 in.

Fig. 3.—Upper extremity and portion of shaft of left radius, from the Niti Pass.—B.M.

Length of fragment, 6· in.; greatest antero-posterior diameter of superior articular surface, 2·5 in. Transverse diameter of perfect portion, 2·1 in. Transverse diameter of shaft at fractured portion, 2·1 in. Antero-posterior diameter of ditto, 1·5 in.

Fig. 4.—Upper extremity and portion of shaft of tibia, from the Niti Pass.—B.M.

Length from anterior margin of the crista tibiæ to posterior border of articular surface, 4·8 in. Breadth of inner condyloid fossa, 2·6 in. Antero-posterior diam. of inner condyloid fossa, centre, 2·3 in.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Scaphoid bone of carpus, left side, from the Niti Pass.—B.M.

Greatest antero-posterior diameter, 2·2 in. Greatest transverse ditto, 3·3 in. Greatest vertical, 2·6 in.

Figs. 6, 6 *a*, and 6 *b*.—Fragment of scapula, including glenoid cavity and coracoid process, from the Niti Pass.—B.M.

Length of fragment, 5·8 in. Height of glenoid cavity, 2·9 in. Greatest breadth of ditto, 2·4 in. Height of coracoid process above glenoid cavity, 1·6 in.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—First phalanx, from the Niti Pass.—No. 39,654 B.M.

Length (superiorly), 1·3 in. Transverse diameter of posterior surface, 2· in. Vertical ditto, 1· in. Transverse diameter of anterior surface, 1·7 in.

Figs. 8, 8 *a*, 8 *b*, and 8 *c*.—Second phalanx, from the Niti Pass.—B.M.

Length between centres of articular surfaces, 1·1 in. Greatest breadth, 2·5 in. Breadth of posterior articular surface, 1·8 in. Breadth of anterior articular ditto, 1·6 in. Height of posterior articular surface, ·8 in.

Fig. 9.—Fragment of bone of Rhinoceros, from the Niti Pass.

Length of fragment, 1·7 in. Breadth, 1·2 in.

Figs. 10, 10 *a*, and 10 *b*.—Fragment of lower end of femur, from the Niti Pass.—B.M.

Antero-posterior diameter internally, 6·6 in. Length of rotular surface ditto, 4·3 in. Length of rotular surface in centre, 2·8 in. Breadth of ditto in centre of height, 2·8 in.

Figs. 11, 11 *a*, and 11 *b*.—Fragment of head of humerus from Beloochistan.

Length of fragment, 6·4 in. Breadth of upper extremity, 3·5 in. Smallest antero-posterior diameter of ditto, 2·6 in. Greatest diameter of head (articular surface), 2·7 in. Length of crest of great tuberosity, 5·9 in.

Figs. 12, 12 *a*, and 12 *b*.—Fragment of lower end of right radius, from Beloochistan.

Breadth of inferior articular surface, 3·3 in. Length of ridge dividing scaphoid and semilunar surfaces, 1·4 in. Breadth of scaphoid surface, 1·8 in. Breadth of semilunar ditto, 1·5 in.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—Scaphoid of right carpus, from Beloochistan.

Antero-posterior diameter, 2·9 in.; transverse, 3·4 in.; vertical, 2·8 in.

Figs. 14 and 14 *a*.—Fragment of adult lower jaw of *Rhinoceros Perimensis*, horizontal ramus, containing three true molars.—Col. Fulljames.

Length of fragment, 15·9 in. Depth of ramus, 4·5 in. Thickness, 3· in. Length of three true molars, 7·9 in.

Figs. 15 and 15 *a*.—Fragment of horizontal ramus of lower jaw of *Rhinoceros Perimensis*, containing three true molars, which agree closely with those of Kaup's *Acerotherium incisivum*.—B.M.

Length of fragment, 12·5 in. Depth of ramus, 5·2 in. Thickness, 2·1 in. Length of three true molars, 7· in.

Figs. 16, 16 *a*, and 16 *b*.—Upper articulating extremity of femur of *Rhinoceros Perimensis*.—B.M.

Length of fragment, 8·4 in. Breadth of upper extremity, including great trochanter, 9·1 in. Diameter of articular surface of head, 4· in.

Figs. 17, 17 *a*, and 17 *b*.—Metacarpal bone (medius) of *Rhinoceros Perimensis*.

Extreme length, 7·7 in. Smallest transverse diameter of shaft, 2·2 in. Breadth of posterior articular surface, 1·9 in. Height of ditto, 1·9 in.

Figs. 18, 18 *a*, and 18 *b*.—Astragalus of Rhinoceros from the Nerbudda Pass.—B.M.

Breadth of tibial surface, 3· in. Smallest antero-posterior diameter, 1·7 in. Breadth of scaphoid surface, 1·9 in. Greatest breadth of cuboid surface, ·9 in. Height of scaphoid surface, 1·8 in. Height of cuboid surface, 2· in.

Figs. 19, 19 *a*, 19 *b*, and 19 *c*.—Scaphoid bone of carpus of Rhinoceros.

Figs. 20, 20 *a*, and 20 *b*.—Head of humerus.

Figs. 21, 21 *a*, and 21 *b*.—Lower extremity of right radius.

Plate LXXVII.

Bones of Anterior Extremity of divers Fossil Indian Species of Rhinoceros.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Humerus, radius, and ulna *in situ*. This specimen was described and figured by Messrs. Baker and Durand in the Journ. As. Soc. for August 1836, vol. v. p. 498, Plate XVII. figs. 1 and 2. The humerus is perfect, with the exception of the deltoid crest. The length of the humerus exceeds that of any of the existing species of Rhinoceros. Its thickness, in proportion to the length of the bone and the development of the articulating pulley, are intermediate between the Sumatra and Indian species. The breadth at the condyles is nearly in the same proportion as that of the Indian Rhinoceros. The length of the radius in proportion to the femur is a little less than in the Indian, and somewhat in excess of the small Sumatra species.—B.M.

Length of humerus from upper articular surface to lower surface of inner condyle, 17·3 in. Extreme length of humerus, 21· in. Greatest width of humerus at termination of deltoid crest, 6·3 in. Greatest width of humerus at upper extremity, 6·2 in. Greatest oblique diam. of humerus at lower extremity, 7·8 in. Greatest ant. posterior diam. of upper extremity, 6·3 in. Greatest ant. post. diam. of lower extremity, 5· in. Circumference of shaft beneath deltoid crest, 11·5 in. Diameter of upper articular surface, 4·2 in. Width of lower articular surface, 4·6 in. Length of radius, 15·5 in. Width of upper extremity of ditto, 4·8 in. Probablo width of lower extremity of ditto, 4·8 in. Length of ulna (olecranon broken), 19·3 in. Width of conjoined lower surfaces of radius and ulna, 6·6 in. Circumference round centre of conjoined shafts, 11·7 in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—Humerus, with strongly-developed deltoid crest. This specimen also is described and figured by Messrs. Baker and Durand, Journ. As. Soc., vol. v. p. 499, Plate XVII. fig. 5.—B.M.

Length of fragment, 12·2 in. Width including deltoid crest (upper extremity), 8· in. Antero-posterior diameter of ditto, 6·1 in. Length of deltoid crest, 8·2 in. Greatest width of lower extremity, 7· in. Antero-posterior diameter of ditto internally, 4·6 in. Width of lower articular surface, 4·4 in.

Figs. 3, 3 *a*, and 3 *b*.—Fragment of head of humerus.—B.M.

Length of fragment, 12·5 in. Width of upper extremity, including deltoid crest, 7·9 in. Antero-posterior diameter of ditto, 5· in. Length of deltoid crest, 8·6 in. Diameter of articular surface of head, 3·6 in.

Figs. 4, 4 *a*, and 4 *b*.—Fragment of lower end of humerus, with articulating surface.

Length of fragment, 10·4 in. Width of lower extremity, 5·4 in. Antero-posterior of lower extremity internally, 4·7 in.

Figs. 5, 5 *a*, and 5 *b*.—Fragment of lower end of humerus, with articulating surface.—B.M.

Length of fragment, 9·2 in. Width of lower extremity, 5·3 in. Antero-posterior diam. of lower extremity internally, 4·3 in.

Fig. 6.—Upper articulating surface of ulna, with upper end of radius. The tip of the olecranon is broken off.—B.M.

Width of articulating surface, 4·3 in. Chord of sigmoid cavity, 2·4 in.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—Upper end of ulna, with entire radius.—B.M.

Extreme length of conjoined radius and ulna, 15·3 in. Length of radius from upper surface to styloid process, 11·3 in. Width of upper extremity of radius, 4· in. Width of lower extremity of radius across epiphysial line, 4· in. Circumference of radius in centre of shaft, 5·5 in.

Figs. 8, 8 *a*, and 8 *b*.—Fragment of radius, with lower articulating surface.—B.M.

Length of fragment, 9·4 in. Circumference of shaft at fractured extremity, 6·7 in. Width of lower articular surface, 3·6 in.

Figs. 9, 9 *a*, 9 *b*, and 9 *c*.—Fragment of ulna, with lower articulating surface.—B.M.

Length of fragment, 12·2 in. Greatest width of lower articular surface, 2· in. Least transverse diameter of shaft of tibia, 2·7 in.

Plate LXXVIII.

Bones of Posterior Extremity of divers Fossil Indian Species of Rhinoceros.

Figs. 1, 1 *a*, and 1 *b*.—Femur of fossil Rhinoceros from the Sewalik hills. The figures are copied from drawings by Messrs. Baker and Durand, in the Journ. Asiatic Soc. for Aug. 1836, vol. v. p. 499. The specimen was found in close proximity to the humerus and radius, Plate LXXVII., fig. 1, so that there could be no doubt that it belonged to the same animal. It is perfect except at the lower part of the great trochanter. The fossil has a greater development in its anterior, and a somewhat less development of its posterior, extremity, than in the Indian Rhinoceros, but the difference is not excessive. The third trochanter also differs from 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.

Length from head to bottom of inner condyle, 24·5 in.; from head to bottom of third trochanter, 17·7 in. Breadth from head to most salient point of great trochanter, 10·6 in. Breadth across condyles, 6·82 in. Diameter of articulating head, 4·65 in. Antero-posterior diameter of inner condyle, 8·45 in.; antero-posterior diameter of outer, 6·35 in.

Figs. 2 and 2 *a*.—Mutilated fragment of upper end of femur.—B.M.

Extreme length of fragment, 11·5 in. Width across third trochanter, 6· in. Circumference below third trochanter, 9·5 in.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Tibia and fibula conjoined.—B.M.

Extreme length of tibia, 16·9 in. Extreme length of fibula, 16· in. Extreme transverse diameter of upper extremity of tibia, 6·1 in. Extreme antero-posterior diameter of upper, including tuberosity, 7· in. Extreme width of lower articular surface, 3·8 in. Extreme antero-posterior diameter of ditto, 3·1 in. Least circumference of shaft of tibia, 9·1 in.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—Fragment of tibia almost perfect.—B.M.

Extreme length, 13·6 in. Least circumference of shaft, 8· in.

Figs. 5, 5 *a*, and 5 *b*.—Fragment of tibia, including lower articulating surface.—B.M.

Length of fragment of tibia, 11·8 in. Width of inferior articular surface, 3·4 in. Least circumference of shaft, 8·1 in.

Figs. 6 and 6 *a*.—Patella.—B.M.

Height, 4·1 in.

Figs. 7 and 7 *a*.—Patella.

Height, 4·7 in. Width of articulating surface, 4· in. Height of ditto, 2·9 in.

Figs. 8, 8 *a*, and 8 *b*.—Bones of tarsus (calcaneum, scaphoid, cuboid, and three cuneiforms) with index and medius metatarsals. The calcaneum and scaphoid do not belong to the remainder.—B.M.

Greatest width of scaphoid, 3·1 in. Greatest width of cuboid, 2· in. Greatest width of external cuneiform, 2·3 in. Greatest width of middle ditto, 1·3 in. Greatest width of inner ditto, 1·9 in. Greatest width of upper articular surface of medius, 2·35 in. Greatest width of upper extremity of index, 1·75 in.

Figs. 9, 9 *a*, and 9 *b*.—Calcaneum.—B.M.

Extreme length, 5·5 in. Height, 3·4 in. Width, 2·8 in.

Figs. 10, 10 *a*, and 10 *b*.—Calcaneum.

Extreme length, 6·5 in. Height, 2·9 in. Width, 3·9 in.

Figs. 11 and 11 *a*.—Calcaneum.—B.M.

Extreme length, 5·8 in. Height, 3·1 in. Width, 3·4 in.

Figs. 12, 12 *a*, and 12 *b*.—Astragalus.—B.M.

Width of anterior articular surface, 3· in. Greatest width of cuboid segment of ditto, 1· in. Width of trochlea, 3·6 in. Antero-posterior diam. of trochlea in centre, 2· in. Greatest height, 2·8 in. Greatest antero-posterior diameter internally, 3·6 in.

Figs. 13, 13 *a*, and 13 *b*.—Astragalus.

Width of anterior articular surface, 3·4 in. Greatest width of cuboid segment of ditto, 1·1 in. Width of trochlea, 3·3 in. Antero-posterior diam. of trochlea in centre, 2· in. Greatest height, 2·6 in. Greatest antero-posterior diameter internally, 3·5 in.

Plate LXXIX.

Bones of Anterior and Posterior Extremities of divers Fossil Indian Species of Rhinoceros.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Left scaphoid bone of carpus.—B.M.

Height, 2·5 in. Width of inferior articular surface, 2·9 in. Greatest antero-posterior diameter, 2·6 in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—Left scaphoid of carpus.—B.M.

Greatest height, 2·6 in. Antero-posterior diameter, 2·35 in. Width of inferior articular surface, 2·7 in.

Figs. 3, 3 *a*, and 3 *b*.—Unciform bone of carpus.—B.M.

Greatest antero-posterior diameter of upper surface, 2·1 in.

Figs. 4, 4 *a*, and 4 *b*.—Unciform bone of carpus.—B.M.
Greatest antero-posterior diameter of upper surface, 2·2 in.

Figs. 5, 5 *a*, and 5 *b*.—Unciform bone of carpus.—B.M.
Greatest antero-posterior diameter of upper surface, 1·6 in.

Figs. 6, 6 *a*, and 6 *b*.—Trapezoid bone of carpus.
Antero-posterior diameter of upper articular surface, 1·4 in.

Figs. 7, 7 *a*, and 7 *b*.—Left index metacarpal bone.—B.M.
Extreme length, 6·5 in. Width of shaft in centre, 1·7 in.

Figs. 8, 8 *a*, and 8 *b*.—Right index metacarpal bone.—B.M.
Extreme length, 6·5 in. Width of shaft in centre, 1·5 in.

Figs. 9, 9 *a*, and 9 *b*.—Left index metacarpal bone.—B.M.
Extreme length, 6·6 in. Width of trapezoid surface, 1·1 in. Width of shaft in centre, 1·6 in.

Figs. 10, 10 *a*, and 10 *b*.—Left medius metacarpal bone.—B.M.
Extreme length, 7·2 in. Greatest width of shaft, 2·3 in.

Figs. 11, 11 *a*, and 11 *b*.—Left medius metacarpal bone.—B.M.
Extreme length, 7·3 in. Extreme width of shaft, 2·3 in.

Figs. 12, 12 *a*, and 12 *b*.—Left medius metacarpal bone.—No. 39,655 B.M.
Width of surface for os magnum, 2· in. Width of surface for os unciforme, 1· in. Width of shaft, 2· in.

Figs. 13, 13 *a*, and 13 *b*.—Left annularis metacarpal bone.—B.M.
Extreme length, 6·5 in. Width of shaft in centre, 1·7 in.

Figs. 14, 14 *a*, and 14 *b*.—Left annularis metacarpal bone.—B.M.
Extreme length, 6·3 in. Width of facet for unciform, 1·5 in. Width of shaft in centre, 1·5 in. Width of distal articular surface, 1·65 in.

Figs. 15 and 15 *a*.—Index and medius metatarsal bones conjoined. *b*. Index. *c*. Medius.—B.M.
Extreme length of index, 6·5 in. Extreme length of medius, 7·5 in. Width of index shaft at centre, 1·3 in. Width of medius shaft at centre, 2·3 in.

Figs. 16, 16 *a*, and 16 *b*.—Right index metatarsal bone.—B.M.
Extreme length, 6·95 in. Width of shaft in centre, 1·25 in.

Figs. 17, 17 *a*, and 17 *b*.—Right medius metatarsal bone.—B.M.
Extreme length, 6·5 in. Width of shaft in centre, 1·9 in.

Figs. 18, 18 *a*, and 18 *b*.—Left medius metatarsal bone.—B.M.
Extreme length, 6·7 in. Width of shaft in centre, 2·05 in.

Figs. 19, 19 *a*, and 19 *b*.—Left annularis metatarsal bone.—B.M.
Extreme length, 5·6 in. Width of shaft in centre, 1·4 in.

Figs. 20, 20 *a*, 20 *b*, 20 *c*, and 20 *d*.—Medius metatarsal bone.—B.M.
Extreme length, 6·1 in. Width of shaft in centre, 2·3 in.

Figs. 21, 21 *a*, and 21 *b*.—Calcaneum.—B.M.
Extreme length, 5·8 in. Extreme height, 2·9 in. Extreme width, 3·6 in.

Figs. 22, 22 *a*, 22 *b*, and 22 *c*.—Cuboid bone.—B.M.
Greatest antero-posterior diameter of upper surface, 1·8 in. Greatest width of ditto, 2·35 in. Greatest height, 3· in.

Figs. 23, 23 *a*, 23 *b*, and 23 *c*.—Cuboid bone.
Greatest antero-posterior diameter of upper surface, 1·65 in. Greatest width of ditto, 2· in. Greatest height, 2·75 in.

Plate LXXX.

Chalicotherium Sivalense (Falc. and Caut.).

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Anterior half of an adult head, with the upper and lower jaws in natural apposition, and exhibiting the greatest portion of the dental series of both jaws. The greater part of the cranium proper is absent. The specimen demonstrates the very remarkable fact that the *Chalicotherium Sivalense* was entirely destitute of incisor teeth in either jaw. The intermaxillary bones are perfect to their tips, and consist of slender slips of bone converging to a sharp point; they show that no incisor teeth could have existed in the upper jaw at any period of the animal's age. The anterior portion of the lower jaw is perfect to the alveolar edge. A detached canine is seen on either side, but the intervening space is without a vestige of incisors, and is contracted in correspondence with the convergence of the intermaxillary bones, and sloped off to a fine edge. The upper jaw is also destitute of canines, or of any trace of canine alveoli; but the lower jaw contains two canines, as shown in figs. 1 *a* and 1 *b*, the crowns of which are thick, cuneiform, and somewhat triangular, and slightly inclined forwards, with a blunt apex. The specimen shows three premolars and the first true molar; the two back molars are absent. The characters of the molars are better seen in figs. 3 and 4, and are described in great detail in Dr. F.'s memoir on Chalicotherium.

This beautiful specimen was originally in the Dadoopoor collection of Messrs. Baker and Durand, and is now in the Museum of Marischal College, Aberdeen. Cast in B.M. Its dimensions are as follows :—

Length of intermaxillary bone of right side, 3· in. Greatest depth of ditto, ·4 in. Length of three premolars and first molar, 2·6 in. Length of three premolars, 1·8 in. Breadth of fragment opposite last premolar, 3·2 in. Breadth of palate ·5 in. in front of anterior premolar, 1·5 in. Breadth of palate 1·2 in. in front of anterior premolar, 1·1 in. Height of fragment of maxillary bone from alveolar border (right side), 2·5 in. Length of fragment of maxillary bone on right side, 3·9 in. Greatest breadth of anterior nares, 1·3 in. Extreme length of fragment of lower jaw, 5·5 in. Length of symphysis, 3·1 in. Depth of horizontal ramus at posterior border of first molar, 1·6 in. Greatest thickness of ramus at ditto, ·8 in. Interval between the horizontal ramus at ditto, 1· in. Breadth of lower jaw at posterior border of symphysis, 2·2 in. Least breadth of symphysis, 1·1 in. From posterior border of symphysis to narrowest part of symphysis, 1·9 in. Between alveolar border of canines, 1·2 in. Breadth of incisive margin, ·9 in. Width of palate posteriorly between first molars, 1·3 in. Length of first premolar, upper jaw, right side, ·5 in. Length of second premolar ditto, ·55 in. Length of third premolar (greatest) ditto, ·7 in. Length of first molar ditto, ·95 in. Breadth of first molar ditto, 1·03 in. Breadth of third premolar ditto, ·9 in. Breadth of second premolar ditto, ·76 in. Breadth of first premolar ditto, ·53 in. Length of three premolars and first molar, 2·8 in. Length of three premolars, 1·8 in. Between opposed margins of canine and first premolar, ·9 in. Between anterior margin of first premolar and incisive margin, 1·7 in. Length of first premolar, lower jaw, ·5 in. Length of second premolar, ditto, ·6 in. Length of third premolar, ditto, ·8 in. Length of first molar, ditto, 1·0 in. Breadth of first molar, ditto, ·6 in. Breadth of third premolar, ditto, ·5 in. Breadth of second premolar, ditto, ·43 in. Breadth of first premolar, ditto, ·3 in. Length of crown of canine, ·45 in. Breadth of crown of canine, ·3 in.

Fig. 2.—*Chalicotherium Sivalense*. Upper jaw, right side, with part of orbit, three true molars and last premolar. The muzzle seems to have fined off rather abruptly in front of the molar protuberances,

and the orbit to have been more forward on the face and more depressed below the brow than in *Anoplotherium commune*. The upper surface of the sub-orbitary canal is seen opening behind the anterior angle of the orbit, the floor of which seems to have extended behind the post-orbitary processes.—B.M.

This specimen is also figured as *Anoplotherium Sivalense* in the Proceedings Geol. Soc., No. 98, 1843, Plate II. fig. 2.

Figs. 3 and 3 *a*.—*Chalicotherium Sivalense*. Horizontal and lateral view of left upper jaw, comprising the three true molars and three premolars. The true molars, and especially the two last, are enormously large in comparison with the other teeth, or with the dimensions of the head. If found isolated, they would seem suitable to an animal approaching the size of Rhinoceros, whereas the anterior part of the lower jaw and the muzzle do not reach the dimensions of the Indian Tapir. The outer surface of the molars presents both vertically and horizontally the double chevron or W form of Anoplotherium, but with this difference, that the surface of the re-entering angles is more inclined inwards. The characters of the teeth in this specimen are minutely described in the memoir on Chalicotherium.

This specimen is also figured in the Proceedings Geol. Soc. No. 98, 1843, Plate II. fig. 1.—B.M.

Figs. 4 and 4 *a*.—*Chalicotherium Sivalense*. Fragment comprising the left half of the lower jaw from the angle on to the commencement of the symphysis of an individual which was not quite full grown, containing three true molars and the last premolars, with the empty alveoli of the first two premolars. The last premolar is fully protruded, but unworn; the last molar is in the germ state. The characters of the teeth in this specimen are minutely described in the memoir on Chalicotherium.—B.M.

The dimensions of the specimen are as follows:—

Extreme length of fragment, 6·8 in. Greatest depth of ramus, 2·1 in. Greatest thickness (towards symphysis), 1·1 in. Depth of ramus at anterior margin of third premolar, 1·5 in. Length of alveolus of second premolar, ·55 in. Breadth of alveolus of ditto, ·35 in. Length of third premolar, ·7 in. Breadth of ditto, ·5 in. Length of first molar, ·8 in. Breadth of ditto, ·5 in. Length of second molar, 1·2 in. Breadth of ditto, ·65 in. Length of third molar, 1·5 in. Breadth of ditto, ·65 in.

Plate LXXXI.

Figs. 1, 1 *a*, and 1 *b*.—*Equus Sivalensis* (Falc. and Caut.). Cranium. Upper, palate, and lateral views. The specimen is broken off transversely in front of the second premolar. The three true molars and two back premolars on the right side are well preserved. The left alveolar ridge is mostly deficient.—B.M.

Length of fragment, 15· in. Between extreme points of zygomata, 8·1 in. Between anterior angles of the orbits, 6·2 in. Breadth of nasal ridge at sub-orbital foramen, 2·7 in. Height of cranium from palate at ditto, 3·3 in. From anterior angle of orbit to nasal notch, 6· in. Great diameter of orbit, 2·6 in. Lesser diameter of orbit, 1·9 in. Depth of zygomatic fossa, 1·8 in. Greatest width of cranium at root of zygomata, 4·5 in. Height of cranium from base of occipital to summit of sagittal crest, 3·6 in. From lower border of occipital foramen to posterior border of palate, 8·5 in. Length of three true molars, 3·1 in. Length of two posterior premolars, 2·2 in. Width of palatine notch, 1·9 in. Width of palate posteriorly, 3·3 in. Width of palate anteriorly, 2·5 in. Width of alveoli, 1·2 in.

Figs. 2, 2 *a*, and 2 *b*.—*Equus Sivalensis*. Fragment comprising posterior portion of skull, broken off in front in a line with anterior angles of zygomatic arches. Shows occipital foramen, crest, condyles, and posterior roots of zygomata.—B.M.

Length of fragment, 7·5 in. Height of occipital facet from lower border of occipital foramen to summit of occipital crest, 4·8 in. Between inferior angles of occipital crest, 4·7 in. Breadth of cranium between roots of zygomata, 3·7 in. Length of ridge of occipital condyle, 1·7 in. Height of condyle (greatest), 2·1 in. Between inner margins of condyles, 1·5 in. Height of occipital foramen, 1·6 in.

Fig. 3.—*Equus Sivalensis*. Fragment of upper jaw, with whole series of six molars.—B.M.

Length of fragment, 9·3 in. Height of fragment (length of molar), 4·1 in. Length of molar series, 7·7 in. Length of three true molars, 3·4 in. Breadth of alveoli, 1·3 in.

Fig. 4.—*Equus Sivalensis*. Fragment of horizontal ramus of lower jaw with whole series of six molars.—B.M.

Length of fragment, 11· in. Depth of jaw at anterior border of fourth premolar, 3·6 in. Width of ditto, 1·2 in. Length of molar series, 7·8 in. Length of three true molars, 3·7 in.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—*Equus Namadicus* (Falc. and Caut.), from the Nerbudda Valley. The occipital condyles and foramen and the left zygomatic arch are very perfect; also the whole series of six molars on left side. The specimen is broken off in front of first (permanent) premolar on left side; from this the line of fracture passes obliquely across the palate and through the middle of the hindmost right premolar. The three right true molars are present. The right zygomatic arch is absent.—B.M.

Extreme length of fragment, 17·6 in. From lower border of occipital foramen to posterior border of palate, 9·6 in. Greatest breadth of cranium at roots of zygomatic processes, 4·4 in. Between extreme points of zygomata, 7·9 in. Between anterior angles of orbits, 6· in. Height of cranium from palate at fractured extremity, 3·6 in. Great diameter of orbit, 2·8 in. Lesser diameter of orbit, 1·8 in. Height of occipital facet from lower border of occipital foramen, 4·2 in. Between inferior angles of occipital facet, 4·1 in. Depth of zygomatic fossa, 1·7 in. Width of palatine notch, 1·7 in. Width of palate posteriorly, 3· in. Width of palate anteriorly, 2·7 in. Width of alveoli, 1·1 in. Length of molar series, 7· in. Length of true molars, 3·3 in.

Fig. 6.—*Equus Namadicus*. Fragment of left upper jaw comprising whole molar series.—B.M.

Length of fragment, 9·2 in. Length of molar series, 7· in. Length of three true molars, 3·2 in. Breadth of alveoli, 1·2 in.

Fig. 7.—*Equus Namadicus*. Fragment of left lower jaw with entire molar series. The fracture exposes the fang of the last true molar.—B.M.

Length of fragment, 12·7 in. Depth of jaw at anterior border of fourth premolar, 3·8 in. Width, 1·2 in. Length of molar series, 8· in. Length of three true molars, 3·8 in.

Plate LXXXII.

Fig. 1.—*Equus Sivalensis*. Upper jaw, right side, with entire molar series.—B.M.

Length of third molar, 1·16 in. Breadth of ditto, 1·03 in. Length of second molar, 1·16 in. Breadth of ditto, 1·2 in. Length of first molar, 1·16 in. Breadth

of ditto, 1·23 in. Length of third premolar, 1·23 in. Breadth of ditto, 1·3 in. Length of second premolar, 1·33 in. Breadth of ditto, 1·3 in. Length of first premolar, 1·7 in. Breadth of ditto, 1·2 in.

Fig. 2.—Lower jaw, right side, with entire molar series.

Length of third molar, 1·26 in. Breadth of ditto, ·6 in. Length of second molar, 1·2 in. Breadth of ditto, ·7 in. Length of first molar, 1·2 in. Breadth of ditto, ·8 in. Length of third premolar, 1·3 in. Breadth of ditto, ·8 in. Length of second premolar, 1·26 in. Breadth of ditto, ·83 in. Length of first premolar, 1·45 in. Breadth of ditto, ·73 in. Length of molar series, 7·65 in. Length of three true molars, 3·55 in.

Fig. 3.—*Equus Sivalensis.* Fragment of upper jaw, right side, with three true molars and two posterior premolars.—B.M.

Length of third molar, 1·25 in. Breadth of ditto, 1·05 in. Length of second molar, 1· in. Breadth of ditto, 1·15 in. Length of first molar, ·9 in. Breadth of ditto, 1·13 in. Length of third premolar, 1·15 in. Breadth of ditto, 1·2 in. Length of second premolar, 1·2 in. Breadth of ditto, 1·2 in. Length of molar series (first premolar wanting), 5·45 in. Length of three true molars, 3·15 in.

Fig. 4.—*Equus Sivalensis.* Fragment of lower jaw, including right horizontal ramus, with three anterior molars, milk dentition, and symphysis with outer incisor and alveoli of middle and inner incisors on either side.

Length of fragment, 9·3 in. Length of milk molar series, 4·15 in. Interval between first milk molar and external incisive alveolus, 3·75 in. Between central points of inner alveolar border of external incisors, 1·3 in. Length of third milk molar, 1·45 in. Breadth of ditto, ·56 in. Length of second milk molar, 1·25 in. Breadth of ditto, ·6 in. Length of first milk molar, 1·5 in. Breadth of ditto, ·63 in. Length of crown of external incisor, ·53 in. Breadth of crown of ditto, ·35 in. Length of alveolus of middle incisor, ·55 in. Length ditto of internal ditto, ·55 in. Between posterior angles of last milk molars, 2·16 in. Between anterior angles of anterior milk molars, 1·2 in.

Figs. 5 and 5 *a*.—*Equus Sivalensis.* Fragment, comprising anterior part of upper and lower jaws in almost natural apposition. Shows six incisors and two small canines in both jaws; also the two front premolars on one side of lower jaw.—B.M.

Between posterior angles of external incisors of lower figure in 5 *a*, 1·9 in. Length of crown of three incisors of one side, 1·2 in. Between anterior edge of mental foramen and anterior edge of canine, 2·4 in. Between anterior edge of mental for. and posterior edge of ext. incisors, 2·9 in. Diastema between canine and exterior incisor, ·4 in. Diastema between canine and anterior edge of first premolar, 3·3 in. Length of anterior premolar, 1·35 in. Breadth of ditto, ·6 in. Length of external incisor, ·5 in. Length of middle ditto, ·45 in. Length of internal ditto, ·35 in. Between posterior angles of exterior incisors of upper jaw in fig. 5 *a*, 2·2 in. Length of three incisors of one side, 1·8 in. Diastema between anterior premolar and canine, 3·2 in. Height of first premolar, 3· in. Length of external incisor, ·8 in. Length of middle ditto, ·8 in. Length of internal ditto, ·75 in.

Figs. 6, 6 *a*, and 6 *b*.—*Equus Sivalensis.* Fragment comprising anterior portion of palate, with six upper incisors and two rudimentary canines.—B.M.

Between posterior angles of external incisor alveoli, 2·45 in. Between external alveolar margins of canines, 2·1 in. Between canine and external incisor, ·4 in. Breadth (extreme) of incisor series, 2·8 in. Breadth of three incisors (oblique), 1·75 in. Length of crown of external incisor, ·7 in. Breadth of ditto, ·45 in. Length of crown of middle incisor, ·65 in. Breadth of ditto, ·46 in. Length of crown of internal incisor, ·56 in. Breadth of ditto, ·5 in.

Fig. 7.—*Equus Namadicus*, from the Nerbudda. Fragment of upper jaw, right side, with entire molar series.—B.M.

Length of molar series, 7·05 in. Length of three true molars, 3·2 in. Length of third molar, 1·15 in. Breadth of ditto, ·9 in. Length of second molar, 1·05 in. Breadth of ditto, 1·1 in. Length of first molar, ·96 in. Breadth of ditto, 1·05 in. Length of third premolar, 1·15 in. Breadth of ditto, 1·15 in. Length of second premolar, 1·16 in. Breadth of ditto, 1·1 in. Length of first premolar, 1·55 in. Breadth of ditto, 1·0 in.

Fig. 8.—*Equus Namadicus*. Fragment of lower jaw, left side, with entire molar series.—B.M.

Length of molar series, 7·93 in. Length of three true molars, 3·76 in. Length of third molar, 1·2 in. Breadth of ditto, ·5 in. Length of second molar, 1·2 in. Breadth of ditto, ·65 in. Length of first molar, 1·25 in. Breadth of ditto, ·7 in. Length of third premolar, 1·2 in. Breadth of ditto, ·7 in. Length of second premolar, 1·3 in. Breadth of ditto, ·73 in. Length of first premolar, 1·55 in. Breadth of ditto, ·66 in.

Figs. 9, 9 *a*, and 9 *b*.—*Equus Palæonus* (Falc. and Caut.), from the Nerbudda. Fragment of anterior portion of palate, with six incisors and two small canines. Presented by C. Frazer, Esq.—B.M.

Between inner alveolar margins of canines, 1·1 in. Diastema between canino and external incisor, ·8 in. Between posterior angles of external incisors, 1·7 in. Length of three incisors of one side, 1·6 in. Length of external incisor, ·6 in. Length of middle ditto, ·65 in. Length of internal ditto, ·56 in. Length of alveolus of canine on left side, ·4 in. Breath of ditto, ·3 in.

Figs. 10, 10 *a*, and 10 *b*.—*Equus Palæonus*. Fragment of anterior portion of lower jaw, with six incisors.—B.M.

Breadth across posterior margin of external incisive alveolus of left side, 2·4 in. Length of three incisors of one side, 1·45 in. Length of broken end of external incisor, ·45 in. Length of crown of middle incisor, ·5 in. Length of crown of internal ditto, ·4 in.

Figs. 11 and 11 *a*.—*Equus Palæonus*. Fragment of lower jaw, right side, milk dentition.—B.M.

Length of third milk molar, grinding surface, 1·3 in. Breadth of ditto, ·36 in. Length of second milk molar, grinding surface, 1·15 in. Breadth of ditto, ·4 in. Length of first milk molar, grinding surface, 1·2 in. Breadth of ditto, ·4 in.

Figs. 12, 12 *a*, and 12 *b*.—Fossil *Equus*, from the Irrawaddi. Fragment of lower jaw, comprising symphysis and six incisors.—B.M.

Length of fragment, 4·4 in. Between external angles of external incisors, 2·4 in. Length of three incisive alveoli of one side, 1·5 in.

Fig. 13.—*Hippotherium Antilopinum* (Falc. and Caut.), from the Sewalik hills. Fragment of upper jaw, left side, with entire series of six molars.—B.M.

Length of molar series, 5·3 in. Length of three true molars, 2·36 in. Length of third molar, ·8 in. Breadth of ditto, ·55 in. Length of second molar, ·85 in. Breadth of ditto, ·76 in. Length of first molar, ·8 in. Breadth of ditto, ·85 in. Length of third premolar, ·93 in. Breadth of ditto, ·86 in. Length of second premolar, ·96 in. Breadth of ditto, ·95 in. Length of first premolar, 1·25 in. Breadth of ditto, ·83 in. Height of second premolar, 2·15 in. Height of first premolar to origin of fangs, 1·4 in.

Fig. 14.—*Hippotherium Antilopinum*. Fragment of lower jaw, right side, with three premolars and portion of first true molar.—B.M.

Length of three premolars, 3·1 in. Length of three premolars and first molar (fragment), 4·1 in. Remaining portion of diastema, 1·8 in. Length of first molar (fragment), ·8 in. Breadth of ditto, ·55 in. Length of third premolar, ·96 in. Breadth of ditto, ·6 in. Length of second premolar, ·96 in. Breadth of ditto, ·55 in. Length of first premolar, 1·05 in. Breadth of ditto, ·5 in.

Figs. 15, 15 *a*, and 15 *b*.—*Hippotherium Antilopinum*. Symphysis of lower jaw, with fragments of six incisors.—B.M.

Length of fragment, 2·2 in. Breadth at anterior angles of canines, 1·6 in. Length of fragments of three incisors of one side, ·95 in.

Fig 16.—*Hippotherium Antilopinum*. Portion of skull, with palate. Shows three true molars and third (permanent) premolar on both sides, and portion of second premolar on right side.—B.M.

Length of three true molars, 2·5 in. Length of three true molars, including last premolar, 3·36 in. Width of palate posteriorly, 2·in. Width of palate between third premolars, 1·9 in. Length of third molar, ·85 in. Breadth of ditto, ·75 in. Length of second molar, ·8 in. Breadth of ditto, ·85 in. Length of first molar, ·8 in. Breadth of ditto, ·9 in. Length of third premolar, ·9 in. Breadth of ditto, ·9 in.

Fig. 17.—*Hippotherium Antilopinum*. Portion of molar, showing plication of enamel.—B.M.

Length of fragment, ·75 in. Breadth, ·45 in.

Fig. 18.—*Hippotherium Antilopinum*. Molar, with characteristic plication of the enamel, like that shown in fig. 19.[1]

Length of grinding surface, ·85 in. Greatest breadth of ditto, ·85 in.

Fig. 19.—*Hippotherium gracile* (of Europe). Molar, with characteristic plication of enamel.

Greatest length of grinding surface, 1·03 in. Greatest breadth of ditto, ·975 in.

Plate LXXXIII.

Figs. 1 to 11.—*Equus* and *Hippotherium*.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Atlas.—B.M.

Extreme width, 4·5 in. Length of inferior arch, 1·4 in. Height of spinal canal anteriorly, 1·5 in. Width of ditto, 1·7 in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—Axis.—B.M.

Extreme length of body, 4·1 in. Length of spinal platform in centre, 2·5 in. Width across posterior articular processes, 2·8 in.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Cervical vertebra.—B.M.

Extreme length of body, 4·4 in. Between extremities of oblique processes, 4·5 in. Width between posterior oblique processes, 2·6 in.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—Cervical vertebra.—B.M.

Extreme length between extremities of oblique processes, 4· in. Width of spinal platform in centre, 1·7 in.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Cervical vertebra.—B.M.

Extreme length of body, 4·3 in.

Figs. 6, 6 *a*, 6 *b*, and 6 *c*.—Dorsal vertebra.—B.M.

Length of spine (fractured), 6·5 in. Length of body, 2·2 in. Width between transverse processes, 3·8 in.

Fig. 7.—Portion of pelvis, showing acetabulum.—B.M.

Chord of acetabulum, 2·4 in.

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[1] This specimen somewhat resembles that figured by Messrs. Baker and Durand in Journ. As. Soc., vol. iv., Plate xlv., and described by Dr. Falconer in same volume, p. 58.

Fig. 8.—Portion of pelvis, showing acetabulum and thyroid foramen. —B.M.

Chord of acetabulum, 2· in. Diameter of thyroid foramen (anterior portion), 2·3 in.

Figs. 9, 9 *a*, and 9 *b*.—Lower end of humerus and upper end of radius and ulna *in situ*.—B.M.

Width of lower end of humerus, 3·1 in. Width of upper end of radius, 3·2 in. Antero-posterior diameter of lower end of humerus internally, 3·4 in.

Figs. 10, 10 *a*, 10 *b*, and 10 *c*.—Fragment of lower articulating extremity of femur.—B.M.

Width of lower extremity of femur, 2·9 in. Antero-posterior diameter of femur externally, 3·2 in. Width of rotular surface, 1·5 in.

Figs. 11, 11 *a*, 11 *b*, and 11 *c*.—Lower end of femur.—B.M.

Width of lower end, 3·5 in.

Figs. 12, 12 *a*, and 12 *b*.—*Hippopotamus* (*Hexaprotodon*) *Iravaticus*. Lower end of radius.—B.M.

Width of lower end, 2·8 in. Antero-posterior diameter of ditto, 1·7 in.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—Second cervical vertebra or axis. Species undetermined. From Col. Baker's collection.—B.M.

Extreme length of body (fractured), 5·5 in. Width of odontoid surface, 3·2 in. Width between outer edges of posterior articular surfaces, 3·5 in.

Figs. 14, 14 *a*, 14 *b*, and 14 *c*.—Fragment of lower end of femur. Species undetermined.—B.M.

Circumference above rotular surface, 8· in. Width of rotular surface, 1·5 in.

Plate LXXXIV.

Figs. 1 and 1 *a*.—*Equus Sivalensis*. Upper articulating extremity, and portion of shaft of ulna.—B M.

Width of radial articular surface, 3·2 in. Chord of sigmoid cavity, 1·55 in. From apex of olecranon to anterior edge of sigmoid cavity, 5·7 in.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—*Equus Sivalensis*. Upper end and portion of shaft of ulna.—B.M.

Width of radial articular surface, 3·1 in. Circumference at lower fractured extremity, 5·2 in.

Figs. 3, 3 *a*, and 3 *b*.—*Equus Sivalensis*. Fragment of lower end of radius.—B.M.

Width of inferior articulating surface, 2·8 in. Greatest antero-posterior diameter, 1·5 in.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—*Equus Sivalensis*. Metacarpal bone. Entire shaft and lower articulating surface.—B.M.

Extreme length, 10· in. Width of upper articular surface, 2·1 in. Width of lower, 1·8 in. Circumference of shaft in centre, 4·1 in.

Figs. 5, 5 *a*, and 5 *b*.—*Hippotherium Antilopinum*. Fragment of upper end of radius.—B.M.

Width of upper articulating surface, 2·5 in.

Figs. 6, 6 *a*, and 6 *b*.—*Hippotherium Antilopinum*. Fragment of lower end of radius.—B.M.

Width of lower articular surface, 1·85 in.

Figs. 7, 7 *a*, and 7 *b*.—*Hippotherium Antilopinum.* Fragment of lower end of radius with bones of carpus.—B.M.

Width of inferior articulating surface of radius, 2·1 in.

Figs. 8 and 8 *a*.—*Hippotherium Antilopinum.* Lower end of radius, with bones of carpus, and portion of metacarpus.

Figs. 9, 9 *a*, 9 *b*, and 9 *c*.—*Hippotherium Antilopinum.* Metacarpal bone.—B.M.

Extreme length, 8·8 in. Width of upper articular surface, 1·5 in. Width of lower articular surface fractured, 1·5 in. Circumference in centre of shaft, 3·2 in.

Figs. 10, 10 *a*, and 10 *b*.—*Hippotherium Antilopinum.* Fragment of metacarpal bone; lower end broken off.—B.M.

Length of fragment, 8·1 in. Width of articular surface of middle metacarpal, 1·65 in. Width of articular surface of left metacarpal, ·4 in. Width of articular surface of right ditto, ·35 in.

Figs. 11 and 11 *a*.—*Hippotherium Antilopinum.* First phalanx.—B.M.

Length, 2·9 in. Greatest width of upper articular surface, 1·7 in. Greatest width of lower ditto, 1·3 in.

Figs. 12, 12 *a*, 12 *b*, and 12 *c*.—*Hippotherium Antilopinum.* Second phalanx.—B.M.

Length, 1·5 in. Greatest width of upper articular surface, 1·4 in. Greatest width of lower ditto, 1·25 in.

Figs. 13, 13 *a*, 13 *b*, 13 *c*, and 13 *d*.—Radius of fossil Equus from the Nerbudda, entire.—B.M.

Greatest length of radius, 11·4 in. Width of upper articular surface, 2·7 in. Width of lower articular surface, 2·15 in. Circumference of shaft in centre, 5· in.

Figs. 14, 14 *a*, and 14 *b*.—Shaft of radius of fossil Equus from the Nerbudda. The articulating extremities are imperfect.—B.M.

Length of fragment, 10·7 in. Circumference of shaft in centre, 4·3 in.

Figs. 15, 15 *a*, and 15 *b*.—Equus from the Niti Pass. Upper end of shaft with articulating extremity of radius.—B.M.

Width of upper articulating surface, 2·45 in.

Figs. 16, 16 *a*, and 16 *b*.—Equus from the Niti Pass. Fragment of lower end of tibia.

Width of lower surface, 1·9 in.

Figs. 17 and 17 *a*.—Equus from the Niti Pass. Astragalus.—B.M.

Width of trochlea, 1·45 in. Antero-posterior diameter of ditto, 1·3 in. Width of scaphoid surface, 1·7 in.

Figs. 18, 18 *a*, and 18 *b*.—Equus from the Niti Pass. Os magnum of carpus.—B.M.

Transverse diameter, 1·4 in. Antero-posterior diameter, 1·15 in. Thickness in centre, ·7 in.

Figs. 19, 19 *a*, and 19 *b*.—Equus from the Niti Pass. Third or ungual phalanx.—B.M.

Width of articular surface, 1·55 in. Probable antero-posterior diameter, 2·1 in.

Figs. 20 and 20 *a*.—Equus. Metatarsal bone from Sewalik hills.—B.M. No. 17,828.

Extreme length, 11·1 in. Width of upper articular surface, 2· in. Width of lower ditto, 1·8 in. Circumference at middle of shaft, 4·4 in.

Fig. 21.—Equus. Metatarsal bone from Sewalik hills.—B.M.

Circumference in centre of shaft, 3·8 in.

Plate LXXXV.

Figs. 1, 1 *a*, 1 *b*, 1 *c*, and 1 *d*.—*Equus Sivalensis*. Entire femur, with both articulating extremities.—B.M.

Extreme length, 15·6 in. Transverse diameter of upper extremity, including trochlea, 4·6 in. Antero-posterior diameter of posterior segment of great trochlea, 1·9 in. Transverse diameter of articular surface, 2·5 in. Antero-posterior diameter of articular surface, 2·1 in. Smallest transverse diameter of shaft, 1·8 in. Smallest antero-posterior diameter of shaft, 1·9 in. Transverse diameter of lower extremity, 3·6 in. Antero-posterior diameter externally, 3·6 in. Height of rotular surface in centre, 2·4 in. Height of external condyle above neck of femur, 1·8 in.

Figs. 2, 2 *a*, and 2 *b*.—*Equus Sivalensis*. Upper end of shaft of femur, with upper articular extremity.

Length of fragment, 6·8 in. Breadth of upper extremity, 4·3 in. Transverse diameter of articular surface, 2·2 in. Antero-posterior diameter of ditto, 1·9 in.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—*Equus Sivalensis*.—Entire tibia.—B.M.

Extreme length, 14·5 in. Transverse diameter of upper extremity, 3·5 in. Transverse diameter of shaft (smallest), 1·7 in. Antero-posterior diameter of shaft (smallest), 1·2 in. Transverse diameter of lower extremity, 3· in. Length of ridge dividing articular fossæ, 2·4 in.

Fig. 4.—Lower end of tibia and astragalus of Equus *in situ*, restoration.

Figs. 5, 5 *a*, and 5 *b*.—Calcaneum of *Equus Sivalensis*.—B.M.

Length, 5·8 in. Projection of heel, 3·2 in. Greatest breadth, 2·1 in. Greatest height, 1·9 in.

Figs. 6, 6 *a*, and 6 *b*.—Astragalus of *Equus Sivalensis*.—B.M.

Length (greatest), 2·5 in. Height (greatest), 1·9 in. Breadth of scaphoid surface, 2·1 in. Breadth of trochlea (tibial surface), 1·7 in. Antero-posterior diameter of trochlea in centre, 1·4 in.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—Metatarsal bone of *Equus Sivalensis*.

Extreme length, 11·5 in. Antero-posterior diam. of shaft in centre, 1·2 in. Transverse of shaft ditto, 1·3 in. Transverse of upper extremity, 2· in. Antero-posterior of ditto, 1·7 in. Transverse of lower articular surface, 1·8 in. Greatest antero-posterior of lower articular surface (in centre), 1·5 in.

Figs. 8, 8 *a*, 8 *b*, and 8 *c*.—First phalangeal bone posterior extremity of *Equus Sivalensis*.—B.M.

Length superiorly, 3·1 in. Transverse diam. of posterior extremity, 2·1 in. Vertical of ditto, 1·3 in. Transverse of anterior articular surface, 1·5 in. Vertical of ditto, ·9 in.

Figs. 9, 9 *a*, and 9 *b*.—*Hippotherium Antilopinum*. Fragment of shaft of tibia with lower articulating extremity.—B.M.

Length, 5· in. Breadth of inferior articular surface, 2·4 in. Length of ridge dividing articular fossæ, 1·8 in.

Figs. 10, 10 *a*, and 10 *b*.—Astragalus of *Hippotherium Antilopinum*.—B.M.

Length, 2· in. Breadth of scaphoid surface, 1·6 in. Breadth of tibial surface, 1·3 in. Length of tibia (in centre), 1·2 in.

Figs. 11, 11 *a*, and 11 *b*.—Tarsus, metatarsus, and phalanx of *Hippotherium Antilopinum*.—B.M.

Length of whole figure, 15·3 in.

Figs. 12, 12 *a*, 12 *b*, and 12 *c*.—Metatarsal bone of *Hippotherium Antilopinum*.—B.M.

Length, 10·4 in. Smallest transverse diameter of shaft, 1· in. Smallest antero-posterior diameter of shaft, ·9 in. Transverse of upper extremity, 1·6 in. Antero-posterior of ditto, 1·4 in. Transverse of lower extremity, 1·4 in. Antero-posterior of lower central ridge, 1·2 in.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—Portion of metatarsal bone and first two phalanges of *Hippotherium Antilopinum*.—B.M.

Transverse diameter of inferior extremity of metatarsal, 1·5 in. Length of first phalanx, 2·7 in. ; of second, 1·5 in. Antero-posterior diameter of lower extremity of metatarsal, 1· in.

Figs. 14, 14 *a*, and 14 *b*.—First phalanx of posterior extremity of *Hippotherium Antilopinum*.—B.M.

Length, 3·1 in. Transverse diameter of posterior extremity, 1·6 in. Vertical diameter of ditto, ·9 in. Transverse diameter of anterior extremity, 1·3 in. Vertical diameter of anterior extremity, ·6 in.

Figs. 15, 15 *a*, and 15 *b*.—Second phalanx of posterior extremity of *Hippotherium Antilopinum*.—B.M.

Length, 1· in. Transverse of posterior extremity, 1·5 in. Vertical of ditto, 1· in. Transverse of anterior extremity, 1·3 in. Vertical of ditto, ·7 in.

Figs. 16, 16 *a*, and 16 *b*.—Last phalanx of posterior extremity of *Hippotherium Antilopinum*.—B.M.

Length of fragment, 1·6 in. Greatest breadth, 1·8 in. Height, 1· in.

Fig. 17.—Lower end of tibia and astragalus of *Hippotherium Antilopinum*, restored.

Figs. 18, 18 *a*, and 18 *b*.—Calcaneum of *Hippotherium Antilopinum*.

Greatest length, 4· in.

Plate LXXXVI.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Camelus Sivalensis*. (Falc. and Caut.) Mutilated fragment of cranium broken off in front through the first true molar. The great elevation of the sagittal and occipital crests, the development of the temporal fossæ, and the advanced position and prominence of the orbits, are to be noted. The orbits also are elongated from before backwards, instead of being circular or elongated vertically as in the existing Camel.—B.M. (See Memoir on Camel, Asiatic Res., vol. xix.)

Height of occipital facet, 4·2 in. Width between extreme parts of occipital condyles, 3· in. Height of for. magnum, 1·5 in. Width of ditto, 1·3 in. Between pariet. occipital angles, 4·3 in. From lower angle of for. magnum to posterior border of last molar, 6·1 in. Width of palate between anterior angles of last molars, 2·8 in. Width across widest part of cranial cavity, 4·7 in. Between external aud. canal and posterior border of orbit, 4·8 in. Antero-posterior diameter of orbit, 2·7 in. Vertical diameter of ditto, 1·7 in. Width across at posterior extremity of zygomatic arches, 8·4 in. Width across at posterior angles of orbits, 9·5 in.

Figs. 2, 2 *a*, and 2 *b*.—*Camelus Sivalensis*. Fragment of cranium showing palate with series of true molars on both sides. The specimen also shows the extreme depth of the maxillary which leads to the arched appearance in the nose of the Camel.—B.M.

Length of true molar series, 4·8 in. Width of palate between posterior angles of last molars, 3·2 in. Width of palate between anterior angles of anterior molars, 2· in.

Fig. 3.—*Camelus Sivalensis*. Skull and lower jaw. Both jaws are

locked together, but the anterior and posterior extremities with the upper surface of the skull are wanting. The animal was young, its last permanent molars not being completely developed, and the third milk molar being still in position. The general character is that of the present Camel; the form of maxillaries, thickness of lower jaw and external appearance of the teeth corresponding as closely as two skulls of one species would do. The position of the sub-orbitary foramen, however, is rather higher up on the maxillary, and the tapering of the lower jaw is less than in the existing Camel. This specimen is also figured in 'Asiatic Researches,' vol. xix. Plate XX. fig. 3.—B.M.

Length of molar series (including two last premolars), 6·2 in. Length of three true molars, 4·8 in. Height of ramus of lower jaw opposite last molar, 2·7 in. Thickness of ramus of lower jaw opposite last molar, 1·35 in. Length of molar series of lower jaw (including last premolar), 6·3 in. Length of true molar of lower jaw, ditto, 5·6 in.

Figs. 4 and 4 *a*.—*Camelus Sivalensis*. Cranium including occiput and nasal bones. The great width and massiveness of the cranium as compared with the muzzle are well seen, and also the antero-posterior elongation of the orbit.—B.M.

Antero-posterior diameter of orbit, 2·3 in. Height of ditto, 1·6 in. Between anterior angle of orbit and sub-orbital foramen, 2·3 in. Length of first and second true molars, 2·6 in. Widest part of cranial box, 3·7 in.

Figs. 5 and 5 *a*.—*Camelus Sivalensis*. Lower jaw, which on the right side, with the exception of the condyle and coronoid process, is almost perfect. Fragments containing molars of upper jaw are still in apposition at some places. The specimen shows four incisors on the left side; the third right incisor is wanting. The wear of the teeth and the flattened surface of the fourth or pointed incisor show that the animal must have been of considerable age. This specimen is also figured in the 'Asiatic Researches,' vol. xix. Plate XX. fig. 4, a larger quantity of matrix containing remains of upper jaw being there still adherent.—B.M.

Between outer margins of canines, 2·5 in. Between outer margins of first premolars, 2·1 in. Diastema between canine and first premolar, ·7 in. Length of the molar series, 5·9 in. Diastema between first and last premolar, 3· in. Length of the three true molars, 4·9 in. Length of symphysis, 5·3 in. Interval between rami opposite last molars, 2·6 in.

Plate LXXXVII.

Camelus Sivalensis.

Figs. 1 and 1 *a*.—Palate with molar series on both sides imperfect. That on the right side is most complete, and contains the penultimate and last deciduous molar and the two first true molars.—B.M.

Length of molar series, 4·9 in. Length of penultimate milk molar, 5 in. Length of last deciduous molar, 1·3 in. Length of first true molar, 1·6 in. Length of second true molar, 1·9 in.

Figs. 2 and 2 *a*.—Fragment of upper jaw, left side, containing three true molars.—B.M.

Length of true molar series, 4·9 in. Length of first molar, 1·3 in. Length of second ditto, 1·6 in. Length of third ditto, 1·9 in. Width of grinding surface of first true molar, 1·1 in.

Figs. 3 and 3 *a*.—Fragment of upper jaw, left side, showing the

second and third true molars. This specimen is also figured in 'Asiatic Researches,' vol. xix. Plate XXI. figs. 12 and 13.—B.M.

Length of second true molar, 1·65 in.; of third ditto, 2· in.

Figs. 4 and 4 *a*.—Fragment of upper jaw, containing third and fourth premolars.—B.M.

Length of third premolar, ·85 in.; of fourth, ·95 in.

Figs. 5 and 5 *a*.—Fragment of horizontal ramus of lower jaw, containing three true molars and fourth premolar.—B.M.

Length of molar series of lower jaw, 5·7 in. Length of true molar ditto, 4·7 in. Length of fourth premolar, 0·9 in. Length of first molar, 1·2 in. Length of second ditto, 1·4 in. Length of third ditto, 2·1 in. Length of last lobe of third molar, ·6 in.

Figs. 6 and 6 *a*.—Fragment of lower jaw, right side, with ascending ramus, condyle, and coronoid process, and containing last molar. The jaw exhibits remarkable differences from the jaw of the existing Camel. It more resembles the lower jaw of Ox, Deer, or Antelope, but is shown to be of Camel by the heel or step on the posterior ascending margin, which is the generic mark of a Camel. In the existing Camel the ascending ramus rises at nearly a right angle to the line of jaw; it has considerable breadth antero-posteriorly, and its coronoid process is short, straight, and massive. In the fossil the ascending ramus is as oblique as in the Ox; it has no excess of breadth antero-posteriorly, and the coronoid process is long, slightly curved back, and slender. The condyle also has a much longer transverse diameter, its proportions are more slender, and the depression on its upper margin much deeper than in the existing Camel. The condyles, however, are not nearly so slight and narrow as in the Ox and Buffalo. This specimen is also figured in 'Asiatic Researches,' vol. xix. Plate XX. figs. 6 and 7.—B.M.

Length of last molar, 2·25 in. Length of last lobe of ditto, ·7 in.

Figs. 7 and 7 *a*.—Fragment of horizontal ramus of lower jaw, containing fourth premolar, and the two first and a fragment of third true molars.—B.M.

Length of fourth premolar, ·85 in. Length of first molar, 1·4 in. Length of second ditto, 1·8 in. Length of fragment of third ditto, 1·6 in.

Figs. 8 and 8 *a*.—Fragment of horizontal ramus of lower jaw, containing penultimate and last milk molars and first true molar.—B.M.

Length of penultimate milk molar, ·6 in. Length of last milk molar, 1·7 in. Length of last lobe of ditto, ·7 in. Length of first true molar, 1·6 in.

Figs. 9 and 9 *a*.—Symphysis of lower jaw with series of six incisors. The fourth incisor, or canine, on left side, also seen.—B.M.

Chord of the incisor series, 2·65 in. Length of first incisor, ·7 in. Length of second ditto, ·73 in. Length of third ditto, ·6 in.

Figs. 10, 10 *a*, and 10 *b*.—Symphysis of lower jaw with alveoli of six incisors and two canines (fourth incisors).—B.M.

Width between outer margin of external incisive alveoli, 1·8 in. Width between outer margin of canine ditto, 1·7 in.

Figs. 11 and 11 *a*.—Symphysis of lower jaw with six incisors and two canines (fourth incisors).—B.M.

Chord of incisor series, 1·55 in. Width between canine alveoli, 1·5 in. Length of first incisor, 0·5 in. Length of second ditto, 0·55 in. Length of third or external, 0·65 in.

Plate LXXXVIII.

Vertebræ of *Camelus Sivalensis*.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Atlas with portion of axis adherent to lower end.—B.M.

Length of lower arch of atlas, 2·6 in. Length of upper ditto, 3·1 in. Extreme length of atlas, 4·4 in. Between outer margin of posterior articular processes, 3·6 in.

Figs. 2, 2 *a*, 2 *b*, 2 *c*, and 2 *d*.—Third cervical vertebra.—B.M.

Greatest length of body, 7·7 in. Height of spinal canal posteriorly, 1· in. Width of spinal canal ditto, 1·3 in.

Figs. 3, 3 *a*, 3 *b*, 3 *c*, and 3 *d*.—Fourth cervical vertebra.—B.M.

Length of body, 7·8 in. Length of spinal platform, 5·5 in. Length between extremities of oblique processes, 8·5 in. Between extremities of inferior transverse processes anteriorly, 4·6 in.

Figs. 4, 4 *a*, 4 *b*, 4 *c*, and 4 *d*.—Fifth cervical vertebra.—B.M.

Greatest length of body, 6·9 in. Width of spinal canal anteriorly, 1·1 in. Height of spinal canal anteriorly, 1· in. Between outer margins of vertebral foramina, 1·95 in. Diameter of vertebral foramen, 0·4 in. Probable width across transverse processes, 3·8 in.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Cervical vertebra imperfect.—B.M.

Length of fragment of body, 3·9 in. Height of spinal canal posteriorly, 1·2 in. Width of spinal canal ditto, 1·2 in.

Figs. 6, 6 *a*, 6 *b*, and 6 *c*.—Cervical vertebra.—B.M.

Greatest length of body, 4·65 in. Height of spinal canal posteriorly, 1·3 in. Width of spinal canal ditto, 1·5 in.

Plate LXXXIX.

Bones of anterior extremity of *Camelus Sivalensis*.

Fig. 1.—Scapula, almost perfect.—B.M.

Length of scapula, 22· in. Width at narrowest part, 3·2 in. Height of coracoid process, 2·3 in. Greatest projection of spine, 1·6 in.

Fig. 2.—Glenoid cavity of scapula.

Greater diameter, 2·6 in. Lesser ditto, 2·3 in.

Figs. 3, 3 *a*, and 3 *b*.—Head of humerus, with double bicipital groove.—B.M.

Greatest antero-posterior diameter, 5· in. Greatest transverse ditto, 4·6 in. Chord of double bicipital groove, 3· in.

Fig. 4.—Head of humerus, with double bicipital groove.—B.M.

Greatest antero-posterior diameter, 4·6 in. Greatest transverse ditto, 3·6 in. Chord of double bicipital groove, 2·7 in.

Figs. 5, 5 *a*, and 5 *b*.—Lower end of humerus, with articular surface.—B.M.

Transverse diameter of inferior articular surface, 3·6 in. Antero-posterior diameter internally of inferior extremity, 4· in. Length of fragment, 7·1 in.

Figs. 6, 6 *a*, and 6 *b*.—Lower end of humerus and upper end of conjoined radius and ulna *in situ*.—B.M.

Width of inferior articular surface of humerus, 3·3 in. Width of superior articular surface of radius, 3·45 in.

Figs. 7, 7 *a*, and 7 *b*.—Portion of shaft and lower articulating extremity of conjoined radius and ulna.—B.M.

Width of conjoined lower extremity of radius and ulna, 2·9 in. Circumference of conjoined shafts at fractured extremity, 5·9 in. Length of fragment, 7·3 in.

Figs. 8, 8 *a*, 8 *b*, and 8 *c*.—Lower end of conjoined radius and ulna, with carpal and metacarpal bones.—B.M.

Extreme width of lower conjoined articular surface of radius and ulna, 3·8 in. Greatest antero-posterior diameter of ditto, 2·1 in. Extreme length of fragment of metacarpal, 14·55 in. Width of upper articular surface of metacarpal, 3·3 in. Greatest transverse diameter of shaft at centre, 1·8 in. Least antero-posterior diameter of shaft at centre, 1·4 in.

Fig. 9.—Lower end of radius and ulna with bones of carpus.—B.M.

Greatest length of pisiform, 2·1 in. Height, 2· in.

Figs. 10, 10 *a*, 10 *b*, and 10 *c*.—Bones of carpus.—B.M.

Figs. 11 and 11 *a*.—Fragment of upper end of metacarpal bone.—B.M.

Length, 12· in. Width of upper articular surface of ditto, 2·9 in. Greatest transverse diameter at centre of shaft, 1·6 in. Least antero-posterior diameter at centre of shaft, 1·3 in.

Figs. 12, 12 *a*, 12 *b*, and 12 *c*.—Lower articulating extremity of metacarpal bone, deeply fissured.—B.M.

Extreme length of fragment, 5·6 in. Interval between articular surfaces, ·5 in. Greatest width of articular surface, 1·85 in. Greatest antero-posterior of articular surface in centre, 1·9 in. Circumference of shaft at fractured extremity, 5·9 in.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—First phalanx and sesamoid bone.—B.M.

Length of first phalanx, 3·9 in. Width of proximal articular surface, 1·6 in. Greatest width of distal surface, 1·5 in. Length of articular surface of sesamoid bone, 1· in. Width of articular surface of sesamoid bone, ·7 in.

Figs. 14, 14 *a*, 14 *b*, and 14 *c*.—First phalanx.—B.M.

Length of first phalanx, 4· in. Width of upper articular surface, 1·9 in. Width of lower articular surface (greatest), 1·6 in.

Plate XC.

Bones of posterior extremity of *Camelus Sivalensis*.

Figs. 1, 1 *a*, and 1 *b*.—Fragment of head of femur.—B.M.

Antero-posterior diameter of great trochanter, 2·9 in.

Figs. 2 and 2 *a*.—Articulating surface of head of femur.—B.M.

Diameter of articulating surface, 2 5 in.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Fragment of lower end of femur with condyles.—B.M.

Length of fragment, 6·6 in. Width of lower extremity, 4·8 in.

Figs. 4, 4 *a*, and 4 *b*.—Fragment of lower end of femur.—B.M.

Transverse diameter of lower extremity, 3·8 in. Width of rotular surface, 2·2 in. Height of rotular surface in centre, 2·7 in.

Figs. 5, 5 *a*, and 5 *b*.—Fragment of lower end of femur.

Width of lower extremity, 4·6 in. Width of rotular surface in centre, 1·6 in. Height of rotular surface in centre, 2·6 in.

Figs. 6, 6 *a*, and 6 *b*.—Patella.—B.M.

Length, 3·7 in. Width, 2·9 in. Width of articular surface in centre, 1·4 in.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—Entire tibia.—B.M.

Extreme length of tibia, 16·7 in. Extreme width of upper articular surface, 3·6 in. Width of inferior articular surface posteriorly, 2·3 in. Circumference of shaft below crest, 6· in.

Figs. 8, 8 *a*, 8 *b*, 8 *c*, and 8 *d*.—Calcaneum and cuboid.—B.M.

Extreme length of calcaneum, 6·7 in. Projection of calcaneal process, 4·3 in. Greatest height, 3·1 in. Height of cuboid, 2·2 in. Greatest width superiorly, 1·7 in. Antero-posterior diameter, 1·5 in.

Fig. 9.—Tarsal bones, conjoined. *a*. calcaneum; *b*. astragalus; *c*. scaphoid; *d*. internal cuneiform; *e*. external cuneiform.—B.M.

Figs. 10, 10 *a*, 10 *b*, 10 *c*, and 10 *d*.—Astragalus.—B.M.

Extreme antero-posterior diameter, 3·4 in. Width of anterior articular surface, 2·3 in. Width of cuboid segment of ditto, ·9 in. Width of trochlea, 2·1 in. Height, 1·95 in.

Fig. 11.—Astragalus.—B.M.

Extreme height, 2·8 in. Width of anterior articular surface, 1·8 in. Width of cuboid segment of ditto, ·6 in. Width of trochlea, 1·6 in. Height of astragalus, 1·55 in.

Figs. 12 and 12 *a*.—Upper extremity of metatarsal bone.—B.M.

Extreme width of upper articular surface, 2·2 in. Antero-posterior diameter in centre of upper extremity, 1·8 in.

Figs. 13, 13 *a*, and 13 *b*.—Metatarsal bone, entire; lower end deeply fissured.—B.M.

Length, 16· in. Width of upper articular surface, 2·3 in. Width of each of lower articular surfaces, 1·3 in. Interval between them, ·35 in. Antero-posterior diameter of each, 1·5 in. Greatest transverse diameter of shaft in centre, 1·45 in. Antero-posterior diameter of ditto, 1·3 in.

Figs. 14, 14 *a*, 14 *b*, and 14 *c*. First phalanx.—B.M.

Length, 4· in. Width of proximal surface, 1·55 in. Width of distal articular surface, 1·45 in.

Figs. 15, 15 *a*, 15 *b*, and 15 *c*.—Second phalanx.—B.M.

Extreme length, 2·4 in. Width of upper articular surface, 1· in. Extreme width of distal ditto, 1·15 in.

Plate XCI.

Sivatherium giganteum (Falc. and Caut.), from the Sewalik hills. (See *antea*, p. 247.) Splendid specimen of cranium, anterior view, from Sir Proby Cautley's collection in British Museum. A full description of this specimen, with measurements, will be found in the Memoir on Sivatherium (See 'Asiatic Researches,' vol. xix. p. 1).—B.M.

Plate XCII.

Sivatherium giganteum.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Four different views of same cranium as figured in Plate XC.—B.M.

Figs. 2 and 2 *a*.—Fragment of cranium showing orbit and temporal fossa, basilar process of occipital, depressions for condyles of lower jaw, &c. This is the same specimen as is figured in Plate A. fig. 3, under which the dimensions will be found.—B.M.

[Plate XCII. completes the series of published plates. Copies of the seventeen plates which follow, and which I have designated by letters (A. to R.), were found among Dr. Falconer's papers, or have been furnished by Mr. Ford, the artist and lithographic engraver. These plates had been executed on stone, and proof impressions struck off, but the plates were never published, and unfortunately the stones were destroyed during Dr. Falconer's absence in India. These seventeen plates have been deposited in the library of the Geological Department in the British Museum, and from them several of the specimens in the Museum have been named. Through the kindness of Mr. Davies, I am enabled to give the British Museum Catalogue number for each of the specimens figured, so that there will be no difficulty in referring to the originals.]

Plate A.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Sivatherium giganteum*. Cranium of female, with perfect series of six molars on either side. The specimen is broken off in front of the molar ridges.—B.M. No. 39,523.

From anterior margin of foramen magnum to alveolus of first molar, 16· in. From anterior to posterior side of last molar, 8·25 in. Width of skull between borders of auditory foramina, 9·3 in. From the anterior margin of auditory foramen to the rear molar, 6·9 in. Extreme length of fragment, 19·7 in. Height of occiput, 6·5 in. Breadth of occiput, 9·5 in. Length of molar series, 8·5 in. Length of true molar series along alveolar border, 4·11 in. Length of premolar series along alveolar border, 4·4 in. Between anterior premolars, 2·4 in. Between posterior molars, 4·3 in. Length of palate in mesial line from anterior edge of first premolar to palatine notch, 6·10 in. Length from lower border of foramen magnum to palatine notch, 9·5 in. Probable width across external orbital angles, 12· in. Length of orbit, 3·2 in. Length between auditory process and posterior border of orbit, 6·5 in. Probable height at posterior border of palate in mesial line, 6·5 in.

Figs. 2 and 2 *a*.—Portion of cranium of *Sivatherium giganteum*, found by Col. Colvin in the lower hills below and west of Nahun. The specimen is valuable, though it has no teeth, from having the occiput very entire, and from its proving the accuracy of Dr. Falconer's assumptions, made before the specimen was found, and based on examination of the original head (Plate XCI.), that the animal had four horns with bony cores, as this has the offset of one of the back branched horns very clearly marked, and suitable to which a large flat horn was found in Capt. Cautley's collection, fig. 4. The parts appear slightly distorted from the occurrence of a shift. This specimen is figured and described by Col. Colvin in the Jour. As. Soc., Feb. 1837, vol. vi. p. 152. It is also figured in Royle's 'Illustrations of the Botany of the Himalayah Mountains,' vol. ii., Plate VI. fig. 1 *c*.

This specimen was presented by Col. Colvin to the Museum of the University of Edinburgh, where it now is. Its dimensions are as follows:—

Length from occipital crest to anterior margin of base of anterior horn-core (on right side), 14·2 in. Between extreme points of occipital crest (imperfect), 16·2

in. Between extreme points of occipital condyles (external angles), 6·1 in. From the basilar surface, between the occipital condyles to occipital crest, 7·5 in. Height of occipital foramen, 1·9 in. Breadth of occipital foramen, 1·8 in. Greatest breadth of upper surface of occipital condyle, 2· in. From occipital crest to posterior border of posterior core, 1·2 in. Breadth of cranium beneath posterior core (distance between outer margins of roots of posterior cores), 12·1 in. Extreme distance between fractured extremities of posterior cores, 21·5 in. Transverse diameter of posterior core before its expansion, 5·8 in. Transverse diameter of root of posterior core, 8·4 in. Thickness of core before expansion, 3·1 in. Great diameter (transverse) of posterior branch, 2·5 in. Thickness (vertical diameter) of posterior branch, 1·6 in. Chord of arc between the origin of posterior branch and occipital crest, 3·1 in. Thickness of stem (thickest part) of core, 3·6 in. Circumference of core before expanding, 15·8 in. Antero-posterior diameter of broken end of anterior core, 4·1 in. Greatest transverse diameter of broken end of anterior core, 3·2 in. Diameter of base of anterior core, 4·9 in. Breadth of cranium beneath anterior cores (at foramen orbitale lacerum), 5·3 in. Between inner margins of articular surfaces of occipital condyles superiorly, 1·7 in. Height of fossa for insertion of ligam. nuchæ, 3·8 in. Base of fossa for insertion of ditto, 6·4 in. Groove between condyles, inferiorly, ·45 in. Between outer margin of condyles (inferiorly) immediately behind parieto-occipital crest, 2·7 in. From grooves behind occipital condyles, inferiorly, to floor of fossa for ligam. nuchæ, 3·7 in.

Fig. 3.—*Sivatherium giganteum.* Fragment of cranium, showing forehead, orbits, and cores of anterior horns. This is the same specimen as figured in Plate XCII. figs. 2 and 2 *a*.—B.M.

Antero-posterior diameter of orbit, 4· in. Height of orbit, 2·7 in. Width of malar bone, 2·7 in. Width between anterior angles of orbit, 11·2 in. Width between outer margins of orbital cornua, 12· in. Long diameter of fractured end of right horn, 5·18 in. Short or transverse diameter of right horn, 3·10 in. Probable width between mastoid processes, 16· in.

Fig. 4.—*Sivatherium giganteum.* Fragment from middle of posterior horn. This specimen was in Sir Proby Cautley's collection, and was found to correspond to the posterior horn-core in Col. Colvin's specimen. —B.M. No. 39,525.

Length following curvature, 21· in. Circumference at lower attachment, 18· in. Breadth at offset, 8·1 in. Length of offset at base, 5· in. Width of offset at base, 4·6 in. Breadth at fractured upper extremity, 6·8 in. Greatest thickness at upper extremity, 2·3 in.

Fig. 5.—*Sivatherium giganteum.* Fragment from apex of posterior flattened horn.—B.M. No. 39,524.

Extreme length, 10·6 in. Breadth at base, 8·4 in. Thickness (extreme), 1·8 in.

Plate B.

Sivatherium giganteum.—Figs. 1, 1 *a*, and 1 *b*.—Fragment of atlas, comprising lower arch.—B.M. No. 39,526.

Extreme length of fragment, 8·3 in. Antero-posterior diameter of lower arch, 3·1 in.

Fig. 2.—Atlas, very perfect.—B.M. No. 39,527.

Extreme breadth, 8·3 in.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Axis.—B.M. No. 39,528.

Extreme length, including odontoid process, 7·6 in. Extreme breadth of anterior articular surface, 5·7 in. Length of spinal platform, 5·2 in. Height of spinal canal, posteriorly, 1·7 in. Breadth of spinal canal, posteriorly, 1·7 in.

Figs. 4 and 4 *a*.—Second, third, fourth, fifth, sixth, and seventh cervical vertebræ *in situ*.

Length of conjoined vertebræ, 27·4 in.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Sixth cervical vertebræ.—B.M. No. 16,225.

Extreme length of body, 5·8 in. Height of spinal canal, posteriorly, 1·3 in. Width of spinal canal, ditto, 1·6 in.

Figs. 6, 6 *a*, 6 *b*, and 6 *c*.—Cervical vertebra.—B.M. No. 18,173.

Extreme length of body, 6·1 in. Between outer margins of anterior articular processes, 7·6 in.

Figs. 7, 7 *a*, 7 *b*, and 7 *c*.—Seventh cervical vertebra.—B.M. No. 15,707.

Extreme length of body, 5·1 in. Width of spinal canal, 2·5 in.

Figs. 8, 8 *a*, and 8 *b*.—First dorsal vertebra. It resembles that of the British elk.

Extreme length of body, 4·5 in. Width across transverse processes, 8·1 in.

Figs. 9, 9 *a*, and 9 *b*.—Dorsal vertebra.—B.M. No. 17,078.

Extreme length of body, 4·7 in. Extreme width across transverse processes, 7· in.

Fig. 10.—Four dorsal vertebræ *in situ*.

Length of conjoined vertebræ, 13·8 in.

Figs. 11 and 11 *a*.—Lower end of tibia, with bones of tarsus. *a*. tibia; *b*. fibular element; *c*. astragalus; *d*. calcaneum; *e*. cuboid; *f*. scaphoid.—B.M. No. 39,529.

Length of fibular element, 2·6 in. Height of fibular element (*a*), 1·3 in. Length of fragment of os calcis (lower edge), 5· in. Height of fragment to fibular surface, 3·3 in. Width of trochlea of astragalus (*c*), 3·1 in. Length of astragalus internally, 4·2 in. Length of scapho-cuboid (inferiorly), 2·1 in. Length of ento-cuneiform (superiorly), 1·1 in.

Figs. 12, 12 *a*, and 12 *b*.—Phalanx (first?) of posterior extremity.—B.M. No. 39,530.

Extreme length, 5·1 in. Width of upper articular surface, 2·5 in. Width of lower articular surface, 2·2 in.

Figs. 13, 13 *a*, 13 *b*, and 13 *c*.—Phalanx (second?) of posterior extremity.—B.M. No. 15,805.

Extreme length, 2·6 in. Width of upper articular surface, 2·2 in. Width of lower articular surface, in centre, 2· in.

Plate C.

Sivatherium giganteum. Bones of anterior extremity.

Figs. 1 and 1 *a*.—Fragment of sternum.—B.M.

Length of fragment, 14·8 in. Greatest depth, 5·5 in. Greatest width, inferior end, 4·2 in. Greatest width, upper end, 3·3 in.

Figs. 2 and 2 *a*.—Fragment of scapula, showing glenoid cavity and coracoid process.—B.M. No. 36,680.

Length of fragment, 11·8 in. Great diameter of glenoid cavity, 4·4 in. Lesser diameter of glenoid cavity, 3·3 in. Elevation of coracoid process above glenoid cavity, 1·8 in. Breadth of scapula towards neck, 4·4 in.

Figs. 3 and 3 *a*.—Glenoid cavity, and coracoid process of scapula.—B.M. No. 39,531.

Length of fragment, 6· in. Great diameter of glenoid cavity, 4·8 in. Lesser diameter of glenoid cavity, 4· in. Elevation of coracoid process above glenoid cavity, 1·8 in.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—Humerus entire. The dimensions almost (not quite) agree with B.M. No. 39,688.

Length of humerus, 20·2 in. Breadth of upper extremity, 8·4 in. Greatest ant.-posterior diam. of upper extremity, 7·7 in. Great diameter of articular surface of head, 5·5 in. Lesser diameter of articular surface of head, 5·2 in. Breadth of inferior extremity, 7·2 in. Antero-posterior diameter, internally, 5·5 in. Breadth of inferior articular surface, 6·2 in. Smallest antero-posterior diameter of inferior articular surface, 2·2 in. Smallest transverse diameter of shaft, 3·8 in. Smallest antero-posterior diameter of shaft, 3·3 in.

Figs. 5, 5 *a*, and 5 *b*.—Upper half of humerus with double bicipital groove.—B.M. No. 39,532.

Length of fragment, 10· in. Transverse diameter of upper extremity, 6·3 in. Antero-posterior diameter greatest of ditto, 7·8 in. Greatest diameter of articular surface of head, 5· in. Lesser diameter of articular surface of head, 4·6 in. Circumference at broken extremity, 11· in.

Figs. 6, 6 *a*, 6 *b*, and 6 *c*.—Radius and ulna conjoined; entire length.—B.M. No. 39,534.

Length of united radius and ulna, 30·2 in. Length of radius, 25·8 in. Width of radius above articular surface, 7·4 in. Chord of sigmoid cavity, 3·1 in. From anterior edge of sigmoid cavity to posterior border of olecranon, 10·8 in. Depth of olecranon, 5·5 in. Breadth of inferior extremity, 6·1 in. Breadth of inferior articular surface, 5·5 in. Greatest antero-posterior diameter of ditto, 3·6 in. Transverse diameter of centre of shaft, 4·5 in. Antero-posterior diameter of centre of ditto, 2·5 in.

Fig. 7.—Upper articular surface of conjoined radius and ulna.—B.M. No. 39,535.

Length of radius, 10·8 in. Width of articular surface above, 7·2 in. Width of upper extremity, 8·3 in. Greatest antero-posterior diameter of articular surface, 3·6 in.

Figs. 8 and 8 *a*.—Lower end of conjoined radius and ulna, with bones of carpus and upper end of metacarpal bone.

Transverse diameter of scaphoid (1), 1·9 in.; height of ditto, 1·6 in. Transverse diameter of semilunar (2), 2·1 in.; height of ditto, 1·8 in. Transverse diameter of cuneiform (3), 1·4 in.; height of ditto, 1·8 in. Transverse diameter of united trapezium, trapezoid, and os magnum (5), 2·3 in.; height of ditto, 1·4 in. Transverse diameter of unciform (6), 1·9 in.; height of ditto, 1·4 in. Breadth of inferior extremity of radius and ulna conjoined, 5·3 in. Breadth of upper extremity of metacarpal bone, 4·5 in.

Fig. 9.—Carpal bones, viz., scaphoid (1), semi-lunar, cuneiform (3), os magnum (5), and unciform (6).

Height of scaphoid, 2·1 in.; breadth of ditto, 1·7 in. Height of semilunar, 2·4 in.; breadth of ditto, 2·3 in. Height of cuneiform, 2·6 in.; breadth of ditto, 2·4 in. Height of os magnum, 1·7 in.; breadth of ditto, 3·1 in. Height of os unciforme, 2· in.; breadth of ditto, 2·1 in. Antero-posterior diameter of os magnum, 3·5 in. Antero-posterior diameter of os unciforme, 2·9 in.

Figs. 10 and 12.—First row of carpal bones, viz., scaphoid (1), semilunar (2), and cuneiform (3).

Antero-posterior of scaphoid, 3·4 in. Antero-posterior of semilunar, 2·2 in. Antero-posterior of cuneiform, 2·5 in.

Figs. 11 and 13.—Second row of carpal bones, viz., os magnum (5) and unciform (6).

Fig. 14.—Phalanges of anterior extremity, restored.

Figs. 15, 15 *a*, 15 *b*, and 15 *c*.—Right metacarpal bone.—B.M. No. 39,533.

Length of right metacarpal, 13·7 in. Breadth of superior articular surface, 4·7 in. Greatest antero-posterior of ditto, 2·7 in. Breadth of inferior articular surface, 4·7 in. Breadth of a single trochlea, 2·2 in. Antero-posterior diameter of a single trochlea measured along ridge, 2·4 in.

Figs. 16, 16 *a*, 16 *b*, and 16 *c*.—First phalanx.—B.M. No. 39,541.

Length between articular surfaces, 4·6 in. Transverse diameter of posterior articular surface, 2·3 in. Height of posterior articular surface in centre, 1·6 in. Transverse diameter of anterior articular surface, 2·3 in. Height of anterior articular surface in centre, 1·4 in.

Figs. 17, 17 *a*, 17 *b*, and 17 *c*.—Second phalanx.—B.M. No. 39,542.

Length, 2·4 in. Transverse diameter of posterior articular surface, 2·4 in. Height of posterior articular surface measured along ridge, 1·5 in. Transverse diameter of anterior articular surface, 2·5 in. Height of anterior articular surface, 2·5 in.

Figs. 18, 18 *a*, and 18 *b*.—Hoof-bone.

Length, 5·2 in. Height, 2·5 in. Breadth, 2·3 in. Length of articular surface, 1·9 in. Breadth of articular surface, 1·9 in.

Plate D.

Bones of posterior extremity of *Sivatherium giganteum*.

Figs. 1, 1 *a*, and 1 *b*.—Fragment of upper end of femur, with articular surface.—B.M. No. 39,545.

Length of fragment, 7·4 in. Breadth of upper extremity including the trochanter, 7·5 in. Antero-posterior diameter of greater trochanter, 3·6 in. Antero-posterior diameter of articular surface of head, 3· in. Transverse diameter of articular surface of head, 3·8 in.

Figs. 2, 2 *a*, and 2 *b*.—Fragment of upper end of femur with articular surface.

Length of fragment, 8·4 in. Antero-posterior diameter of great trochanter, 4· in.

Figs. 3, 3 *a*, and 3 *b*.—Lower end of femur, with condyles and articular surface.—B.M. No. 39,546.

Length of fragment, 9·6 in. Breadth of inferior extremity, 6·4 in. Antero-posterior diameter internally, 8·6 in. Antero-posterior diameter externally, 6· in. Height of rotular surface in centre, 4·1 in. Breadth of rotular surface in centre, 2·9 in.

Figs. 4, 4 *a*, and 4 *b*.—Fragment of lower end of femur, showing articular surface.—B.M. No. 39,547.

Breadth of inferior extremity, 7·6 in. Height of rotular surface in centre, 4·7 in.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Entire tibia.—B.M. No. 17,072.

Extreme length of tibia, 20·3 in. Breadth of upper extremity, 6· in. Antero-posterior diameter of upper extremity, 3·5 in. Breadth of inferior extremity, 4·6 in. Antero-posterior diameter of ditto, 3·2 in. Breadth of shaft (smallest), 2·7 in. Antero-posterior diameter of shaft (ditto), 1·9 in.

Figs. 6, 6 *a*, and 6 *b*.—Proximal end of tibia, with articular surface. —B.M. No. 18,452.

Length of fragment, 9·5 in. Breadth of upper extremity, 6·8 in. Antero-posterior diameter of ditto, 3·8 in.

Figs. 7, 7 *a*, and 7 *b*.—Proximal end of tibia, with articular surface. —B.M. No. 16,611.

Breadth of upper extremity, 7·1 in. Antero-posterior diameter of ditto, 4· in.

Figs. 8, 8 *a*, and 8 *b*.—Distal half of tibia, with lower articular surface.—B.M. No. 39,548.

Length of fragment, 9·5 in. Breadth of inferior extremity, 5· in. Antero-posterior diameter of ditto, 3· in.

Figs. 9, 9 *a*, and 9 *b*.—Distal end of tibia, with lower articular surface.—B.M. No. 39,549.

Length of fragment, 7· in. Breadth of inferior extremity, 5· in. Antero-posterior diameter of ditto, 2·6 in.

Fig. 10.—Calcaneum and astragalus, *in situ*, restored.

Figs. 11, 11 *a*, and 11 *b*.—Astragalus.—B.M. No. 16,998.

Length of astragalus, extreme, 4·9 in. Breadth of ditto, 3·4 in. Height of ditto, 2·4 in.

Figs. 12, 12 *a*, and 12 *b*.—Calcaneum, imperfect.—B.M. No. 39,543.

Length of fragment, 8·2 in. Projection of heel, 6·2 in. Breadth of calcaneal tuberosity, 2·9 in. Height of calcaneal tuberosity, 2·8 in.

Figs. 13, 13 *a*, 13 *b*, 13 *c*, and 13 *d*.—Scapho-cuboid bone.—B.M. No. 39,544.

Breadth of scapho-cuboid bone, 4·9 in. Greatest antero-posterior diameter, 5· in. Greatest height, 3·4 in. Breadth of astragalar surface, 3·6 in. Breadth of calcaneal ditto, 1·3 in. Breadth of cuneiform ditto, 1·5 in. Breadth of metatarsal ditto, 1·8 in.

Plate E.

Camelopardalis Sivalensis (Falc. and Caut.).

Figs. 1, 1 *a*, 1 *b*, 1 *c*, and 1 *d*.—Third cervical vertebra of fossil giraffe, from the Sewalik hills. The elongated character of the vertebra shows that the animal had a columnar neck, and the fact that the transverse processes are provided with foramina for the vertebral arteries shows that it was not a camel. The complete synostosis of the upper and lower articulating surfaces, the strong relief of the ridges, and the depth of the muscular depressions, indicate that the animal was an adult, which had long attained its full size.

A note of this specimen, by Captain (now Sir Proby T.) Cautley, appeared in the Journ. As. Soc. for July 1838, vol vii. p. 658, and a detailed account was afterwards communicated to the Geological Society of London by Dr. Falconer and Captain Cautley, an abstract of which appeared in the 'Proceedings,' No. 98. In the latter communication the measurements and drawings of the specimen are given. —B.M. No. 39,747.

Figs. 2 and 2 *a*.—Fragment of second cervical vertebra of *Camelopardalis Sivalensis*, from Perim Island. The right margin of the drawing shows the mesial longitudinal ridge under the side of the body, and the left margin is the ridge of the spinous process. The process pointing

downwards on the left side is the inferior oblique process. The cup-shaped articulating surface for the head of the third cervical vertebra is well seen.

This specimen was in the collection of fossils brought from Perim Island by Captain Fulljames, and was described and figured by Dr. Falconer in the Quarterly Journal of the Geol. Soc., vol. i. Plate XIV. fig. 5.—B.M. No. 39,748.

Length of fragment, 4·9 in. Height of body posteriorly, 2·5 in. Greatest breadth posteriorly between remains of transverse processes, 3·1 in. Height of the spinal canal, 1·4 in. Height of the broken surface of the spine above inferior margin of body, 5·4 in. Vertical diameter of articulating cup, 2·1 in. Transverse diameter of ditto, 2·1 in.

Figs. 3 and 3 *a*.—R. humerus, head wanting.—B.M. No. 39,749.

Length of humerus wanting upper head, 17·7 in. Breadth of inferior extremity, 5·2 in. Antero-posterior diameter of inferior extremity, 4·3 in. Breadth of articular surface of inferior extremity, 4·8 in. Breadth of upper extremity, 4·1 in. Circumference at smallest part of shaft, 7·9 in.

Figs. 4, 4 *a*, and 4 *b*.—Fragment of shaft of left radius and ulna.—B.M. No. 17,130.

Length of fragment, 8·5 in. Greatest diameter, 3· in. Smaller ditto, 2·1 in. Great diameter of ulna at upper extremity, ·7 in. Thickness of ditto, ·5 in.

Figs. 5, 5 *a*, and 5 *b*.—Radius and ulna, restored.

Figs. 6, 6 *a*, and 6 *b*.—Metacarpal bone, fragment including upper end.—B.M. No. 39,750.

Length of fragment, 18·7 in. Transverse diameter of upper extremity, 3·7 in. Antero-posterior diameter of upper extremity, 2·3 in. Transverse diameter of centre of shaft, 2·4 in. Antero-posterior diameter of ditto, 1·8 in.

Figs. 7 and 7 *a*.—Fragment of shaft of metacarpal bone.—B.M. No. 39,751.

Length of fragment, 6·8 in. Transverse diameter of shaft, 2·3 in. Antero-posterior diameter of ditto, 1·3 in.

Figs. 8 and 8 *a*.—Fragment of shaft of metacarpal bone.—B.M. No. 17,129.

Length of fragment, 4·2 in. Transverse diameter of shaft, 2· in. Antero-posterior diameter of ditto, 2· in.

Figs. 9 and 9 *a*.—Fragment of shaft of metacarpal bone, near lower end.—B.M. No. 17,131.

Length of fragment, 3·9 in. Transverse diameter of shaft at lower extremity, 2·8 in. Antero-posterior ditto at upper ditto, 1·5 in.

Figs. 10, 10 *a*, and 10 *b*.—Entire metacarpal bone, restored.

Figs. 11, 11 *a*, and 11 *b*.—First cervical vertebra, imperfect.—B.M. No. 39,746.

Length of fragment, 4·2 in. Height of body posteriorly, 3·3 in.; breadth of ditto, 2·8 in. Between extremities of transverse processes, 6· in. Between inner angles of posterior articular processes, 2· in. Length of posterior articular surface, 2·1 in.; breadth of ditto, 1·2 in. Height of spine above inferior margin of body, 6·4 in. Height of spinal canal, 1·4 in.; breadth of ditto, 1·6 in.

Figs. 12, 12 *a*, 12 *b*, and 12 *c*.—Left metatarsal bone of *Sivatherium giganteum*.—B.M. No. 39,752.

Length of left metatarsal, 16·4 in. Transverse diameter of upper extremity, 3·8 in. Antero-posterior diameter of ditto, 3·3 in. Transverse diameter of lower

extremity, 4· in. Transverse diameter of a single trochlea, 1·9 in. Antero-posterior diameter measured alongst ridge of trochlea, 2·2 in. Transverse diameter of shaft, 2·1 in. Antero-posterior ditto, 2·1 in.

Figs. 13, 13 *a*, and 13 *b*.—Fragment of upper end of metatarsal bone of *Sivatherium giganteum*.—B.M. No. 39,753.

Length of fragment, 7·2 in. Transverse diameter of upper extremity, 4·1 in. Antero-posterior diameter of ditto, 3·8 in.

Plate F.

Bramatherium Perimense (Falc.), from Perim Island. A large and peculiar ruminant, nearly equalling the Sivatherium in size, but essentially different. The plate represents fragments of the bones of the anterior and posterior extremities. A description of two fragments of the left upper jaw, including the entire series of upper grinders, will be found in the memoir on Perim Island fossils. (Journ. Geol. Soc., July, 1845). The specimens figured in this plate were brought from Perim Island by Captain Fulljames.

Figs. 1, 1 *a*, and 1 *b*.—Fragment of lower end of humerus, with articular surface.

Figs. 2 and 2 *a*.—Fragment of upper end of ulna, with olecranon and sigmoid cavity.

Figs. 3, 3 *a*, and 3 *b*.—Fragment of lower end of radius and ulna.

Figs. 4, 4 *a*, and 4 *b*.—Fragment of lower end of radius and ulna.

Figs. 5 and 5 *a*.—Fragment comprising portion of shaft and distal extremity of metacarpal bone.

Figs. 6 and 6 *a*.—Fragment comprising distal articulating extremity of metacarpal bone.

Figs. 7, 7 *a*, and 7 *b*.—Fragment of upper end of femur.

Figs. 8, 8 *a*, 8 *b*, 8 *c*, and 8 *d*.—Calcaneum.

Figs. 9, 9 *a*, 9 *b*, 9 *c*, and 9 *d*.—Astragalus.

Figs. 10, 10 *a*, 10 *b*, 10 *c*, 10 *d*, and 10 *e*.—Astragalus.

Plate G.

Bos Namadicus (Falc. and Caut.), from the Nerbudda.

Figs. 1, 1 *a*, and 1 *b*.—Fragment of cranium, showing forehead, occiput, occipital condyles, and foramen magnum ; portion of right horn and core of left horn. The specimen shows well the flat square forehead, the height being about equal to the breadth. The horns are attached to the extremity of the highest salient line of the head. The horn-cores spread out horizontally, with a slight arch upwards and concavity below. The section of the horn-core shown in fig. 1 *b*. is much more circular than in the Gour or Gayal or than in *Bos Palæindicus*.

This specimen is in the British Museum (No. 39,760).

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—*Bos Namadicus*. Four different views of

cranium, including orbit, nasal bones, and palate, and four posterior molars on either side. The forehead is mutilated and the horn-cores are broken off.—B.M. No. 39,758.

Bos Palæindicus (Falc. and Caut.), from the Nerbudda.

Figs. 3 and 3 *a*.—Fragment of cranium, including orbits, horn-cores, frontal and occipital, on both sides.—B.M. No. 39,716.

Fig. 4.—Fragment of cranium, showing occiput, foramen magnum, condyles, and horn-cores.—B.M. No. 39,717.

Figs. 5 and 5 *a*.—Fine specimen of cranium, showing occiput, condyles, and foramen magnum, portion of right horn and left horn-core, both orbits, palate, and four posterior molars. The upper surface of the frontal is arched. The horn-cores spread out more horizontally, and with a less inclination upwards than in the existing wild buffalo, and are slightly concave anteriorly and convex behind. In these respects it differs from the existing wild buffalo, and so far as the horizontal offset is concerned, it approximates to the Gayal, from which, however, it differs in the flattened form of the horns and in every other respect. These characters are so constant that there can be little doubt that the species is distinct from the existing wild buffalo.—B.M. No. 39,759.

Fig. 6 —Fragment showing anterior portion of upper jaw, with intermaxillary bones.—B.M. No. 39,715.

Figs. 7 and 7 *a*.—Fragment of horn, broken off at tip, and of a compressed form. Fig. 7 *a* shows the flattened form of the horn, as seen at section. This, as well as the fragment represented in fig. 6, have been found to belong to a skull in the British Museum (No. 39,715), to which they are now attached. (See *postea*, p. 134.)

Length, 33·5 in. Greatest diameter, 6·5 in. Least ditto, 3·25 in.

Plate II.

Hemibos triquitriceras. (Falc. and Caut.), from the Sewalik hills.

Figs. 1 and 1 *a*.—Cranium, including both orbits and horn-cores, occiput, nasals, palate, and entire molar series on both sides.—B.M. No. 39,584.

Length of fragment, 18·2 in. Great diameter of core, 4· in. Breadth of cranium at post. angles of orbits, 8·7 in. Great diameter of orbit, 2·7 in. Length of molar series, 5·4 in. Length of three premolars, 2 3 in. Width of palate anteriorly and posteriorly, 2·9 in. Height of cranium from middle of palate, 4·2 in. Breadth of ditto in front of premolars, 4· in.

Figs. 2 and 2 *a*.—Another fine specimen of cranium, showing occipital condyles and foramen, palate and five back molars on either side, both horn-cores, and a portion of right horn. The remarkable triangular form of the horn-core is well shown.—B.M. No. 16,411.

Length of fragment, 14·4 in. Height of occipital facet from lower border of occipital foramen to summit of occipital crest, 4·8 in. Between extreme points of occipital crest, 8·8 in. Breadth of cranium beneath cores, 4·6 in. Breadth of cranium at post. angles of orbits, 8·8 in. Length of core from roughness on frontal bone, 11·3 in. Base of the triangular core ant. surface (at origin), 3·9 in. Base of the triangular core ant. surface (at broken end), 3· in. Diameter of occipital

condyle, 2·6 in. Height of occipital foramen, 1·5 in. Breadth of ditto, 1·2 in. Greatest diameter of orbits, 2·5 in. From lower border of occipital foramen to posterior border of palate, 6·2 in. Length of true molar series, 3·2 in. Length of two posterior premolars, 1·3 in. Width of palate posteriorly and anteriorly, 2·8 in. Width of alveoli, 1·3 in.

Figs. 3 and 3 *a*.—Fine specimen of cranium, showing orbits and horn-cores, but no horns, nasals, palate with entire molar series (on left side), nasal and intermaxillary bones almost complete. Presented by Colonel Colvin.—B.M. No. 23,109.

Length of fragment, 17· in. Breadth of cranium between posterior angles of orbit, 8·8 in. Between most projecting points of maxillary bones, 5·7 in. Breadth at intermaxillaries, 3·5 in. Breadth of two nasal bones, 1·9 in. Length of molar series, 5·3 in. Length of three true molars, 3·3 in. Breadth of alveoli, 1·2 in. Width of palate, 3·1 in.

Figs. 4, 4 *a*, and 4 *b*.—Very perfect specimen of cranium, showing horn-cores, orbits, occipital foramen and condyles, palate, and entire molar series on either side. Probably a female.—B.M. No. 16,173.

Length of fragment, 13·7 in. Height of occipital facet from lower border of occipital foramen to occipital crest, 3·8 in. Breadth of cranium beneath cores, 3·8 in. Breadth of ditto at posterior angles of orbits, 7·6 in. Height of occipital foramen, 1·4 in. Breadth of ditto, 1·2 in. Diameter of occipital condyle, 2· in. From lower border of occipital foramen to posterior border of palate, 5·9 in. Length of three true molars, 3·2 in. Length of two posterior premolars, 1·4 in. Width of palate, 3· in. Breadth of alveoli, 1·2 in. Great diameter of orbits, 2·8 in. Lesser diameter of ditto, 2·5 in. Diameter of core at root, 2·3 in.

Plate I.

Bos (*Amphibos*) *acuticornis* (Falc. and Caut.), from the Sewalik hills.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Fine specimen of cranium, showing palate and molar series, occiput, orbits, and horn-cores, but without horns.

Figs. 2 and 2 *a*.—Fragment of cranium with both horns, perfect to the tips. The direction of the horns is more upright and less horizontal than in *Hemibos triquitriceras*. The horns are rounded on their anterior surface and flattened behind, and taper to a point.—B.M. No. 39,560.

Between mastoid angles, 8·5 in. Height of occipital facet from lower border of occipital foramen, 4·4 in. Between external angles of condyles, 4·3 in. Diameter of condyle, 2·2 in. Height of occipital foramen, 1·4 in. Breadth of occipital foramen, 1·3 in. Breadth of cranium beneath the cores, 4·5 in. Breadth of cranium in front of the cores, 7·5 in. Length of cores along great curvature, 27· in. Between tips of cores, 33·6 in. Antero-posterior diameter of core (inner surface), 3·4 in. Circumference of core at root, 12· in. Between nearest points of base of cores, 2·8 in.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Another specimen of cranium, with palate and entire series of six molars, occiput, both orbits, and horn-cores.—B.M. No. 39,564.

Length of fragment, 17·4 in. From posterior plane of occipital condyles to anterior margin of molar series, 13·7 in. Length of molar series, 5·4 in. Length of three true molar teeth, 3·3 in. Breadth of alveoli, 1·1 in. Width of palate posteriorly, 2·8 in. Between external angles of occipital condyles, 4·5 in. Height of occipital facet from lower border of foramen magnum, 4·3 in. Height of occipital foramen, 1·4 in. Between mastoid angles, 7·2 in. Width of cranium beneath cores, 3·7 in. Between most projecting points of maxillary bones, 5·8 in. Breadth opposite sub-orbital foramina, 4·1 in. Least width of nasal bones, 1·4 in. Great diameter of orbit, 2·8 in.

Plate K.

Felis cristata (Falc. and Caut.), from the Sewalik hills. This fossil Tiger forms the subject of a special memoir ('Asiatic Researches,' vol. xix.).

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Four different views of an imperfect specimen of the cranium, from Mr. W. Ewer's collection. The left maxillary bone with the teeth is absent, but this portion was found after the drawing was made, and has been added to the specimen in the British Museum (No. 15,902). The specimen shows well the great prominence of the sagittal crest, whence the specific name is derived, also the relative shortness of the facial portion of the head, the great height of the occipital, and the horizontal outline of upper surface of cranium.

Figs. 2, 2 *a*, 2 *b*, and 2 *c*.—Another specimen of the cranium with the alveolar ridges almost perfect. The anterior portion of the palate with the incisors is broken off. The canine, two false molars, the carnassier, and tuberculous teeth well seen.—B.M. No. 37,133.

Figs. 3, 3 *a*, and 3 *b*.—Mutilated fragment of posterior portion of cranium.—B.M. No. 37,134.

Figs. 4, 4 *a*, and 4 *b*.—Mutilated fragment of anterior portion of cranium and face, showing the left orbit entire, the palate, and the series of teeth on both sides.—B M. No. 37,135.

Plate L.

Hyæna Sivalensis (Falc. and Caut.)—Fossil Hyæna from the Sewalik hills. Unfortunately no description of this fossil was ever published, and no account of it is to be found among Dr. Falconer's notes. This species, however, is no doubt that designated *Hyæna Sivalensis* by Messrs. Baker and Durand in the brief description given by them in the Journal of the Asiatic Society for October 1835, vol. iv. p. 569. Their description is accompanied by drawings of a remarkably perfect specimen of the skull, with the lower jaw *in situ*.

Figs. 1 and 1 *a*.—Fragment of anterior portion of right side of palate, with canine, and incisor teeth.—B.M. No. 39,718.

Figs. 2, 2 *a*, and 2 *b*—Fragment of anterior portion of cranium, showing canine and incisors in very perfect state.—B.M. No. 16,583.

Figs. 3, 3 *a*, and 3 *b*.—Another fragment of anterior portion of palate with three incisors.—B.M. No. 39,719.

Fig. 4.—Dental series, right side, consisting of canine anteriorly, three false molars, the two posterior of which are very large. A very large carnivorous tooth with a small tubercle within and in front, and a small back or fifth molar, placed transversely at the back of the palate.

Figs. 5 and 5 *a*.—Fragment of upper jaw, left side, containing hindmost false (or third) molar, large carnivorous tooth or fourth molar, and small back or fifth molar, placed transversely at the back of the palate.—B.M. No. 34,140.

Figs. 6 and 6 *a*.—Fragment of upper jaw, right side, containing three false molars, large carnivorous tooth with its internal tubercle, and a portion of the fifth or small back molar.—B.M. No. 37,137.

Figs. 7 and 7 *a*.—Fragment of upper jaw, right side, with hindmost false or third molar, and large carnivorous tooth with its internal tubercle.—B.M. No. 37,139.

Figs. 8 and 8 *a*.—Fragment of upper jaw, right side, with two posterior false molars, and large carnivorous tooth with internal tubercle.—B.M. No. 37,138.

Figs. 9 and 9 *a*.—Large carnivorous tooth with internal tubercle detached.—B M. No. 15,413.

Fig. 10.—Dental series of *Hyæna*, left side, comprising canine, three false molars (two back ones large), large carnivorous tooth with internal tubercle in front, and small back molar placed transversely at back of palate.

Plate M.

Figs. 1 and 1 *a*.—*Hyæna Sivalensis*. Fragment of lower jaw, right side, very perfect, containing carnivorous molar and two backmost false molars.—B.M. No. 16,565.

Figs. 2 and 2 *a*.—*Hyæna Sivalensis*? Fragment of lower jaw, left side, containing three incisors, one canine, three false molars, and one large carnivorous molar. Belongs to an undetermined feline animal (Hyæna?).—B.M. No. 16,555.

Figs. 3 and 3 *a*.—*Hyæna Sivalensis*. Fragment of lower jaw, left side, with canine and three false molars.—B.M. No. 16,584.

Figs. 4 and 4 *a*.—*Hyæna Sivalensis*. Imperfect fragment, lower jaw, right side, with two incisors, canine, and three false molars.

Figs. 5 and 5 *a*.—*Hyæna Sivalensis*. Imperfect fragment, lower jaw, left side, containing canine, three false molars, and large carnivorous molar. Large mental foramen corresponding to front false molar.—B.M. No. 39,731.

Figs. 6 and 6 *a*.—*Hyæna Sivalensis*? Fragment of anterior portion, lower jaw, right side, containing two incisors, canine, and two anterior false molars. (An. *Felis*?)—B.M. No. 16,585.

Figs. 7 and 7 *a*.—*Hyæna Sivalensis*? Crushed fragment, lower jaw, left side, containing carnivorous molar and two back false molars. (An. *Felis*?)—B.M. No. 37,140.

Figs. 8 and 8 *a*.—*Hyæna Sivalensis*? Fragment of lower jaw, right side, containing two posterior false molars, and large bicuspid carnivorous false molar.—B.M. No. 16,578.

Fig. 9.—*Hyæna Sivalensis*. Fragment of lower jaw, right side, containing three false molars and large canine. Large mentary foramen corresponding to front false molar.

Plate N.

Drepanodon (*Machairodus*) *Sivalensis* (Falc. and Caut.), or fossil Drepanodon, from the Sewalik hills. No description of this fossil was ever published, but the Sewalik specimens are referred to by Professor Owen in 'British Fossil Mammalia,' pp. 178,179, and also in 'Odontography,' vol. i. p. 491. A brief description of it is also given by Dr. Falconer in his 'Notes on the Fossil *Felis spelæa* of the Mendip Hills.'

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Drepanodon Sivalensis*. Fragment of posterior portion of skull, showing occipital condyles, foramen magnum, and prominent sagittal crest.—B.M. No. 39,278.

Fig. 2.—*Drepanodon Sivalensis*. Mutilated specimen of cranium, including facial portion, but no distinct evidence of teeth.—B.M. No. 39,729.

Figs. 3 and 3 *a*.—*Drepanodon Sivalensis*. Fine fragment of upper jaw, right side, with apparently the first or deciduous dentition. The crown of the canine is broken off, but what remains is seen to be flat, and very finely serrated along the posterior edge, like a shark's tooth. The tooth evidently bore the same proportion to the molar series as does the canine of the *Felis megantereon* of Bravard (*Vide* Owen, Brit. Fos. Mam. p. 178).—B.M. No. 16,350.

The following note, from Dr. Falconer's Note-book, dated October 2, 1858, probably referred to this specimen and to that represented in fig. 5 :—

'In the Sewalik Machairodus the right upper carnassier is formed with a very thin blade. The anterior lobe is damaged, but judging from what remains it would seem to have been two-lobed. The middle lobe is thin and pointed; but neither the anterior lobe nor the middle one bears the slightest indication of an internal tubercle. If ever there, it is gone. Owen describes it as being there, "but less developed than in the normal species of *Felidæ*." The posterior lobe is nearly horizontal and very trenchant; in fact, the tooth is compressed and sharp-edged. All the points rise. The length of the crown is ·75 inch. There is an interval between the carnassier and canine of 0·8 in., part of which has been artificially rubbed down, but there is not the least indication of a fang-pit or fang. (Owen says there is, and that it is single-fanged and simple!) There is a distinct show of a double fang, fore and aft, of a tubercular in a line with the sectorial, behind it. The breadth of the canine at its base is 0·5 in. It is very compressed. The posterior concave edge is finely serrated. (Owen says that both edges are distinctly serrated.)'

Figs. 4 and 4 *a*.—*Drepanodon Sivalensis*. Fragment of lower jaw with three premolars, the last being the sectorial. Professor Owen refers to this specimen in the following description :—

'A portion of the lower jaw of a larger Machairodus, from the Sewalik range, shows the beginning of the characteristic downward extension of the symphysis, and the depression on the outside of the ramus for the lodgment of the long upper canine. The molar series, which consists, as in the typical Felines, of three premolars, the last being the sectorial tooth, has a longitudinal extent of two inches; the second molar slightly overlaps the third, which has an antero-posterior extent of eleven lines. This portion of jaw indicates a species of Machairodus as large as the Jaguar; it most probably belongs to an adult of the same species as the one indicated by the instructive portion of the upper jaw.' (Fig. 3). (Owen, Brit. Foss. Mam. p. 179).

B.M. No. 16,557.

Figs. 5 and 5 *a*.—*Drepanodon Sivalensis*. Fragment of upper jaw, containing two anterior molars. The first is simple, singled-fanged and very small. The second is the carnassial or sectorial tooth. Its crown is more compressed, its trenchant margins sharp. See description of fig. 4.—B.M. No. 39,730.

Figs. 6 and 6 *a*.—*Drepanodon Sivalensis*. Lower jaw, right side, more perfect than fig. 4, and containing the incisors as well as the canine and three molars. The downward projection of the symphysis, and the depression for the upper canine, are well seen.—B.M. No. 16,573.

Figs. 7 and 7 *a*.—*Drepanodon Sivalensis*. Another specimen of lower jaw, right side, containing three molars and alveolus of large canine.—B.M. No. 16,537.

Figs. 8 and 8 *a*.—*Drepanodon Sivalensis*. Fragment of lower jaw, with three molars.—B.M. No. 16,554.

Plate O.

Ursus (*Hyænarctos*) *Sivalensis* (Falc. and Caut.), from the Sewalik hills. The fossil Bear of the Sewalik hills forms the subject of a distinct memoir ('Asiatic Researches,' vol. xix.). Its chief peculiarities are to be found in the teeth, which are constructed more after the type of the higher Carnivora than any other described species of the genus.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—Superb specimen of cranium. The three rear molars are perfect on one side, and but little damaged on the other. Both canines are present, and that of the right side is entire. The alveoli of the two false molars and three incisors on either side are distinct, although the teeth are wanting. The only considerable deficiencies are in the posterior and lower parts of the occiput, both zygomatic arches, and in the lower end of the nasals, where a fissure extends across the face, on both sides towards the orbits. Fig. 1 *a* shows the dental series on right side, of natural size.

This specimen is described in detail in the memoir already referred to, in the 'Asiatic Researches,' vol. xix.—B.M. No. 39,721.

Figs. 2 and 2 *a*.—*Ursus Sivalensis*. Greater part of the body of the lower jaw, broken off where the canine protrudes, and also deficient in the coronoid and articulating processes. There are indications of six molars, of which the two first premolars and the rear tubercular molar have dropped out. The third premolar is distinctly three-lobed. The antepenultimate or carnassier is chiefly remarkable for its length. The penultimate or first tubercular is broader for its length and less complicated with tubercles than what is general in the genus. Fig. 2 *a* shows the dental series of the natural size.

Further details of this specimen are given in the memoir on Ursus above referred to.—B.M. No. 39,722.

Figs. 3, 3 *a*, 3 *b*, 3 *c*, and 3 *d*.—*Ursus Sivalensis*. Second cervical vertebra or axis.—B.M. No. 37,143.

Figs. 4, 4 *a*, and 4 *b*.—*Ursus Sivalensis*. Radius and ulna. Greater portion of shafts and lower articulating extremity. From Messrs. Baker's and Durand's collection.—B.M. Nos. 39,725–6.

Figs. 5, 5 *a*, 5 *b*, 5 *c*, and 5 *d*.—*Ursus Sivalensis*. Specimen of femur, very perfect.—B.M. No. 39,723.

Figs. 6, 6 *a*, 6 *b*, 6 *c*, and 6 *d*.—*Ursus Sivalensis*. Distal end of metacarpal bones.—B.M. No. 37,147.

Figs. 7, 7 *a*, and 7 *b*.—*Ursus Sivalensis*. Fragment of phalanx.

Fig. 8.—*Ursus Namadicus* (Falc. and Caut.). Portion of upper jaw with four molars of a smaller species of Bear, from the Nerbudda, represented of the natural size. The rear molar is much more elongated from before backwards than in the Sewalik species.—B.M. No. 39,720.

Figs. 9 and 9 *a*.—*Ursus Namadicus*. Tibia of Bear, from the Nerbudda, presented by C. Frazer, Esq.—B.M. No. 39,727.

Fig. 10.—Right femur of *Ursus spelæus*, from College of Surgeons, figured for comparison.

Plate P.

Fossil *Otters*, from the Sewalik hills.

Figs. 1, 1 *a*, 1 *b*, and 1 *c*.—*Lutra Palæindica* (Falc. and Caut.). Beautiful specimen of cranium with alveolar ridges very perfect. The zygomatic arches are absent. Shows the alveoli of three incisors on either side, the outer one being slightly larger than the two inner ones. Outside the three incisors is the alveolus of a large canine, followed by the alveoli of four small molars, and last of all by the carnassier and tubercular, the latter greatly developed.—B.M. No. 37,151.

Figs. 2 and 2 *a*.—*Lutra Palæindica*. Beautiful specimen of lower jaw, left side, including ascending ramus. Shows a portion of canine and of three small molars, the crowns of which are broken off. Behind there is a large carnassier, very perfect; and last of all is the alveolus of the tubercular, which is small in comparison to that of the upper jaw.—B.M. No. 37,152.

Figs. 3 and 3 *a*.—*Lutra Indica*. Two views of skull, upper and lateral, of existing Indian Otter.

Figs. 4, 4 *a*, and 4 *b*.—*Enhydriodon ferox*.[1] A new fossil genus of otter from the Sewalik hills. Three views of cranium, probably female, much mutilated. Shows on right side the posterior of the two false molars, the carnassier and the tubercular. The anterior premolar, which is deciduous, is wanting. The remarkably square form of the carnassier is well seen.—B.M. No. 37,153.

Figs. 5 and 5 *a*.—*Enhydriodon ferox*. Fine specimen of anterior portion of cranium of an old individual, with very perfect alveolar ridges. Shows on either side the alveolus of a large outer incisor, which evidently served as a subsidiary canine. The middle incisors are not only wanting, but the alveoli are completely filled up and obliterated. The canines, which are broken across, are seen to be very

[1] Subsequently designated *Enhydriodon Sivalensis*.

large, and were evidently of great strength and massiveness. All trace of the first molar, which is very small and deciduous, has disappeared. The second molar has two fangs, and is encircled by a rugged basal ridge. The carnassier is very remarkable, and presents the prominent feature of the genus. It is nearly square, instead of being triangular, as in both Lutra and Enhydra; and instead of the cusps and trenchant ridges of Lutra, or the flattened inequalities of Enhydra, the coronal lobes are developed into cervical mammillæ, somewhat like those of the Mastodon. A more detailed description of this tooth will be found in Dr. Falconer's memoir on 'Enhydriodon.' Behind the carnassier, the tubercular is seen *in situ*.—B.M. No. 37,155.

Figs. 6, 6 *a*, and 6 *b*.—*Enhydriodon ferox*. Fine specimen of anterior portion of cranium of a young and probably female individual. Shows three incisors on either side, the two inner of which are very much compressed laterally, so that their antero-posterior diameter is three times that of their width. The outer incisors are remarkably large, as are also the canines. The left canine has dropped out, leaving a large oval alveolus; the right canine is seen in section. Behind the canine, on either side, is an extremely small empty alveolus of the first deciduous molar. Then comes the bicuspid second molar, the peculiar, square, mammillated carnassier, and the tubercular.—B.M. No. 37,154.

Plate Q.

Carnivora, from the Sewalik hills.

Figs. 1, 1 *a*, and 1 *b*.—Skull, showing palate and teeth, of a fossil species of *Canis*? from the Sewalik hills.[1]—B.M. No. 40,183.

Figs. 2, 2 *a*, and 2 *b*.—Skull, showing palate and alveoli of entire dental series of a fossil species of *Canis*? from the Sewalik Hills.—B.M. No. 37,150.

Fig. 3.—Fragment of palate, right side, with two posterior molars of fossil *Canis*?—B.M. No. 40,180.

Figs. 4, 4 *a*, 4 *b*, and 4 *c*.—*Ursitaxus Sivalensis*. Very perfect cranium and face of a species of Ratel from the Sewalik hills. This appears to be the specimen of fossil '*Gulo*' described by Messrs. Baker and Durand, in the Journ. As. Soc., vol. v. p. 582, and figured in Plate XXVII. fig. 5, of the same volume.—B.M. No. 40,184.

Plate R.

Fossil Remains of Birds from the Sewalik hills.

Figs. 1 and 1 *a*.—Cervical vertebræ of a bird.—B.M. No. 23,105.

Figs. 2, 2 *a*, 2 *b*, 2 *c*, and 2 *d*.—Lower end of tibia.—B.M. No. 39,732.

Figs. 3, 3 *a*, 3 *b*, and 3 *c*.—Lower end of ditto.—B.M. No. 39,735.

Figs. 4, 4 *a*, and 4 *b*.—Lower end of ditto.—B.M. No. 39,737.

[1] Another specimen belonging to Dr. Falconer, and labelled by him 'Skull of fossil *Canis*, from Sewalik hills,' has, since his death, been added to the collection in the British Museum. Along with the skull are portions of the femur, tibia, and bones of the foot.

Figs. 5, 5 *a*, 5 *b*, and 5 *c*.—Lower end of ditto.—B.M. No. 39,734.

Fig. 6.—Lower end of tibia of a bird, recent.

Figs. 7, 7 *a*, and 7 *b*.—Fragment of wing-bone.—B.M. No. 39,740.

Figs. 8, 8 *a*, 8 *b*, and 8 *c*.—Fragment of ditto.—B.M. No. 39,738.

Figs. 9 and 9 *a*.—Upper end of metatarsal bone.—B.M. No. 39,741.

Figs. 10, 10 *a*, and 10 *b*.—Fragment of wing-bone.—B.M. No. 39,744.

Figs. 11, 11 *a*, and 11 *b*.—Fragment of ditto.—B.M. No. 39,743.

Figs. 12 and 12 *a*.—Fragment of ditto.—B.M. No. 39,739.

Figs. 13, 13 *a*, 13 *b*.—Fragment of ditto.—B.M. No. 39,742.

Figs. 14, 14 *a*, and 14 *b*.—Fragment of tarso-metatarsus.—B.M. No. 39,736.

Figs. 15, 15 *a*, 15 *b*, 15 *c*, and 15 *d*.—Phalanx of large bird.—B.M. No. 39,733.

[Among Dr. Falconer's papers were also found numerous outline sketches on tracing paper of Sewalik fossils, &c., belonging to the *Ruminantia* and *Reptilia*, intended for the Fauna, but which had never been engraved. These tracings have been pasted on sheets of paper, and deposited with the seventeen unpublished plates in the Library of the Geological department of the British Museum. They are as follows :—]

A. Ruminantia.

Sheet 1.—Four views of skull of European bison, recent.

Sheet 2.—Four views of skull of Indian bison, recent.

Sheet 3.—Four views of skull of wild Indian buffalo, recent.

Sheet 4.—Four views of skull of *Bubalus brachycerus*, recent.

Sheet 5.—Skull of *Bos primigenius*, for comparison.

Sheet 6.—Restoration of head of *Bos Palæindicus*, including anterior portion of face and horn, figured in Plate G. figs. 6 and 7.

Sheet 7.—Fragment of horn of *Amphibos acuticornis*.

Length of fragment along great curvature, 18·2 in. Chord of lesser curvature, 11·8 in. Great diameter at larger end, 3·7 in. Thickness at ditto, 2·7 in. Circumference at smaller end, 8· in.

Sheet 8.—Skull of *Amphibos acuticornis* (See *antea*, p. 127), including fragments of both horns and both orbits, but greater part of face deficient.—B.M. No. 36,666.

Length of fragment, 10·1 in. Between mastoid angles, 6·5 in. Between external angles of condyles, 3·8 in. Breadth of cranium beneath cores, 4·1 in. Breadth of cranium in front of cores, 6·4 in. Breadth of cranium between posterior angles of orbits, 7·7 in. Height of occipital facet from lower border of occipital foramen, 3·7 in. Diameter of condyle, 2· in. Height of occipital foramen, 1·2 in. Breadth of ditto, 1·2 in. Diameter of orbits, 2·3 in. Length of three true molars, 3·2 in. Width of alveoli, 1·1 in. Width of palate, 2·9 in. Diameter of core at root (greatest), 2·7 in. Circumference of ditto, 8· in.

Sheet 9.—Figs. 1 to 3, and fig. 4. Two specimens of portion of skull of *Hemibos triquitriceras* (See *antea*, p. 126). Fig. 4 includes

the orbit, palate, and molars, but the posterior portion of the skull is broken off. Its dimensions are as follows :—

Length of fragment, 14·3 in. Length of three true molars, 3·3 in. Length of three true molars and last premolar, 4· in. Breadth of alveoli, 1·2 in. Width of palate posteriorly, 2·3 in. Between mastoid angles, 6·2 in. Breadth of cranium beneath cores, 4· in. Breadth of cranium between posterior angles of orbits, 7·3 in. Breadth of cranium between most projecting points of maxillary bones, 5·3 in. Height of occipital facet from lower border of foramen magnum, 4·1 in. Great diameter of orbit, 2·4 in. Great diameter of root of core, 3·1 in. Thickness of ditto, 2·7 in. Length of fragment of core, 6·2 in.

Sheet 10.—Portion of skull of *Bos Sivalensis*.

Length of fragment, 12·7 in. Breadth of cranium behind orbits, 8·7 in. Breadth of cranium between posterior angles of orbits, 10·4 in. Width of alveoli, 1·1 in. Width of palate posteriorly, 3·5 in. Diameter of orbit, 2·5 in. Height of cranium from palate in front, 7·4 in.

Sheet 11.—*Antilopidæ*. Figs. 1, 2, and 3 represent the skull of *Antilope Palæindica* (Falc.), No. 39,594 in B.M. This is the skull described and figured by Captain Baker in the Journ. As. Soc., vol. xii. p. 770.

Sheets 12 to 18.—Represent numerous fossil remains of *Antilopidæ*, *Cervidæ*, &c.

B. Reptilia.

Sheet 1.—*Crocodilus bombifrons*. Fossil Crocodile, from the Sewalik hills. Ten figures, illustrating different portions of the skull. Figs. 1 and 2 correspond to British Museum Spec., No. 39,795; figs. 5 and 6 to B.M., 39,796; and figs. 8 and 9 to B.M. 39,797.

Sheet 2.—*Crocodilus bombifrons*. Other specimens of the skull. Figs. 1 and 2 correspond to British Museum Spec., No. 39,799; figs. 3 and 4 to B.M., 39,800; figs. 5, 6, and 7 to B.M., 39,801; and figs. 8, 9, and 10 to B.M. 39,798.

Sheet 3.—*Crocodilus* (*Leptorhynchus*) *crassidens*. (Falc. and Caut.) Fossil Crocodile from the Sewalik hills. Five specimens are figured of different portions of the skull; four of which correspond to specimens in the British Museum, Nos. 16,218, 39,802, 39,803, and 39,804.

Sheet 4.—*Crocodilus* (*Leptorhynchus*) *Leptodus*. (Falc. and Caut.) Fossil Crocodile from the Sewalik hills. Four different specimens of cranium, which correspond to the specimens in the British Museum, Nos. 7,453, 39,805, 39,806, and 39,807.

Sheet 5.—*Crocodilus* (*Leptorhynchus*) *Gangeticus*. Fossil Crocodile from the Sewalik hills, identical with modern Gavial. Three specimens of different portions of skull, which correspond to the following catalogue numbers in the British Museum, viz., 36,647, 39,809, and 39,810.

Sheet 6.—*Crocodilus* (*Leptorhynchus*) *Gangeticus*. Five specimens of different portions of cranium and jaws, four of which correspond to the following catalogue numbers in the British Museum, viz., 36,726, 39,808, 39,811, and 39,812.

Sheet 7.—*Crocodilus* (*Leptorhynchus*) *Gangeticus*. Portion of cranium, vertebræ, and other parts of skeleton. Correspond to British Museum numbers, 17,006, 39,811 *a*, 39,813, 39,814, 39,815, 39,816, and 39,818.

Sheet 8.—Skull and jaws of Crocodile.

Sheet 9.—*Colossochelys Atlas* (Falc. and Caut.), from the Sewalik hills. Different specimens of episternal bones.

Sheet 10.—*Colossochelys Atlas*. Entosternal and xiphosternal bones, margin of carapace, &c.

Sheet 11.—*Colossochelys Atlas*. Portions of carapace.

Sheet 12.—*Colossochelys Atlas*. Humerus, fragments showing upper and lower ends, &c.

Sheet 13. — *Colossochelys Atlas*. Specimens showing ulna, pubes, ischium, femur, &c.

Sheet 14.—*Colossochelys Atlas*. Foot bones.

Sheet 15.—Fossil *Emydæ*, from the Sewalik hills. Portions of carapace.

Sheet 16.—Fossil *Emydæ*, from the Sewalik hills. Carapace.

Sheet 17.—Fossil *Emydæ*, from the Sewalik hills. Carapace.

Sheet 18.—Fossil *Emys tecta*, from the Sewalik hills, identical with the existing species. Two specimens are figured corresponding to Nos. 39,837 and 17,435 in the British Museum catalogue.

Sheet 19.—Fossil *Trionyx*, from the Sewalik hills and the Nerbudda.

Sheet 20.—Fossil *Trionyx*, from the Sewalik hills.

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