FAUNA ANTIQUA SIVALENSIS, BEING THE FOSSIL ZOOLOGY OF THE SEWALIK HILLS IN THE NORTH OF INDIA, PP. 1-64

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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