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Synopsis of the Fossil Vertebrata *of* India, *by* R. Lydekker, B.A., F.G.S., F.Z.S.

Introductory.

In the "Journal of the Asiatic Society of Bengal" for the year 1880 there appeared a paper by the present author, under the title of a "Sketch of the History of the Fossil Vertebrata of India," in which every species of fossil vertebrate animal then discovered in India was recorded, while there was also given a short summary of the labours of those palæontologists who had written on the Indian Fossil Vertebrata. Since the date of publication of that paper a great increase in our knowledge of the subject has been obtained, and it has accordingly been thought advisable to republish the substance of that paper, with such additions and alterations as are necessary to bring it up to the present state of our knowledge. In many instances these alterations have been so extensive as to have made it necessary to totally re-write a great portion of the original paper. It has been thought better to omit the introductory portion, in which the names of the chief workers in this field of enquiry are recorded, as there is no essential alteration to be made regarding them. Some introductory observations on the general relations of the Indian fossil vertebrates have likewise been omitted, as well as all the references. The record of the local distribution of species, and the places where the more remarkable specimens are preserved, form a new feature in this memoir.

The plan of the original paper has been in the main strictly adhered to; this consists in taking each of the classes of the vertebrata and recording their geological distribution, from the oldest to the present time. At the end a systematic synopsis of all the known forms is given, arranged according to their geological distribution; and also an alphabetical list of the species.

Class I.—PISCES.

Carboniferous.—The earliest fishes of which there is any record are known merely by a few specimens of teeth and dorsal spines obtained in the palæozoic rocks of the Salt-range in the Panjáb. The beds from which these remains were obtained are termed the "Productus-Limestone," and are considered to correspond roughly to the carboniferous of Europe. Among these fishes there is a new

genus of ganoid described, upon the evidence of a single tooth, under the name of *Sigmodus dubius;* this tooth is of an elongated conical form, much resembling the teeth of certain Saurians. Of the *Cochliodontidæ*, here provisionally referred to the Ganoidei, there are two genera, each represented by a single species, namely, *Pœcilodus paradoxus* and *Psephodus indicus;* the tooth of the former is of the flattened cestraciout type. Of the Elasmobranchii, five genera have been named, some from the evidence of teeth, and others from spines; but in view of certain modern discoveries, it is not impossible that in some cases distinct genera have been formed from the different remains of the same animal. Of these the new genus *Helodopsis*, allied to the European *Helodus*, has been formed for the reception of two teeth, which have been referred to distinct species under the respective names of *H. elongata* and *H. abbreviata*. A fragmental tooth, too imperfect for specific determination, has been referred to the common European carboniferous genus *Psammodus*. A fourth tooth, under the name of *P. indicus*, is referred to the European genus *Petalorhyncus*, which is very doubtfully separated from *Petalodus*. Of the spines, three specimens are referred to the genus *Xystracanthus*, of the carboniferous of America, under the names of *X. gracilis*, *X. major*, and *X. minor;* the possibility of these specimens belonging to some species of *Helodopsis* is, however, suggested. A fourth spine is referred to a new genus, under the name of *Thaumatacanthus blanfordi*. As far as the evidence of these fishes goes, it is apparent that sharks with crushing teeth were the dominant forms in the Indian carboniferous seas, as well as in those of Europe and America. All the specimens noticed above are in the collection of the Indian Museum.

From the same rocks there have been obtained teeth of two species of the elasmobranch genus *Acrodus*, to one of which the name *A. flemingi* has been applied. Other small teeth have been doubtfully referred to the ganoid genus *Saurichthys*, with the name of *S. (?) indicus*.

Trias-jura.—In the upper portion of the great Gondwána system, probably corresponding as a whole to the trias and jura, remains of fishes have been found in some abundance, the determined forms belonging to freshwater ganoids. In the Maleri group[1] of this system, the fauna of which shows a rhæto-triassic facies, three spines of the genus *Ceratodus* have been determined, and respectively named *C. hislopianus*, *C. hunterianus*, and *C. virapa*. The latter is considered to be closely allied to *C. polymorphus* of the rhætic of Bristol. At the present day the genus inhabits the rivers of Queensland, and in Europe is found fossil from the keuper to the jura. The specimens of the Maleri teeth are in the Indian Museum. From the Kota group, sometimes classed with the Maleri group, but showing a more distinctly liassic series of fossils, nine species of ganoids have been determined, belonging to the genera *Dapedius*, *Lepidotus*, and *Tetragonolepis*, all of which occur in the secondary strata of Europe, where they range from the lias to the eocene, *Lepidotus* being especially characteristic of the wealden. The majority of the specimens on which these species are founded are, it is believed, in the collection of the Geological Society, but there are a few in the Indian Museum;

[1] I follow the Director General of the Geological Survey of Great Britain and Ireland in continuing to use the term 'group' as subordinate to the terms 'system' and 'series.'—See Geikie: "Text-Book of Geology," 1882, p. 635.

in many cases they comprise nearly perfect fish. Bones, apparently of fishes, have been obtained from the trias of Tibet, but are too imperfect for determination.

Cretaceous.—A few remains of fishes have been obtained from the middle cretaceous Lameta group, but are not determined, though it has been suggested that some of them may belong to the genus *Sphyrænodus*, of the eocene and miocene of Europe. From the middle and upper cretaceous Trichinopoli series, seventeen species of Elasmobranchi have been described, belonging to the genera *Corax*, *Enchodus*, *Lamna*, *Odontaspis*, *Otodus*, *Oxychina*, *Ptychodus*, and *Sphærodus*, and one ganoid, doubtfully referred to *Pycnodus*; all these genera occur in the cretaceous of Europe, of which period some are characteristic. Two of the Indian species, *viz.*, *Corax pristodontus* and *Ptychodus latissimus*, are common to the cretaceous of Europe. Most of these species are founded on the evidence of teeth, some of which are in the Indian Museum and others in the collection of the Geological Society of London.

Eocene.—From the eocene of the Andaman Islands and Rámri Island on the Arakán coast, there have been obtained two teeth of a large *Diodon*, named *D. foleyi*; from the occurrence of *D. hystrix* off these coasts at the present time, it may be assumed that the genus has lived there since the eocene. Remains of a large species of this genus have been obtained from the miocene of Malta. Undetermined cycloid scales have been obtained from the eocene of Thyetmyo in Burma. From the eocene of the Panjáb there are other undetermined scales, and the dental plate of a species of eagle-ray,—*Myliobatis*,—a genus very common in the eocene of Europe, and widely distributed at the present day. From the neighbourhood of Kohát, in the Panjáb, from strata of eocene or lower miocene age, a single incisor of a sparoid fish, named *Copidotus indicus*, has been obtained. The genus was previously known only from the miocene of Vienna and Silesia, and is allied to the living *Sargus*. All the above specimens of teeth are in the collection of the Indian Museum.

Pliocene.—From the Siwalik series numerous species of fishes have been obtained, though several have not been determined. Among the siluroids, we have a large skull in the Indian Museum (originally referred to a gigantic batrachian) belonging to the living species *Bagarias yarrelli*, of the larger Indian and Burman rivers. The British Museum has the anterior portion of the skull of a siluroid (labelled *Pimelodus*), belonging probably to a smaller species of the same genus; and a smaller but nearly complete skull in the same collection belongs probably to this species. The survival of a pliocene fish to the present day is a fact of much interest. The genus would seem to have been widely distributed in eocene times throughout the East, as a species has been described from the tertiaries of Sumatra under the name of *B. gigas*. The posterior half of the skull of a gigantic siluroid in the British Museum indicates another genus of this group. Palatal teeth of a third form of siluroid, from the Panjáb and Sind, and now in the Indian Museum, probably belong to the genus *Arius*, now inhabiting the rivers of India. Among the elasmobranchi a few teeth indicate a species of Siwalik *Lamna*, while a single tooth in the Indian Museum from Burma belonged to a small species of *Carcharodon* or *Carcharias*. Large squaline vertebræ, now in the Indian Museum, have been obtained from the Siwaliks of Perim Island.

From the tertiaries, or post-tertiaries, of the Káshmír valley a few fish-scales have been obtained.

Class II.—AMPHIBIA.

Trias-jura.—The oldest-known Indian amphibian is represented by a skull and part of the vertebral column, from the Bijori group of the Gondwánas, of a large species. This fine specimen belonged to the Asiatic Society of Bengal, and was sent to England for description about 18 years ago, since which time it has lain unnoticed. It has recently been recovered, and the writer hopes subsequently to give a description of it. The skull is of a triangular shape, and has been referred to *Archegosaurus* and *Labyrinthodon*. In its restricted sense, no skull is known of the latter genus, and it is quite possible that the Indian specimen may belong to *Mastodonsaurus* or to some other genus. Provisionally, it is convenient to refer to it as an *Archegosaurus* (see Note, p. 93).

From the Panchet group of the Gondwánas three genera of slender-jawed labyrinthodonts, allied to those of the European trias, are known. The first of these, *Pachygonia*, has only the one species *P. incurvata*, and is known by the greater part of the mandible, and a fragment of the skull. The marking of the former is like that of *Mastodonsaurus*. The second genus, *Gonioglyptus*, has two species, the smaller known as *G. longirostris* and the larger as *G. huxleyi*; it is considered to be closely allied to *Trematosaurus* of the bunter-sandstone of Germany. The third genus is known only by a single fragment of the mandible, to which the name *Glyptognathus fragilis* has been applied. These three genera are peculiar to India, and all their remains are exhibited in the Indian Museum; the two former belong to the group Euglypta.

From the Mángli beds of the Gondwánas, another peculiar genus of labyrinthodont has been obtained, and is represented by a single skull in the collection of the Geological Society, to which the name *Brachyops laticeps* has been applied. The genus is allied to *Rhinosaurus* from the jurassic of Europe, to *Micropholis* of the trias of Africa, and to *Bothriceps* of the trias of Australia, and with them constitutes the group Brachyopina.

From the Maleri group fragmentary jaws of a species of *Pachygonia*, probably the same as the Panchet form, have been obtained, as well as simple biconcave vertebræ of considerable size, probably belonging to a labyrinthodont; these specimens are in the Indian Museum.

Tertiary.—No amphibian remains have hitherto been obtained between the trias-jura and the tertiaries. In the lower series of the latter at Bombay there occur numerous remains of a small frog, belonging to the genus *Oxyglossus*, now living in China, Siam, and possibly India; the fossil species is extinct, and is known as *O. pusillus:* remains of a larger, but undetermined, frog are also indicated.

Class III.—REPTILIA.

Trias-jura.—The oldest reptiles hitherto found in India belong to the orders Dinosauria and Dicynodontia, and occur near Rániganj in lower Bengal, in the Panchet group of the Gondwanas, probably of triassic age. The remains

of a species of *Dicynodon*, belonging to the sub-genus *Ptychognathus*, are of comparatively common occurrence in the coarse Panchet sandstone, and have been described as *D. orientalis*. Other remains seem to indicate a second and larger species of the genus. This order of reptiles seems to be characteristic of the trias of India, Russia, and Africa, and to have attained its fullest development in the latter country. The remains of the Indian forms all occur over a very small area in one thin seam of the Panchets. The Dinosaur has been named *Ankistrodon indicus*, and is the sole representative of the genus; it is known merely by two minute compressed and trenchant teeth with serrated edges, like those of *Megalosaurus*, implanted in distinct sockets. The above specimens are in the Indian Museum. The Maleri group of the same system has yielded numerous, though much broken, remains of a large crocodilian, constituting the still undescribed genus *Parasuchus*, and bearing the manuscript specific name of *hislopi*, after the late Rev. Mr. Hislop, the discoverer of the vertebrate fossils of the Maleri group. This crocodile belonged to the amphicœlian division of the order, and seems to have been closely allied to *Belodon* and *Stagonolepis* of the trias of Europe, the three genera forming a group characterised by the non-union of the pterygoids behind the palatines. The scutes referred to *Parasuchus* differ from those of living crocodiles by their sculpture consisting of ridges and furrows radiating from a sub-central point, instead of isolated irregular pits. From the Denwá group of the same system a single scale of a gigantic crocodilian, probably belonging to the above genus, has been obtained. The Tiki beds in South Rewá, which are not improbably the equivalent of the Panchet group, have yielded other crocodilian remains, agreeing in the structure of the scales with *Parasuchus*, but distinguished by a totally different form of basioccipital, whence it is inferred that they probably belong to a distinct genus. In addition to the above, the Maleri and South Rewá rocks have yielded remains of a large species of the lacertian genus *Hyperodapedon*, originally described from the English trias. The Indian species, *H. huxleyi*, differs from the European *H. granti* by the greater number of the palatal teeth, and the presence of some additional teeth on the outer surface of the mandible; its length has been roughly estimated at 16 feet. The genus is closely allied to the living *Hatteria* of New Zealand, and has been supposed to have an affinity to *Rhynchosaurus* of the trias of Europe. From the Chári group of the jura of Kach there has been obtained a single crocodilian vertebra, not improbably belonging to *Parasuchus;* and from the Umia group of the same, a fragment of the mandible of a *Plesiosaurus*, described as *P. indicus;* the affinities of this form cannot be fully determined from the specimen.

The whole of the remains from the trias-jura, mentioned above, are in the collection of the Indian Museum.

Cretaceous.—From the Trichinopoli group (upper cretaceous), and probably from the Lameta group (middle cretaceous), there have been obtained a few teeth of a species of *Megalosaurus*, a genus whose range in Europe extends from the jurassic to the wealden; the one tooth of the Indian form now forthcoming is in the Indian Museum. From the Lameta series there have also been obtained the remains of another genus of gigantic dinosaur, to which the name *Titano-*

saurus has been assigned. This genus is allied to *Pelorosaurus* of the English wealden, and to *Cetiosaurus* of the jurassic, and was a long-tailed terrestrial form. The genus was represented by two species,—*T. indicus* and *T. blanfordi;* the former characterised by the centre of the caudal vertebræ being compressed, while in the latter they are sub-cylindrical. Numerous vertebræ, chiefly caudal, and a huge femur, nearly 4 feet in length, are preserved in the Indian Museum, and there is a cast of one of the former, belonging to *T. indicus*, in the British Museum. A few bones, in the former collection, indicate a smaller undetermined reptile from the Lametas.

The Chelonia are known in the cretaceous merely by some broken plates, in the collection of the Indian Museum, obtained from the Lametas, from the infra-trappeans of Rájamahendri (Rajamundry), and from the upper cretaceous of Sind.

The Crocodilia of the cretaceous are known only by one amphicœlian species, apparently allied to *Suchosaurus* of the English wealden, of which some vertebræ have been obtained from the upper cretaceous of Sind, and are now in the Indian Museum.

A large species of *Ichthyosaurus*, named *I. indicus*, is known solely by a few vertebræ obtained from the middle cretaceous of Trichinopoli, and now in the Indian Museum; the range of the genus in Europe is from the lias to the chalk.

Eocene.—The only specifically determined eocene reptile has been referred to the genus *Hydraspis*, under the name *H. leithi*. The specimen on which this determination rests is a carapace from the inter-trappeans of Bombay. The genus *Hydraspis* belongs to the *Emydidæ*, and is now confined to tropical America. From the nummulitics of the Panjáb numerous fragmentary remains of crocodilians have been obtained, but in too imperfect condition for determination.

Pliocene[1].—Many of the Siwalik chelonians in the British and Indian Museums are still undescribed, and the following list must, therefore, be considered imperfect. Of the Crocodilia, a species from the Sub-Himalaya and Perim Island has been identified with the living Indian *Crocodilus palustris* (*bombifrons*); remains from Burma and Sind probably belonging to the same species. Of the genus *Gharialis* (*Leptorhynchus*), a species from the Sub-Himalaya, Burma, Sind, and Perim Island is identical with *Gharialis gangeticus* of the Ganges and Jamna. A second species from the Sub-Himalaya, with slender teeth, has been named *G. leptodus;* and a third, of gigantic dimensions, and with shorter and stouter jaws and teeth, *G. crassidens;* the latter has been obtained from the Sub-Himalaya, Burma, and Sind. Remains of the above species are preserved both in the British and Indian Museums.

Of the order Lacertilia only one species of *Varanus* is known, and named *V. sivalensis:* this determination rests on the evidence of the distal extremity of a humerus, from the Sub-Himalaya, in the British Museum. The genus *Varanus*

[1] In this memoir the fossiliferous Siwaliks of Sind (lower Manchhars) are termed earlier pliocene, and those of the Sub-Himalaya and other parts of India higher pliocene,—the possibility of some of the Sind beds being of miocene age being still kept in view. The terms earlier and higher pliocene are intended merely to indicate that the one is older than the other, and not to indicate their correlation with the divisions of the European pliocene.

is now of common occurrence, and has probably existed since the oligocene, as the so-called *Palæovaranus* of the Quercy phosphorites is probably the same.

The Ophidia are known only by some vertebræ from the Panjáb and Sind, belonging to the genus *Python*, and not distinguishable from those of the living Indian *P. molurus;* these specimens are in the Indian Museum. A species of python (*P. cadurcensis*) from the Quercy phosphorites seems to have very closely resembled *P. molurus*.

The Chelonia are well represented, and comprise among other land tortoises the gigantic *Colossochelys atlas* from the Sub-Himalaya and Burma. This form is stated to be mainly distinguished from *Testudo* by the thickening of the episternal portion of the plastron, but it is doubtful if this character is of generic value, and the species should probably be referred to the latter genus. The length of the restored carapace in the British Museum is 12 feet 3 inches, and the entire animal, with the head and tail extended, is considered to have attained the length of 22 feet. In addition to this gigantic animal there is good evidence of the existence of other large tortoises, as the Indian Museum possesses several specimens of the ankylosed episternals of at least two species of large tortoises. These bones are as thick, but not as long, as those of *Colossochelys*, and their extremities are shorter, but more divergent; they probably belonged to species of *Testudo*, about two-thirds the size of *C. atlas*. A broken episternal indicates a third, but smaller species; while a fourth species of about the same size as the last is represented by three episternals in the Indian Museum, which are not bifurcated at their anterior extremities. A single carapace of a small tortoise in the Indian Museum seems also to belong to the genus *Testudo*. Among the hard-shelled emydine tortoises we have a species of *Bellia*, represented by two carapaces in the Indian Museum, which has been named *B. sivalensis*, and is considered to be closely allied to *B. crassicollis*, now inhabiting Tenasserim, Siam, and Sumatra; the genus is only represented by one other living species, *B. nuchalis* of Java. Another carapace in the Indian Museum, also from the Panjáb, seems to indicate a second Siwalik species of the genus. In the British Museum there are two carapaces of Siwalik land tortoises, with three dorsal ridges, which, although differing considerably in size, evidently belong to the same species, and since the smaller cannot be distinguished from the living *Damonia hamiltoni*, inhabiting Lower Bengal, they may be referred to that species; as is frequently the case, however, the fossil form greatly exceeded the living in size. The larger specimen was named *Emys hamiltonoides* in manuscript. An imperfect carapace from the Panjáb, in the collection of the Indian Museum, seems to belong to the genus *Emys*. A single marginal plate, also in the Indian Museum, has been referred, under the name of *Cautleya annuliger*, to a new genus, said to be distinguished from all other emydine tortoises by the cartilaginous, in place of the osseous, union of the marginals with the adjoining plates. Among the Bataguridæ, some carapaces in the British Museum indicate an animal identical with the living *Pangshura* (*Emys*) *tectum*, now inhabiting Lower Bengal; the fossil form attained a larger size than the recent. A large species of *Batagur* has been obtained in some numbers, but is not specifically determined. A carapace of this genus in the Indian Museum, with a ridge on the vertebral

plates, very probably belongs to a second species. Remains of a large *Trionyx* are likewise not uncommon, but have not yet been specifically determined. A carapace in the British Museum has been identified with the living *Emyda vittata* (*ceylonensis*) of Central and Southern India and Ceylon, and it is probable that numerous other remains of this genus may be referred to the same species.

Pleistocene.—The reptiles of the pleistocene are still very imperfectly known, but it is probable that they all belong to living Indian species. From both the Jamna and Narbada beds specifically indeterminable remains of crocodiles have been obtained. Two complete specimens of the carapace of *Pangshura tectum* from the Narbada are in the Indian Museum, and serve to connect the living with the Siwalik form, and show that the range of the species once extended over the greater part of India. A portion of the plastron of a *Batagur* from the Narbada has been provisionally referred to *B. dhongoka*, now found in the same river. A fragment of the carapace of a *Trionyx*, from the same deposits, probably belonged to *T. gangeticas*, and it is highly probable that a large chelonian cranium in the British Museum, from the same deposits, should be referred to the same species.

General.—The foregoing notes will show that the fossil reptiles are very few in number, and that many are only known by very fragmentary remains. The known mesozoic forms belong entirely to extinct genera; the one known eocene reptile belongs to a genus still living, but now far removed from India; the pliocene forms (with the exception of the doubtful genus *Colossochelys*) all belong to modern Indian genera, and frequently to existing species, although their range is now frequently restricted to the more southern parts of India; in the pleistocene it is probable that all the forms belong to existing species, which still inhabit the same districts as their fossil ancestors.

Class IV.—AVES.

Pliocene.—Remains of birds have hitherto been found only in the Sub-Himalayan Siwaliks, and in one instance in Sind; their numbers are still very small. Some of these remains are in the British, and the others in the Indian Museum. Among the carinates, a tarso-metatarsus has been considered to belong to a cormorant, and is provisionally referred to the genus *Graculus*. A species of pelican (*Pelecanus cautleyi*), somewhat smaller than the living Indian *P. mitratus*, is indicated by a fragment of the ulna; while another fragment of the same bone has been referred to a second species, under the name of *P. sivalensis*, but there is some doubt whether the generic determination is correct. A gigantic wader has been described, from the evidence of a sternum and tibia, under the name of *Megaloscelornis sivalensis*, and it is possible that the condyles of a humerus from Sind, measuring 2 inches in diameter, may belong to the same genus. A species of adjutant stork, which appears to have had considerable variations in size, has been named *Argala falconeri*. The Ratitæ appear to have been represented by three species, one of which was a true ostrich (*Struthio asiaticus*[1]), and is known by several bones of the leg and foot, and some cervical vertebræ. The second species is an emeu (*Dromœus sivalensis*), and is indicated

[1] The name *S. palæindicus* occurs in manuscript.

by some toe-bones; while the third, which is not even generically determined, is considered to be a three-toed form intermediate between the ostrich and the emeu, and is only known by one of the bones of the foot.

CLASS V.—MAMMALIA.

Eocene.—No traces of mammals have yet been detected below the eocene, and there only some very fragmentary bones have been obtained from the Panjáb. The determinable bones consist of the distal portions of the femur and the metatarsus of a perissodactylate animal, allied to, if not identical with, the palæothere, and the astragalus of an artiodactylate. The latter was obtained above the nummulitic clays of Fatehjang, and belonged to a (probably) ruminant animal, in which the navicular and cuboid elements of the tarsus were united. These specimens are in the Indian Museum.

Miocene.—The only definitely determined miocene mammal is a rhinoceros from the Gáj beds of Sind, which is apparently a variety of *R. sivalensis*, and has been named *v. gajensis*.

Pliocene.—The primates are known merely by a few fragmentary specimens of upper and lower jaws, with their teeth, and by one bone. The palate of a female, and the upper canine of a male, have been referred to a large anthropoid ape, under the title of *Palæopithecus sivalensis*; the genus seems to be allied to the orang, but is distinguished by the narrower form of the premolars: this specimen is in the Indian Museum. The half of a palate, not improbably belonging to a species of *Semnopithecus*, in the British Museum, has been provisionally named *S. subhimalayanus*. A lower jaw and an astragalus, the former in the British Museum, seem probably to belong to a smaller form of *Semnopithecus*, considered to be distinct from the former species. A species of *Macacus*, larger than *M. rhesus*, is indicated by two fragments of the mandible, in the British Museum; while a second species, smaller than *M. rhesus*, and known as *M. sivalensis*, is represented by two fragments of the maxilla, with teeth, in the Indian Museum.

Among the Carnivora we find a large species of tiger, characterised by its greatly developed sagittal crest, which has accordingly been named *Felis cristata*[1]; this species is represented by three crania (and limb-bones) in the British Museum, to one of which the separate specific name *F. grandicristata* has been applied, but apparently on insufficient grounds. The Indian Museum possesses some limb-bones, and a lower carnassial tooth, which not improbably belong to this species. A smaller species of the genus, about the size of *F. bengalensis*, is indicated by a single ramus of the mandible, in the Indian Museum. The genus *Machairodus* is represented by *M. sivalensis* (*M. falconeri*, Pomel), apparently varying in size from the dimensions of the jaguar to those of the tiger, although it has been proposed to distinguish the larger form under the name of *M. palæindicus*. This species is represented by two broken skulls, and numerous fragments of the jaws in the British Museum, and by the hinder part of a small skull, and part of the mandible in the Indian Museum. The genus *Pseudælurus*, distinguished from *Felis* by the presence of three, or occasionally four,

[1] The manuscript name, *F. palæotigris*, exists.

in place of two lower premolars[1] (although the ante-penultimate premolar is occasionally present as an abnormality in *Felis*), is known by a ramus of the mandible, in the Indian Museum, named *P. sivalensis;* the species was about equal in size to a small leopard. Among the civet-like animals we have a species of *Viverra*, said to be closely allied to the living civet, and represented by two skulls in the British Museum, to which the name *Viverra bakeri* has been applied. *Ictitherium* is represented by *I. sivalense*, of which the two rami of one mandible, a broken ramus, without teeth, of another, and a canine tooth are known, all of which are in the Indian Museum, and came from the Panjáb. The hyænas are represented by *Hyæna sivalensis*, said to present relationship both to the Indian *H. striata* and to the African and European *H. crocuta*, of which there are numerous specimens of the skull and mandible in the British and Indian Museums. It has been proposed to separate some of these specimens under the name of *H. felina*, a so-called species said to be characterised by the absence of the first upper premolar, and by the minute size of the last upper true molar; a large series of specimens shows, however, a great variety in these respects. Remains of a species of *Hyæna* have been described from the pliocene of China, and referred to a distinct species. The dogs are represented by *Canis cautlegi*, and *C. curvipalatus;* the former closely allied to the wolf: portions of the skulls of these species are in the British Museum, and a specifically undetermined palate in the British Museum. The genus *Amphicyon*, distinguished from *Canis* by its plantigrade character and by the presence of an additional upper true molar, is represented by *A. palæindicus*, of which the Indian Museum possesses several specimens of the jaws and teeth from Sind and the Panjáb. The bears are represented by the genera *Ursus* and *Hyænarctos:* of the former there is a skull, without teeth, from the Sub-Himalaya, and a canine from the Irawádi, both in the collection of the Indian Museum. Of the latter there are two species, *H. sivalensis* and *H. palæindicus*. *H. sivalensis* has the molars with quadrangular crowns, and is known by a fine skull, the half of a mandible, and some limb-bones, in the British Museum; and by numerous specimens of the teeth and jaws in the Indian Museum; a single upper molar from the newer pliocene of England much resembles the teeth of this species. *H. palæindicus* is known only by a single maxilla in the Indian Museum, and is distinguished by the triangular form of the crowns of the upper molars, which approach those of *Amphicyon*. Of the subursoid carnivores, the genus *Mellivora* (*Ursitaxus*) is represented by *M. sivalensis*, known by a fragment of the mandible from the Panjáb, in the Indian Museum, and apparently very closely allied to the living Indian species; and the genus *Meles* by a single species, of which there is also only a fragment of the mandible contained in the Indian Museum. Of the otters, *Lutra palæindica* has been named from the evidence of a skull and lower jaw in the British Museum; and a second species seems to be indicated by a lower jaw from the Panjáb, in the Indian Museum. *Enhydriodon*, represented by *E. ferox*, is a genus peculiar to the Siwaliks; the only known specimens are two skulls in the British Museum, a part of the maxilla in the Museum of the Royal College of Surgeons, and a mandible. The genus takes its name from its

[1] Occasionally a tubercular true molar is present, and the genus then approaches *Proailurus*.

affinity to the living sea-otter (*Enhydras*). The living genus inhabits the coasts of the North Pacific during winter, and proceeds up the rivers in summer; but it is probable that its fossil ancestor must have been entirely a river-dwelling form.

The Proboscidia are very abundantly represented, species of all the known genera or sub-genera being present. The most specialized genus, *Euelephas*, is represented by *E. hysudricus*, of which the molars are of less complex structure than those of *E. indicus*. *Loxodon* is represented by *L. planifrons*, remarkable for being the only species of true elephant in which premolars are known to have been developed. The genus or sub-genus *Stegodon*, peculiar to South-Eastern Asia, is represented by four species. Of these the molars of *S. ganesa* and *S. insignis* appear to be indistinguishable from one another; the skull of the former, however, of which there is a magnificent specimen in the British Museum, is distinguished by its enormous tusks; while that of the latter, of which there are numerous specimens, by the peculiarly depressed form of the fronto-parietal region. Molars of either *S. insignis* or of the next species, if not of both, have been obtained from strata of probably pliocene age in Japan. The molars of the third species, *S. bombifrons*, are less complex than those of the preceding; its skull has very prominent frontals; remains of this species have been obtained from the pliocene (?) of China, and described under the name of *S. orientalis*. Of the fourth species, *S. clifti*, the skull is unknown, but the molars are still simpler, the intermediate ones bearing only six ridges each; remains of this species have also been obtained from Burma, Japan, and China, a tooth from the latter country having been named *S. sinensis*. Five species of mastodons are also known, three belonging to the tetra-, and two to the tri-lophodont sub-division of the genus. Of the former, *M. latidens* approaches nearest to the stegodons, and as it has open valleys, and the intermediate molars occasionally carry five ridges, it affords such a complete transition between *S. clifti* and the other mastodons, that it seems highly probable that the generic divisions of the elephants and mastodons should be swept away, and the whole of them included under one large genus. The skull of *M. latidens* is unknown; its remains have been obtained from the Irawádi valley, the Sub-Himalaya, Sind, and Perim Island. *M. perimensis* has the molars rather less regular than the last; there is a fine skull in the British Museum, and its remains have been found in the Panjáb and Perim Island. The third tetralophodont species, *M. sivalensis*, has the molars with an "alternate" arrangement of the ridges, and occasionally presenting a tendency to a pentalophodont formula; there is a fine skull in the British Museum, and remains of this species have been obtained only from the Sub-Himalaya. The skulls of the two trilophodont species are unknown, and all their remains, which are from the Panjáb, Sind, and Perim Island, are in the Indian Museum[1]. In the first, *M. falconeri*, the valleys of the molars are open, and the symphysis of the lower jaw is short, and sometimes provided with small cylindrical tusks. In the second, *M. pandionis*, the valleys of the molars are obstructed by outlying columns, and the symphysis of the lower jaw is produced into a long trough-like process, which may or may not be furnished with large compressed tusks. Of the genus *Dinotherium* three species are

[1] This is exclusive of the remains of *M. pandionis* from the pleistocene of Madras.

known: the largest of these, *D. indicum*, rivals in size the European *D. giganteum*; there are several specimens of the teeth and jaws in the Indian Museum, and also in the collection of the Bombay Branch of the Royal Asiatic Society; there is also a cervical vertebra, part of the mandible, and an upper molar in the British Museum; remains of this species have been obtained from the Panjáb and Perim Island. The second species, *D. pentapotamiæ*, is of smaller size, and has been obtained from the Panjáb, Kach, and Sind; numerous specimens of the teeth and jaws are exhibited in the Indian Museum. The last species, *D. sindiense*, is only known by two specimens of a part of the mandible, one from Sind and the other, lacking the crowns of the molars, from the Panjáb; both specimens are in the Indian Museum. The mandible in this species is subcylindrical in cross-section, and thereby approaches the mastodons.

Coming to the Ungulata, we find both the perisso-, and the artio-dactylate sections well represented, though the latter are by far the most numerous. Among the former, we have the rhinoceroses represented by three species of true *Rhinoceros*: the first of these was a unicorn form, apparently very closely allied to the living *R. javanicus* (*sondaicus*), which it resembles in the form of its molars and the mandible. Skulls and teeth of this species are contained both in the British and Indian Museums, and its remains have been obtained from the Sub-Himalaya and Sind. The second species, *R. palæindicus*, does not seem to come very near to any living form; this species was also unicorn, and the mandible had two pairs of incisors; the upper molars are intermediate in structure between those of the living Javan and Indian species. Most of the remains of this form are from the Sub-Himalaya, and are in the British Museum. The third species, *R. platyrhinus*, was of huge size, and furnished with two horns; its molars are of the complex type of *R. indicus*, and its mandible has no incisors like the mandibles of the living African species, and the extinct *R. pachygnathus* of Pikermi. Remains of this species have been obtained only from the Sub-Himalaya, and are nearly all in the British Museum, where there is a nearly complete skull. All the above species have high-crowned (hypsodont) molars. It is possible that certain remains from the Bhúgti hills, now in the hands of the writer, may indicate a new species of the genus, with a mandible resembling that part in the existing African species.

Imperfect molars of a species of *Rhinoceros* have been obtained from the pliocene of China, and described as *R. sinensis*. The hornless rhinoceroses are represented by the gigantic *Acerotherium perimense*[1], of which there is a fine skull and numerous teeth and jaws from the Panjáb, in the Indian Museum, and a magnificent palate and some specimens of the mandible, from Perim Island, in the collection of the Bombay Branch of the Royal Asiatic Society; the British Museum also possesses a few specimens of teeth and jaws from Perim Island. The genus *Chalicotherium*, formerly classed among the artiodactylates, but now placed by many among the perissodactylates as a link between the rhinoceroses and the palæotheres, is represented by *C. sivalense*,—a species presenting a peculiarly aborted dentition, and hence referred by some to a distinct genus, under the name of *Nestoritherium*; it has been considered to be nearly allied to *Rhinoceros pachygnathus*. This species is of rare occurrence, but is known by an

[1] Syn. *Rhinoceros irvaticus* and *R. planidens*.

associated cranium and mandible, in the Museum of St. Andrew's University; by the upper molars of each maxilla and a mandible in the British Museum, and by a few lower molars in the Indian Museum. The latter specimens are from Sind, and the others from the Sub-Himalaya. Another species has been described from the pliocene of China. It seems doubtful whether the genus *Tapirus* occurs; the symphysis of a mandible from the Irawádi valley has indeed been referred to it, but the determination cannot be considered certain[1]. Fossil remains of the genus have, however, been obtained from the pliocene of China. The genus *Listriodon*, sometimes referred to the pigs, is represented by *L. pentapotamiæ* and *L. theobaldi*, the former being known by several molars, and the latter only by one molar of small size. All these teeth were obtained from the Panjáb, and are in the Indian Museum.

The horses are represented by the genera *Equus* and *Hippotherium* (*Hipparion*); of the former there are two species, *viz.*, *E. sivalensis*, apparently closely allied to the Tibetan kiang (*E. hemionus*), but retaining some ancestral characters, and *E. namadicus*, more nearly allied to the existing horse. Remains of these species have been obtained from the Sub-Himalaya, and one species of the genus from Perim, of which there are three molars in the Museum of Trinity College, Dublin. Of *Hippotherium*, there are also two species, *viz.*, *H. antelopinum*, closely allied to the European *H. gracile*, and *H. theobaldi*, distinguished by its superior size, and the form of its upper milk-molars. The former has been obtained from the Sub-Himalaya and Perim Island, and there are numerous remains both in the British and Indian Museums. A fine skull from Perim has been recently sent on loan to the Indian Museum, and is the only known example. The latter has been obtained from the Panjáb, Burma, and Perim Island, and most of its remains are in the Indian Museum; it is not improbable that the range of this species extended to China, where molars belonging to some form of the genus have been obtained. Coming to the artiodactylates, we have among the bunodont pig-like animals two species of *Hippopotamus*, one of which, *H. sivalensis*, was of large size, and furnished with six incisors in either jaw; the other, *H. iravaticus*, is very imperfectly known, but seems to have been of small size. Remains of these species have been obtained from the Sub-Himalaya and the Irawádi valley. A large animal, *Tetraconodon magnum*, is known only by a broken mandible, from the Panjáb, in the Indian Museum, and of which there is a cast in the Museum of the Royal College of Surgeons, and by a figure of the upper dentition. The mandible is remarkable for the enormous size of the premolars, and indicates an animal allied to the European and American tertiary genus *Entelodon* (*Elotherium*), but distinguished by the greater relative size of the premolars, and the more regularly oblong form of the true molars. The true pigs (*Sus*) are represented by three species, the first of which, *S. giganteus*, is distinguished by its enormous size; there is a nearly complete skull, with the mandible attached, and with some of the limb-bones, of this fine species, as well as numerous other remains in the Indian Museum, and a large series of teeth and jaws in the British Museum, all of which have been obtained from the Panjáb and Sub-Himalaya. The second species, *S. hysudricus*, is smaller

[1] Remains of *Listriodon* have been described as *Tapirus*.

than the living wild-boar, and has been obtained from the Panjáb, Sub-Himalaya, Perim Island, and Sind. The last species, *S. punjabiensis*, is of very small dimensions, and is only known by two portions of the mandible from the Panjáb, now in the Indian Museum. *Hippohyus* is a genus peculiar to the Siwaliks, whose molars present a remarkable complex arrangement of the columns recalling the pattern of the molars of the horse; it appears to have been represented by two species, both from the Sub-Himalaya, and one of which has been named *H. sivalensis*. *Sanitherium* is another genus peculiar to the Siwaliks, and is represented only by *S. schlagintweiti*, of which three fragments of the mandible are known, two being in Germany and the third in the Indian Museum; all three are from the Panjáb and Sub-Himalaya. The European miocene genus *Hyotherium* is represented by the molars of one species from Sind and Perim Island, which has been named *H. sindiense;* these teeth are in the Indian Museum. Of the selenodont pig-like animals, we have, among the group with five columns on the upper molars, two species of *Anthracotherium*, and two of *Hyopotamus*. Of the former, one species, *A. silistrense*, is of small size, and is known by three upper molars, and parts of the mandible; these specimens have been obtained from near Sylhet, the Punjab, and Sind, and most of them are in the Indian Museum. The second species, *H. hyopotamoides*, is of large size, and is known by an upper molar in the Indian Museum, from the Bhúgti hills, to the north of Sind; some mandibles may also belong to this species. Of *Hyopotamus*, a small species, *H. palœindicus*, is known by several teeth and one lower jaw, from Sind, in the Indian Museum; the molars of this species differ somewhat from those of typical species. The second species, *H. giganteus*, is known by an upper molar, and by some specimens of the mandible from the Bhúgti hills, now in the Indian Museum [1]; the upper tooth much resembles that of *Anthracotherium hyopotamoides*, and with that species forms such a complete transition between the genera *Anthracotherium* and *Hyopotamus*, that it seems highly probable that the two should be united. Among the forms characterised by having only four columns on the upper molars, there are four peculiar genera, each of which is known only by a single representative. The best known of these is *Merycopotamus*, represented by *M. dissimilis*, a genus allied to the hyopotamids by the structure of its teeth, and to the hippopotamus by the form of the mandible; this species has been obtained from the Sub-Himalaya and the Irawádi valley, and there are fine series of its remains in both the British and the Indian Museums. A second genus, *Hemimeryx*, is only certainly known by an upper molar of somewhat similar structure to the molars of the last genus; this specimen has been named *H. blanfordi*, and was obtained from Sind; it is now in the Indian Museum. Another upper molar in the same collection, also from Sind, has been named *Sivameryx sindiensis*, and indicates a smaller animal allied to the above. A maxilla with the upper molars, from the Garo hills, presented to the Geological Society, indicates another small animal of the same group, to which the name *Chœromeryx silistrensis* has been applied.

[1] Casts of the teeth of this species and of *A. hyopotamoides* will be found in the British Museum. The names of these, and of other selenodont Suina, are mentioned here for the first time, the memoir in which they are described being still in the press.

A single upper molar from Sind, in the Indian Museum, belongs to the American family *Oreodontidæ*, and has been provisionally referred to the genus *Agriochœrus*; it seems to be very close to the American *A. latifrons*.

Among the true ruminants we have the deer family represented by several imperfectly known species, at least one of which had large branching antlers. Of these, *Cervus triplidens* had a large accessory column to the molars, while in *C. simplicidens*, a species as large as *C. kashmirianus*, the accessory column is much smaller. In *C. sivalensis* the molars had very low crowns. The genus of the fourth species, *C. latidens*, is somewhat doubtful. Remains of these species have been obtained from the Panjáb and the Sub-Himalaya, and are numerously represented in the Indian Museum. The genus *Dorcatherium* is represented by the two species *D. majus* and *D. minus*, of which there are teeth in the Indian Museum, obtained from the Panjáb. A single upper molar in the Indian Museum, from the Panjáb, seems to belong to a genus related to *Palæomeryx*, for which the provisional name *Propalæomeryx sivalensis* has been proposed; it probably connects the true deer with the giraffe. The family *Camelopardalidæ*, which is taken to include both the giraffes and the sivatheres, is represented by several genera. In these we have a true giraffe, distinguished as *Camelopardalis sivalensis*, of which there are numerous teeth and a few bones in the British and Indian Museums, from the Sub-Himalaya, the Panjáb, and Perim Island. A species of *Helladotherium*, not distinguishable from *H. duvernoyi* of Europe, is represented by a single cranium in the British Museum. Of four genera peculiar to the Siwaliks, the first, *Vishnutherium*, is known by a part of the mandible from Burma, and probably by two upper molars, and some bones from the Panjáb, all of which are in the Indian Museum. It seems to come the nearest of the four to the giraffe, and has been named *V. iravaticum*. The second, *Hydaspitherium*, is known by two species, of which *H. megacephalum* is known by a skull and a large series of teeth and bones; all from the Panjáb, and now in the Indian Museum; it carried a massive common horn-base above the occiput from which the horns took their origin. The second species, *H. grande*, was larger and is only known by the upper molars and the mandible; all from the Panjáb, and now in the Indian Museum. It is probable that a cervical vertebra from Beluchistan, in the collection of the Geological Society, belongs to one of the above species. The third genus, *Bramatherium*, is represented by *B. perimense*, of which the skull, teeth, mandible, and some of the limb-bones are known; this species carried a pair of horns above the occiput, and a large common horn-base on the frontals. Its remains have been obtained from Perim Island, and the one known skull is in the Museum of the Royal College of Surgeons, the upper molars in the British Museum, two fragments of the mandible in the Indian Museum, and another, with the last true molar, in the Museum of Trinity College, Dublin. The fourth genus is the well-known *Sivatherium*, represented by the one species, *S. giganteum*, in which the skull was furnished with two pairs of horns. Remains of this species have been obtained only from the Sub-Himalaya eastward of the Panjáb, and the British Museum possesses a magnificent series of them. There has been much discussion as to the serial position of the foregoing forms, *Helladotherium*, with the giraffe, being classed by

some with the stags, while *Sivatherium* and the two preceding genera are classed with the antelopes. The resemblance of the teeth of all these animals is, however, so close that it seems preferable to class them all together in one large family, connecting the deer with the antelopes.

Of the antelopes, the best known is the so-called *Antilope palæindica*, which seems to have been closely allied to the South African genus *Damalis* (Bonte-bok, and Sassaby), and should probably be termed *D. palæindica;* there are two skulls in the Indian and one in the British Museum; all from the Sub-Himalaya. A skull from the same locality, in the Indian Museum, indicates a second species of antelope closely allied to the living Indian *A. cervicapra*, which has been named *A. sivalensis*. A third species, *A. acuticornis*, is indicated by numerous horn-cores from the Panjáb, in the Indian Museum, and was probably a kind of gazelle. A fourth species, *A. patulicornis*, has been named from a pair of horn-cores in the same collection. A species of *Portax* is indicated by numerous teeth and a fore-limb, in the Indian Museum; while other molars in the same collection not improbably belong to the genus *Palæoryx*, of the Pikermi beds. The oxen are represented by numerous species, three of which are here referred to one genus under the name of *Hemibos*, but have also been referred to two genera under the names of *Probubalus* and *Amphibos;* the group is closely allied to, if not identical with, the living Celebes genus *Anoa*, which has been referred to it under the name of *Probubalus celebensis*. The first species of *Hemibos* is named *H. occipitalis*, and varies considerably in the form of its horn-cores, which are sometimes nearly straight and triangular in section, and at others curved and pyriform in section; another variety is hornless. There are fine series of the skulls of this species, both in the British and the Indian Museums, all from the Sub-Himalaya. The second species, *H. antilopinus*, is also known by several skulls from the same districts. The third species *H.* (*Amphibos*) *acuticornis*, is a long-horned form, and is also represented by numerous skulls, from the Sub-Himalaya, in the British and Indian Museums. *Leptobos falconeri* is a fourth form of ox, which was in some cases hornless, of which there are several crania in the British Museum. The genus *Bubalus* is represented by two species; the first of these, *B. platyceros* (*sivalensis*), is known by one cranium in the British and another in the Indian Museum, both from the Sub-Himalaya; the horns were stout and concave superiorly. The second species is *B. palæindicus*, which occurs also in the pleistocene, if, indeed, the topmost beds of the Siwaliks in which it occurs should not be referred to that period; this species is evidently only a race of the living *B. arni*, and is very probably the same as *B. pallasi* from the pleistocene of Danzig. One skull from the Sub-Himalaya, in the Indian Museum, belongs to a species of *Bubalus*, and has been named *B. sivalensis;* it is the earliest form of the genus, and seems to have been allied to the fossil European *B. priscus*. Of the true oxen (*Bos*), three species have been named, *viz.*, *B. acutifrons*, remarkable for its enormous horns and angulated frontals; *B. planifrons*, with shorter horns and flattened frontals, and closely allied to the European *B. primigenius;* and *B. platyrhinus*, only known by the lower half of a skull of which the generic affinities are doubtful. The latter specimen, as well as a skull of each of the preceding species, are in the Indian Museum, and came from

the Sub-Himalaya. Species of *Bos* or allied genera are indicated from Perim Island by molars in the Museum of Trinity College, Dublin.

A remarkable hornless skull, of comparatively large size, from the Sub-Himalaya, in the collection of the British Museum, has been described under the name of *Bucapra daviesi;* this skull comes nearest to the skulls of the goats, while the molars are of a bovine type, and if found separately would certainly have been referred to some form of oxen. There is evidence of three species of true goats, the first of which, *Capra sivalensis*, is known by two skulls in the British Museum, from the Sub-Himalaya, and is considered to be allied to the jharal of the Nilgherries (*Hemitragus jemlaicus*), and not improbably belongs to the same genus. The second species, *C. perimensis*, is known by a portion of a skull in the Indian Museum from Perim Island, and was probably allied to the living markhoor (*C. falconeri*) of the Himalaya, though the horn-cores do not show a spiral twist. The third species is unnamed, since its horn-cores, of which the Indian Museum possesses numerous specimens from the Panjáb, are so like those of the markhoor, that it is difficult to point out characters of specific distinction with the materials available; it is possible that the horns may belong to older individuals of *C. perimensis*. It has been stated that a cranium from the Sub-Himalaya, which is not now forthcoming, belongs to the living Himalayan ibex (*C. sibirica*), but this determination requires confirmation, although it is highly likely that the specimen may have belonged to an allied species. Another cranium, also lost, has been referred to the genus *Ovis*.

A species of chevrotain has been determined from the evidence of a single upper molar, from the Panjáb, in the Indian Museum, under the name of *Tragulus sivalensis*.

The camels are known by *Camelus sivalensis*, which presents a peculiarity in the structure of its lower molars, connecting it with the llamas (*Auchenia*) of America. Remains of this species have been obtained from the higher beds of the Sub-Himalayan Siwaliks, and are well represented in both the British and Indian Museums.

The remaining orders of the mammalia are only represented by a few species of rodents, and by one edentate. Of the former, a species of rat (*Mus*) is indicated by some incisors from the Sub-Himalaya. A species of bambú-rat (*Rhizomys sivalensis*[1]) has been determined on the evidence of three specimens of the mandible from the Panjáb, now in the Indian Museum. A porcupine (*Hystrix sivalensis*) is known by a part of the cranium and the mandible, the former being in the British and the latter in the Indian Museum; one is from the Sub-Himalaya and the other from the Panjáb.

The edentates are known by one species of pangolin, *Manis sindiensis*, named on the evidence of a solitary phalangeal bone from Sind, now in the Indian Museum. The species must have been about four times the size of the living Indian *M. pentedactylus*.

Pleistocene.—Coming to the pleistocene, we find that its mammals are even less well known than those of the pliocene. As the pleistocene ossiferous strata are distributed in patches, very frequently in the valleys of the great rivers, the

[1] Probably the same as *Typhlodon* of Falconer.

remains from the more important of these areas must be treated of separately. The most important areas are parts of Madras and the Deccan; the valleys of the Jamna, Narbada, Pemganga, Krishna (Kistna), and Godávari, with their numerous tributaries, and the plains of Húndes in Tibet. It is also not improbable, as already mentioned, that the topmost strata of the Sub-Himalayan Siwaliks should really be referred to the pleistocene. In many instances, as in the delta of the Ganges, it is difficult, if not impossible, to draw any satisfactory line of distinction between the pleistocene and the prehistoric deposits. The presence in any stratum of the remains of *Hippopotamus*, or other genus not now found living in India, is considered as fair evidence for assigning such deposit to the pleistocene.

From the laterite of Madras palæolithic implements and a human platycnemic tibia have been obtained, and are assigned to the pleistocene.

From the alluvium of the Krishna valley, in the Deccan, a part of the skull and the mandible of a rhinoceros has been obtained, and described under the name of *Rhinoceros deccanensis*. This species seems to be more nearly allied to the living African and the pliocene European species than to any living Indian form. Remains of an ox, not improbably *Bos namadicus*, have also been obtained from the same deposits, and with the last-mentioned specimens are in the Indian Museum. Certain molars of the pliocene *Mastodon pandionis* from the Deccan, and now in the British Museum, were not improbably derived from the same deposits in the upper part of the Krishna basin.

From the ossiferous gravels of the Narbada palæolithic implements of a rude form have been found associated with mammalian bones. The carnivora are represented by a small species of bear (*Ursus namadicus*), of which there is a maxilla and a tibia in the British, and a canine in the Indian Museum; and a large species of *Felis* is indicated by the distal extremity of a femur in the former collection. Of the Proboscidia, there is *Euelephas namadicus*, characterised by its prominent frontal ridge, and whose molars very closely resemble those of the European *E. antiquus*, from which resemblance it has been thought that the two forms may belong to the same species. The Indian species has also been obtained from Japan. There is one fine skull in the British Museum, and three skulls in the Indian Museum. *Stegodon* is represented by *S. ganesa*, of which there is a fine tusk in the Indian Museum, and very probably by *S. insignis*. The perissodactyles are represented by *Rhinoceros indicus*, of which the Indian Museum has two molars; and by a little-known extinct form to which the name *R. namadicus* has been applied; there is a scapula of this species in the last-named collection. There is also a species of horse, *Equus namadicus*, which seems to be a survivor from the Siwaliks. Among the Artiodactyla two species of hippopotamus were originally described under the names of *Hippopotamus namadicus* and *H. palæindicus;* the former having six and the latter four incisors. Specimens in the Indian Museum seem, however, to show that there is a transition in these respects between these two so-called species, and all the remains have accordingly been referred to *H. palæindicus*, which was hexaprotodont in some individuals, and tetraprotodont in others. The pigs seem to have been represented by *Sus giganteus*, another survivor from the Siwaliks. Remains of a deer

apparently very close to, if not identical with, the living Indian *Cervus duvaucelli*, have been obtained, and there is some evidence of a second species. Three species of oxen have been described, *viz.*, *Bos namadicus*, a species showing some affinity to the Asiatic genus *Bibos*, of which there is a magnificent skull in the Indian Museum; *Bubalus palæindicus*, also occurring in the topmost Siwaliks, and the ancestor of *B. arni*; and *Leptobos frazeri*, which was sometimes hornless, and is represented by some fine skulls in the British Museum. A species of nilghai, of which there are two broken crania in the same collection, has been named *Portax namadicus*; it is distinguished from the living species, among other characters, by the horns being placed nearer to the orbits. The rodents are only known by some incisors in the Indian Museum, probably belonging to a species of *Mus*.

From the pliestocene of the Jamna valley only four mammals have been specifically determined with any certainty, *viz.*, *Euelephas namadicus*, *Bubalus palæindicus*, *Hippopatamus palæindicus*, and the living *Antilope cervicapra*; the latter being known by a single horn-core in the Indian Museum. In addition to these, remains of a species of *Semnopithecus*, *Sus*, *Portax*, *Equus*, *Mus*, and of a *Rhinoceros* furnished with lower incisors, have also been obtained. A tiger, as large as the existing species, is indicated by a scapho-lunar bone in the Indian Museum; this species was very probably the same as the Narbada form, and may have been *Felis tigris*.

The pleistocene of the Pemganga valley has yielded remains of *Bos namadicus*, a *Portax*, and *Hippopotamus palæindicus*.

The remains from the Godávari deposits have not been satisfactorily determined.

The horizontal lacustrine strata of Húndes in Tibet formerly classed as Siwalik, but which are more probably of pleistocene age, have yielded a small number of mammalian remains. Among these is a tooth referred to a species of *Hyæna*. Bones belonging to some form of horse have also been obtained, among which a cannon-bone in the collection of the Geological Society belongs to a species of *Hippotherium*, a genus elsewhere unknown in the pleistocene. Several of the limb-bones and the fragment of an upper molar of a rhinoceros are also known, but they are too imperfect for specific determination. The other known fossils belong to ruminants, the best preserved of which is the greater portion of the skull of an antelope, provisionally referred to the living Tibetan genus *Pantholops*, under the name of *P. hundesiensis*; this specimen cannot now be found, but is figured in Royle's "Illustrations of the Botany of the Himalaya Mountains." There is also a skull said to belong to some genus of bovine animal; another belonging to a goat resembling the markhoor (*Capra falconeri*); and a palate, in the collection of the Geological Society, doubtfully referred to a sheep (*Ovis*).

It may be added that mammalian remains are stated to have been obtained from a cave in the Karnúl district of Madras; these remains have, however, never been described, and cannot now be found.

Prehistoric.—The prehistoric deposits, as already said, have in many cases not yet been satisfactorily separated from the pleistocene, and the very local

occurrence of vertebrate remains in the former renders this point of doubt one not likely to be soon cleared up. Any old alluvial deposit in which bones of only living mammals occur is here provisionally referred to the prehistoric.

Human remains and neolithic implements have been obtained in the alluvium of the plains in many localities, and frequently at considerable distances below the surface; the former are generally very imperfectly preserved and have never been carefully examined. Polished celts are extremely abundant in many places, and particularly in Burma and the Banda district of the North-West Provinces. The prevailing types are elongated forms with oval section, wedges, and the "shouldered" form. Among the mammals, specimens of the teeth and jaws of *Macacus rhesus* from the alluvium and turbary of Goalpára, in Assam, and from Madras are exhibited in the Indian Museum; those from the former district being in a highly mineralised condition. Molars of the Indian elephant occur at considerable depths in the alluvium of the plains and of Burma. A last upper molar of *Rhinoceros indicus*, in the Indian Museum, was obtained from the turbary of Madras, and indicates the former extensive range of this species. It may be observed in passing that the range of the other species of *Rhinoceros* was probably much more extensive than at present, even in the historic period, because it has been inferred that the species killed by Akbar on the banks of the Indus was *R. javanicus* (*Sondaicus*); this inference being founded on the improbability of its being possible to kill *R. indicus* by means of arrows, with which Akbar's animals were destroyed. *Sus indicus* has also been obtained from the turbaries of Madras and Calcutta. Antlers, horn-cores, and teeth of undetermined species of *Bos* and *Cervus* have been obtained from the alluvium of various districts in the plains, and from raised beaches in Kattiawár; some of the latter deposits being probably in part of pleistocene age.

General.—Of the mammalia as a whole it may be observed that those of the pliocene are characterised by the great number of forms belonging to the orders which include animals of large corporeal bulk. Another noticeable point is the admixture of genera characteristic of modern Africa (*Hippopotamus*, *Camelopardalis*) and other parts of the old world (*Bos*, *Capra*, *Ursus*, *Equus*, etc.); of oligocene, miocene, and pliocene Europe (*Dinotherium*, *Anthracotherium*, *Hippotherium*, etc.) with those now peculiar to Asia (*Euelephas*, *Rhinoceros* [in its restricted sense] etc.). Among orders which have now diminished extensively in numbers in India, the Proboscidia stands pre-eminent, its fourteen Siwalik representatives having now dwindled to one. The perrissodactylate Ungulata have also diminished considerably, the modern forms inhabiting India and the adjacent countries being five and the extinct eleven or twelve. The artiodactylate modification has perhaps suffered a still more serious diminution, especially among the pig-like animals, in which the whole of the selenodont group like *Merycopotamus* and *Hyopotamus* has completely disappeared, while their congener, the hippopotamus, is now confined to Africa, and the Indian wild-boar and the diminutive terai hog (*Porcula*) are the sole representatives now remaining. The ruminants have lost their larger representatives, either entirely (*Sivatherium*) or by transference to Africa (*Camelopardalis*), and some of their smaller forms are considered to be allied to South Indian (*Hemitragus*) or South African form (*Damalis*), while others have always

been exclusively Indian (*Portax*). The diminution in numbers of the ruminants cannot be clearly indicated owing to the numbers of small forms now existing, when analogues cannot be determined in the Siwaliks. Similarly, owing to the poverty of the remains of the other orders, and of the almost total absence of the micro-mammalia, comparisons cannot be instituted between the numbers of the recent and fossil species, but enough has been indicated to show that modern India has only the impoverished remains of a once extensive fauna of mighty forms. Regarding the range in space of the Siwalik fauna, it is probable that this was once very extensive, as we find some of the species ranging as far as China and Japan, and it has even been suggested that one species (*Hyænarctos sivalensis*) occurs in the pliocene of England. Representatives of some of the other common Siwalik or Indian genera, although considered to be specifically distinct, have also been obtained from China (*e.g.*, *Chalicotherium*, *Rhinoceros*, *Tapirus*, and *Hyæna*). It may also be observed that the mammals from Sind belong mainly to European oligocene and miocene genera, while those from the Panjáb show a mixture of miocene, pliocene, and existing genera; the two latter prevailing more extensively as we proceed eastward along the Sub-Himalaya. The high degree of evolution or specialization of many of the genera is a marked feature, and one strongly confirmative of their pliocene age. Thus it may be noticed that the rhinoceroses had high-crowned molars, and that in one form the incisors were absent and two horns present; while some of the horses had reduced their digits to one on each limb. The pigs had well-developed tusks, the deer large branching antlers, the oxen wide-spreading horns, and the cats (*Machairodus*) huge trenchant fangs.

In the pleistocene the majority of the larger forms had disappeared, though a few of the extinct genera and species still lingered on. Many of the existing species were already in existence, or were represented by closely allied forms. Palæontological history is, however, still silent as to the origin of some of the larger existing mammals, like the Indian elephant. Some new forms (*e.g.*, *Bos namadicus*), which cannot be directly traced back to pliocene ancestors, seem to have appeared and to have died out again before the prehistoric.

In the latter period all the mammals seem to belong to existing species, although the range in space of some of them was more extensive than at present.

SYSTEMATIC CHRONOLOGICAL LIST OF SPECIES.

A.—ANTHROPOZOIC.

a.—PREHISTORIC.

MAMMALIA .	. PRIMATES	. Homo (? sapiens, Lin.).
		Macacus rhesus (F. Cuv.).
	PROBOSCIDIA	. Euelephas indicus, Linné.
	UNGULATA	. Rhinoceros indicus, Cuvier.
		Sus indicus, Gray.
		Cervus sp.
		Bos sp.
REPTILIA	. CHELONIA	. Gen. *non det.*

b.—PLEISTOCENE.

MAMMALIA	PRIMATES	Homo sp.
		Semnopithecus sp.
		Ursus namadicus, F. & C.
		Hyæna sp.
		Felis (? tigris, Lin.).
	PROBOSCIDIA	Euelephas namadicus, F. & C.
		Stegodon ganesa, F. & C.
		(?) ——— insignis, F. & C.
		Mastodon pandionis, Fals.
	UNGULATA	Rhinoceros deccanensis, Foote.
		——— indicus, Cuv.
		——— namadicus, F. & C.
		——— sp.
		Equus namadicus, F. & C.
		Hippotherium sp.
		Sus giganteus, F. & C.
		Cervus (? duvaucelli, Cuv.).
		Bubalus palæindicus, F. & C.
		Bos namadicus, F. & C.
		Leptobos frazeri, Rüt.
		Portax namadicus, Rüt.
		Antilope cervicapra, Pallas.
		Pantholops (?) hundesiensis, Lyd.
		Capra sp.
		Ovis (?) sp.
	RODENTIA	Mus sp.
REPTILIA	CROCODILIA	Crocodilus (?) sp.
	CHELONIA	Pangshura tectum (Bell).
		Batagur (? dhongoka, Blyth).
		Trionyx (? gangeticus, Cuv.).

B.—THERIOZOIC.

a.—PLIOCENE [1].

MAMMALIA	PRIMATES	Palæopithecus sivalensis, Lyd.
		Macacus sivalensis, Lyd.
		——— sp.
		Semnopithecus (?) sub-himalayanus, Myr.
		——— sp.
	CARNIVORA	Felis cristata, F. & C.
		—— sp.
		Machairodus sivalensis, F. & C.
		Pseudælurus sivalensis, F. & C.
		Ictitherium sivalense, Lyd.
		Viverra bakeri, Bose.
		Hyæna sivalensis, F. & C.
		Canis curvipalatus, Bose.
		—— cautleyi, Bose.
		† Amphicyon palæindicus, Lyd.
		Ursus sp.

[1] The forms of the earlier pliocene are marked by a cross (†).

MAMMALIA . . CARNIVORA . Hyænarctos sivalensis, F. & C.
———— palæindicus, Lyd.
Mellivora sivalensis, F. & C.
Meles sp.
Lutra palæindica, F. & C.
—— sp.
Enhydriodon sivalensis, F. & C.

PROBOSCIDIA . Euelephas hysudricus, F. & C.
Loxodon planifrons, F. & C.
Stegodon ganesa, F. & C.
———— insignis, F. & C.
———— bombifrons, F. & C.
———— clifti, F. & C.
† Mastodon latidens, Clift.
———— sivalensis, F. & C.
† ———— perimensis, F. & C.
† ———— pandionis, Falc.
† ———— falconeri, Lyd.
† Dinotherium sindieuse, Lyd.
† ———— pentapotamiæ, Falc
———— inidcum, Falc.

UNGULATA . † Chalicotherium sivalense, F. & C
Rhinoceros palæindicus, F. & C.
———— platyrhinus, F. & C.
† ———— sivalensis, F. & C.
† Acerotherium perimense, F. & C.
Listriodon pentapotamiæ, Falc.
———— theobaldi, Lyd.
(?) Tapirus sp.
Equus sivalensis, F. & C.
—— namadicus, F. & C.
Hippotherium antilopinum, F. & C.
———— theobaldi, Lyd.
Hippopotamus iravaticus, F. & C.
———— sivalensis, F. & C.
Tetraconodon magnum, Falc.
Sus giganteus, F. & C.
† — hysudricus, F & C.
— punjabiensis, Lyd.
Hippohyus sivalensis, F. & C.
———— sp.
Sanitherium schlagintweiti, Myr.
† Hyotherium sindiense, Lyd.
† Anthracotherium silistrense (Pent).
† ———— hyopotamoides, Lyd.
† Hyopotamus palæindicus, Lyd.
† ———— giganteus, Lyd.
Merycopotamus dissimilis, F. & C.
Chœromeryx silistrensis (Pent).
† Hemimeryx blanfordi, Lyd.
† Sivameryx sindiensis Lyd.
† Agriochœrus (?) sp.
Cervus triplidens, Lyd.
—— sivalensis, Lyd.

MAMMALIA .	. UNGULATA	.	Cervus simplicidens, Lyd.
			——— (?) latidens, Lyd.
			Dorcatherium majus, Lyd.
			——————— minus, Lyd.
			Propalæomeryx sivalensis, Lyd.
			Camelopardalis sivalensis, F. & C.
			Helladotherium duvernoyi, Wag.
			Vishnutherium iravaticum, Lyd.
			Hydaspitherium grande, Lyd.
			——————— megacephalum, Lyd.
			Sivatherium giganteum, F. & C.
			Antilope (? Damalis) palæindica, F. & C.
			——— patulicornis, Lyd.
			——— (? Gazella) porrecticornis, Lyd.
			——— sivalensis, Lyd.
			Palæoryx (?) sp.
			Portax sp.
			Hemibos occipitalis, Falc.
			——— acuticornis, Falc.
			——— antilopinus, Falc.
			Leptobos falconeri, Rüt.
			Bubalus platyceros, Lyd.
			——— palæindicus, F. & C.
			Bison sivalensis, Falc.
			Bos acutifrons, Lyd.
			—— planifrons, Lyd.
			—— (?) platyrhinus, Lyd;
			Bucapra daviesi, Rüt.
			Capra (? Hemitragus) sivalensis, Lyd.
			—— perimensis, Lyd.
			—— sp.
			Ovis (?) sp.
			Tragulus sivalensis, Lyd.
			Camelus sivalensis, F. & C.
	RODENTIA		Mus sp.
			Rhizomys sivalensis, Lyd.
			Hystrix sivalensis, Lyd.
	EDENTATA	. †	Manis sindiensis, Lyd.
AVES .	. CARINATÆ	.	Graculus (?) sp.
			Pelecanus cautleyi, Dav.
			——— (?) sivalensis, Dav.
			Megaloscelornis sivalensis, Lyd.
		†	——————— (?) sp.
			Argala falconeri, M. Ed.
	RATITÆ .	.	Struthio asiaticus, M. Ed.
			Dromæus sivalensis, Lyd.
			Gen. *non det.*
REPTILIA .	. CROCODILIA	.	Crocodilus palustris, Less.
			Gharialis gangeticus, Gmel.
			——— leptodus, F. & C.
		†	——— crassidens, F. & C.
	LACERTILIA	.	Varanus sivalensis, Falc.
	OPHIDIA .	. †	Python (? molurus, Lin.)
	CHELONIA	.	Colossochelys atlas, F. & C.

REPTILIA	CHELONIA	Testudo (?) 5 sp.
		Bellia sivalensis, Theo.
		—— sp.
		Damonia hamiltoni, Gray.
		Emys sp.
		Cantleya annuliger, Theo.
		Pangshura tectum (Bell.)
		† Batagur sp.
		† Trionyx sp.
		Emyda vittata, Pet.
PISCES	ELASMOBRANCHII	Carcharias sp.
		Lamna sp.
	TELEOSTEI	Bagarias yarrelli, Syk.
		Arius sp.
		Gen. *non. det.*

b.—MIOCENE.

MAMMALIA	UNGULATA	Rhinoceros sivalensis v. gajensis, Lyd.

c.—EOCENE.

MAMMALIA	UNGULATA	(?) Palæotherium sp.
		Artiodactyle, gen *non. det.*
REPTILIA	CROCODILIA	Gen. *non det.*
	CHELONIA	Hydraspis leithi, Carter.
AMPHIBIA	ANOURA	Oxyglossus pusillus, Owen.
		————(?) sp.
PISCES	ELASMOBRANCHII	Myliobatis sp.
	TELEOSTEI	Diodon foleyi, Lyd.
		Capitodus indicus, Lyd.
		Gen. *non det.*

C.—SAUROZOIC.

a.—CRETACEOUS.

REPTILIA	DINOSAURIA	Megalosaurus sp.
		Titanosaurus blanfordi, Lyd.
		————indicus, Lyd.
		Gen. *non det.*
	CROCODILIA	Gen. *non det.*
	CHELONIA	Gen. *non det.*
	ICHTHYOSAURIA	Ichthyosaurus indicus, Lyd.
PISCES	ELASMOBRANCHII	Corax incisus, Eg.
		———pristodontus, Ag.
		Enc odus serratus, Eg.
		Lamna complanata, Eg.
		——— sigmoides, Eg.
		Odontaspis constrictus, Eg.
		————oxypeion, Eg.
		Otodus basalis, Eg.
		——— divergens, Eg.
		——— marginatus, Eg.
		——— minutus, Eg.
		——— nanus, Eg.
		——— semiplicatus, Eg.

PISCES .	. ELASMOBRANCHII	. Oxyrhina triangularis, Eg.
		——— sp.
		Ptychodus latissimus, Ag.
		Sphyrænodus (?) sp.
	GANOIDEI	. Pycnodus (?) sp.

b.—JURA-TRIAS.

REPTILIA	. DINOSAURIA . .	Ankistrodon indicus, Hux.
	CROCODILIA . .	Gen. *non det.* (Chari gp.).
		Parasuchus hislopi, Hux. Mss.
		Gen. *non det.* (Rewah).
	LACERTILIA . .	Hyperodapedon huxleyi, Lyd.
	DICYNODONTIA . .	Dicynodon orientalis, Hux.
		———sp.
	PLESIOSAURIA . .	Plesiosaurus indicus, Lyd.
AMPHIBIA	. LABYRINTHODONTIA .	Brachyops laticeps, Owen.
		Gonioglyptus longirostris, Hux.
		———huxleyi, Lyd.
		Glyptognathus fragilis, Lyd.
		Pachygonia incurvata, Hux.
		Archegosaurus (?) sp.
		Gen. *non det.*
PISCES . .	. GANOIDEI . .	Ceratodus [1] hislopianus, Old.
		——— hunterianus, Old.
		——— virapa, Old.
		Dapedius egertoni, Syk.
		Lepidotus breviceps, Eg.
		——— calcaratus, Eg.
		——— deccanensis, Eg.
		——— longiceps, Eg.
		——— pachylepis, Eg.
		Tetragonolepis analis, Eg.
		——— oldhami, Eg.
		——— rugosus, Eg.
		Gen. *non* det.

D.—ICHTHYOZOIC.

CARBONIFEROUS.

PISCES . .	. GANOIDEI . . .	Sigmodus dubius, Waag.
		Pœcilodus paradoxus, Waag.
		Psephodus indicus, Waag.
		Saurichthys indicus (?), De Kon.
	ELASMOBRANCHII	Helodopsis elongata, Waag.
		——— abbreviata, Waag.
		Psammodus sp.
		Petalorhynchus indicus, Waag.
		Xystracanthus gracilis, Waag.
		——— major, Waag.
		——— giganteus, Waag.
		Thaumatacanthus blanfordi, Waag.
		Acrodus flemingi, De Kon.
		——— sp.

[1] Following Professor Miall ("Monograph of the Sirenoid and Crossopterygian Ganoids," Palæontographical Society, 1878), the order Dipnoi is merged with the Ganoidei.

ALPHABETICAL AND SYNOPTICAL LIST OF SPECIES, ARRANGED IN CLASSES[1].

CLASS I.—PISCES.

Acrodus flemingi, De Kon.	Salt-range	Carboniferous.
—— sp.	„	„
Arius	Panjáb and Sind	Pliocene.
‡ Bagarias yarrelli, Sykes	Sub-Himalaya	Higher pliocene.
Pimelodus bagarias, Syk.		
Capitodus indicus, Lyd.	Panjáb	Eocene.
Carcharias sp.	Burma	Higher pliocene.
Ceratodus hislopianus, Old.	Maleri	Trias-jura.
—— hunterianus, Old.	„	„
—— virapa, Old.	„	„
Corax incisus, Eg.	Trichinopoli	Cretaceous.
—— pristodontus, Ag.	Trichinopoli and Europe	„
Dapedius egertoni, Syk.	Kota	Trias-jura.
Diodon foleyi, Lyd.	Rámri and Andamans	Eocene.
Enchodus serratus, Eg.	Trichinopoli	Cretaceous.
* Helodopsis abbreviata, Waag.	Salt-range	Carboniferous.
—— elongata, Waag.	„	„
Lamna complanata, Eg.	Trichinopoli	Cretaceous.
—— sigmoides, Eg.	„	„
—— sp.	Burma	Higher pliocene.
Lepidotus breviceps, Eg.	Kota	Trias-jura.
—— calcaratus, Eg.	„	„
—— deccanensis, Eg.	„	„
—— longiceps, Eg.	„	„
—— pachylepis, Eg.	„	„
Myliobatis sp.	Panjáb	Eocene.
Odontaspis constrictus, Eg.	Trichinopoli	Cretaceous.
—— oxypeion, Eg.	„	„
Otodus basalis, Eg.	„	„
—— divergens, Eg.	„	„
—— marginatus, Eg.	„	„
—— minutus, Eg.	„	„
—— nanus, Eg.	„	„
—— semiplicatus, Eg.	„	„
Oxyrhina triangularis, Eg.	„	„
—— sp.	„	„
Petalorhynchus indicus, Waag.	Salt-range	Carboniferous.
Pœcilodus paradoxus, Waag.	„	„
Psammodus sp.	„	„
Psephodus indicus, Waag.	„	„
Ptychodus latissimus, Ag.	Trichinopoli and Europe	Cretaceous.
Pyoncdus (?) sp.	Trichinopoli	„
Saurichthys indicus (?), De Kon.	Salt-range	Carboniferous.
* Sigmodus dubius, Waag.	„	„
Sphyrænodus (?) sp.	Lameta, gp.	Cretaceous.

[1] Synonyms (of which only the more important are given) are in italics; living species are indicated by a double cross (‡), and fossil genera peculiar to India or Burma by an asterisk (*).

Tetragonolepis analis, Eg.	Kota		Trias-jura.
——— oldhami, Eg.	„		„
——— rugosus, Eg.	„		„
* Thaumatacanthus blanfordi, Waag.	Salt-range		Carboniferous.
Xystracanthus giganteus, Waag.	„		„
——— gracilis, Waag.	„		„
——— major, Waag.	„		„

CLASS II.—AMPHIBIA.

Archegosaurus (?) sp.	Bijori gp.	Trias-jura.
* Brachyops laticeps, Owen.	Mangli	„
* Glyptognathus fragilis, Lyd.	Panchet gp.	„
* Gonioglyptus huxleyi, Lyd.	„	„
* ——— logirostris, Hux.	„	„
Oxyglossus pusillus, Owen (*Rana pusilla*, Owen).	Bombay	Eocene.
——— (?) sp.	„	„
* Pachygonia incurvata, Hux.	Panchet gp.	Trias-jura.

CLASS III.—REPTILIA.

* Ankistrodon indicus, Hux.	Panchet gp.	Trias-jura.
‡ Batagur (? dhonkoka, Blyth)	Narbada	Pleistocene.
Bellia sivalensis, Theo.	Panjáb	Higher pliocene.
—— sp.	„	„
* Cautleya annuliger, Theo.	„	„
* Colossochelys atlas, F. & C.	Sub-Himalaya and Burma	„
‡ Crocodilus palustris, Less. (*C. bombifrons*, Gray.)	Sub-Himalaya and (?) Narbada.	Higher pliocene and (?) pliestocene.
‡ Damonia hamiltoni, Gray (*Emys hamiltonoides*, Falc.) (*Damonia hamiltonoides*, Falc.)	Sub-Himalaya	Higher pliocene.
Dicynodon orientalis, Hux. (*Ptychognathus orientalis*, Hux.)	Panchet gp.	Trias-jura.
‡ Emyda vittata, Peters (*E. ceylonensis*, Gray.)	Sub-Himalaya, &c.	Higher pliocene.
Emys sp.	„	„
‡ Gharialis crassidens, F. & C. (*Crocodilus crassidens*, F. & C.) (*Leptorhynchus crassidens*, F. & C.)	Sub-Himalaya and Sind	Pliocene.
‡ ——— gangeticus, Gmel. (*Leptorhynchus gangeticus*, Gmel.)	Sub-Himalaya, Burma, Sind, and Perim.	„
——— leptodus, F. & C. (*Leptorhynchus leptodus*, F. & C.)	Sub-Himalaya, Burma, Sind, and Perim	„
Hydraspis leithi, Carter (*Testudo leithi*, Carter.)	Bombay	Eocene.
Hyperodapedon huxleyi, Lyd.	Maleri and South Rewá	Trias-jura.
Ichthyosaurus indicus, Lyd.	Trichinopoli	Cretaceous.
Megalosaurus sp.	Trichinopoli and Lameta gp.	„
‡ Pangshura tectum, Bell. (*Emys tectum*, Bell.)	Sub-Himalaya and Narbada.	Higher pliocene and pleistocene.

* Parasuchus hislopi, Hux.	Maleri	Trias-jura.
——— (?) sp.	Denwa gp.	„
Plesiosaurus indicus, Lyd.	Umia gp.	Jura.
‡ Python (? molurus, Lin.)	Panjáb and Sind	Pliocene.
Testudo *sp. var.*	Sub-Himalaya	Higher pliocene.
* Titanosaurus blanfordi, Lyd.	Lameta gp.	Cretaceous.
——— indicus, Lyd.	„	„
‡ Trionyx (? gangeticus, Cuv.)	Narbada	Pleistocene.
——— sp.	Sub-Himalaya	Higher pliocene.
Varanus sivalensis, F. & C.	„	„

CLASS IV.—AVES.

Argala falconeri, M. Ed. (*Leptoptilus falconeri* [M. Ed.])	Sub-Himalaya	Higher pliocene.
Dromœus sivalensis, Lyd.	„	„
Graculus (?) sp.	„	„
Megaloscelornis sivalensis, Lyd.	„	„
Pelecanus cautleyi, Dav.	„	„
——— (?) sivalensis, Dav.	„	„
Struthio asiaticus, M. Ed. (*S. palæindicus*, Falc.)	„	„

CLASS V.—MAMMALIA.

Acerotherium perimense, F. & C. (*Rhinoceros iravaticus*, Lyd.) (——— *perimensis*, F. & C.) (——— *planidens*, Lyd.)	Panjáb, Burma, Perim, and Sind	Pliocene.
Agriochœrus (?)	Sind	Earlier pliocene.
Amphicyon palæindicus, Lyd.	Panjáb and Sind	Pliocene.
‡ Antilope cervicapra, Pallas (*A. bezoarctica*, Ald.)	Jamna	Pleistocene.
——— palæindica, F. & C. (*Damalis* (?) *palæindica*, F. & C.)	Sub-Himalaya	Higher pliocene.
——— patulicornis, Lyd.	„	„
——— porrecticornis, Lyd. (*Gazella* (?) *porrecticornis*, Lyd.)	„	„
Anthracotherium hyopotamoides, Lyd.	Bhúgti hills	Earlier pliocene.
——— silistrense, Pent. (*Chæromeryx silistrensis*, Pent.) (*Rhagatherium? sindiense*, Lyd.) (*A. punjabiense*, Lyd.)	Sind, Gáro hills, and Panjáb	„
Bison sivalensis, Falc.	Sub-Himalaya	Higher pliocene.
Bos acutifrons, Lyd.	„	„
— namadicus, F. & C.	Narbada, &c.	Pleistocene.
— planifrons, F. & C.	Sub-Himalaya	Higher pliocene.
— platyrhinus, Lyd.	„	„
— (?) sp.	Perim	„
* Bramatherium perimense, Falc. (*Sivatherium* sp., Owen.)	„	„
Bubalus palæindicus, F. & C.	Sub-Himalaya, Narbada, &c.	Higher pliocene and pleistocene.
——— platyceros, Lyd. (*B. sivalensis*, Rüt.)	Sub-Himalaya	Higher pliocene.

*	Bucapra daviesi, Rüt.	Sub-Himalaya	Higher pliocene.
	Camelopardalis sivalensis, F. & C. (*C. affinis*, F. & C.)	Sub-Himalaya and Perim	„
	Camelus sivalensis, F. & C.	Sub-Himalaya	„
	Canis cautleyi, Bose.	„	„
	—— curvipalatus, Bose.	„	„
	Capra perimensis, Lyd.	Perim	„
	—— sivalensis, Lyd. (*Hemitragus sivalensis*, Lyd.)	Sub-Himalaya	„
	—— sp.	„	„
	—— sp.	Tibet	Pleistocene (?).
‡	Cervus (? duvaucelli,)	Narbada	„
	—— (?) latidens, Lyd.	Sub-Himalaya	Higher pliocene.
	—— simplicidens, Lyd.	„	„
	—— sivalensis, Lyd.	„	„
	—— triplidens, Lyd.	„	„
	Chalicotherium sivalense, F. & C. (*Anoplotherium sivalense*, F. & C.) (*Nestoritherium sivalense*, Wag.)	Sub-Himalaya and Sind	Pliocene.
	Chœromeryx silistrensis, Pent. (*Anthracotherium silistrense*, Pent.)	Gáro hills	Higher pliocene.
	Dinotherium indicum, F. & C.	Panjáb and Perim	„
	———— pentapotamiæ, Falc.	Panjáb, Kách, and Sind	Pliocene.
	———— sindiense, Lyd.	„	„
	Dorcatherium majus, Lyd. (*Merycopotamus nanus*, Falc.)	Panjáb	Higher pliocene.
	———— minus, Lyd.	„	„
*	Enhydriodon ferox, F. & C. (*E. sivalensis*, F. & C.) (*Amyxodon*, F. & C.)	Sub-Himalaya	„
	Equus namadicus, F. & C. (*E. palæonus*, F. & C.)	Sub-Himalaya and Narbada	Higher pliocene and pleistocene.
	—— sivalensis, F. & C.	Sub-Himalaya and (?) Perim	Higher pliocene.
‡	Euelephas indicus, Lin. (*Elephas indicus*, Lin.)	Plains and Burma	Prehistoric.
	———— hysudricus, F. & C. (*Elephas hysudricus*, F. & C.)	Sub-Himalaya	Higher pliocene.
	———— namadicus, F. & C.) (*Elephas namadicus*, F. & C.)	Narbada, &c.	Pleistocene.
	Felis cristata, F. & C. (*F. grandicristata*, Bose.) (*F. palæotigris*, F. & C.) (*Uncia cristata*, Cope.)	Sub-Himalaya	Higher pliocene.
	—— sp.	„	„
‡	—— (? tigris, Lin.)	Jamna and Narbada	Pleistocene.
	Helladotherium duvernoyi, Wag.	Sub-Himalaya	Higher pliocene.
*	Hemibos acuticornis, F. & C. (*Amphibos acuticornis*, F. & C.) (*Leptobos acuticornis*, Falc.)	„	„
	——— antilopinus, F. & C.) (*Amphibos antilopinus*, F. & C.) (*Leptobos antilopinus*, Falc.)	„	„

	Hemibos occipitalis, Falc. (*H. triquetriceros*, F. & C.) (*Bos occipitalis*, Falc.) (*Leptobos triquetricornis*, Falc.) (*Peribos occipitalis*, Lyd.) (*Probubalus triquetricornis*, Rüt.)	Sub-Himalaya	Higher pliocene.
*	Hemimeryx blanfordi, Lyd.	Sind	Earlier pliocene.
	Hippopotamus iravaticus, F. & C. (*Hexaprotodon iravaticus*, F. & C.)	Sub-Himalaya and Burma	Higher pliocene.
	——— palæindicus, F. & C. (*Hexaprotodon namadicus*, F. & C.) (*Hippopotamus namadicus*, F. & C.) (*Tetraprotodon palæindicus*, F. & C.)	Narbada, &c.	Pleistocene.
	——— sivalensis, F. & C.) (*Hexaprotodon sivalensis*, F. & C.)	Sub-Himalaya	Higher pliocene.
*	Hippohyus sivalensis, F. & C.	,,	,,
	——— sp.	,,	,,
	Hippotherium antilopinum, F. & C. (*Equus antilopinus* F. & C.) (*H. gracile*, Myr.)	Sub-Himalaya and Perim	,,
	——— theobaldi, Lyd. (*Sivalhippus theobaldi*, Lyd.) (*H. gracile*, Myr.)	Burma, Perim, and Sub-Himalaya	,,
	——— sp.	Tibet	Pleistocene (?).
*	Hydaspitherium grande, Lyd.	Sub-Himalaya	Higher pliocene.
	——— megacephalum, Lyd. (*H. leptognathus*, Lyd.)	,,	,,
	Hyæna sivalensis, F. & C. (*H. felina*, Bose.)	,,	,,
	——— ? sp.	Tibet	Pleistocene (?).
	Hyænarctos sivalensis, F. & C. (*Ursus sivalensis*, F. & C.)	Sub-Himalaya and Panjáb	Higher pliocene.
	——— palæindicus, Lyd. (? *Dinocyon*.)	Panjáb	,,
	Hyopotamus giganteus, Lyd.	Bhúgti hills	Earlier pliocene.
	——— palæindicus, Lyd.	Sind	,,
	Hyotherium sindiense, Lyd.	,,	,,
	Hystrix sivalensis, Lyd.	Sub-Himalaya	Higher pliocene.
	Ictitherium sivalense, Lyd.	Panjáb	,,
	Leptobos falconeri, Rüt.	Sub-Himalaya	,,
	——— frazeri, Rüt.	Narbada	Pleistocene.
	Listriodon pentapotamiæ, Falc. (*Tapirus pentapotamiæ*, Falc.)	Panjáb	Higher pliocene.
	——— theobaldi, Lyd.	,,	,,
	Loxodon planifrons, F. & C. (*Elephas planifrons*, F. &. C.)	Sub-Himalaya	,,
	Manis sindiensis, Lyd.	Sind	Earlier pliocene.
‡	Macacus rhesus, F. Cuv.	Plains	Prehistoric.
	——— sivalensis, Lyd.	Sub-Himalaya	Higher pliocene.
	——— sp.	,,	,,
	Machairodus sivalensis, F. & C. (*M. falconeri*, Pomel.) (*M. palæindicus*, F. & C.) (*Drepanodon sivalensis*, F. & C.)	,,	,,

	Mastodon falconeri, Lyd.	Panjáb & Sind	Pliocene.
	——— latidens, Clift. (*M. elephantoides*, Clift.)	Sub-Himalaya, Burma, Panjáb, and Sind	„
	——— pandionis, Falc.	Sub-Himalaya, Sind, Perim, and Deccan.	Pliocene and pleistocene.
	——— perimensis, F. & C.	Sub-Himalaya, Sind, and Perim	Pliocene.
	——— sivalensis, F. & C.	Sub-Himalaya	Higher pliocene.
	Meles sp.	Punjáb	„
	Mellivora sivalensis, F. & C. (*Ursitaxus sivalensis*, F. & C.)	„	„
*	Merycopotamus dissimilis, F. & C. (*M. sivalensis*, F. & C.) (*Hippopotamus dissimilis*, F. & C.)	Sub-Himalaya and Burma	„
	Mus sp.	Sub-Himalaya	Higher pliocene.
	—— sp.	Narbada	Pleistocene.
	Ovis (?) sp.	Sub-Himalaya	Higher pliocene.
	—— (?) sp.	Tibet	Pleistocene.
*	Palæopithecus sivalensis, Lyd.	Panjáb	Higher pliocene.
	Palæoryx (?) sp.	„	„
	Palæotherium (?) sp.	„	Eocene.
	Pantholops (?) hundesiensis, Lyd.	Tibet	Pleistocene (?).
	Portax namadicus, Rüt.	Narbada, &c.	„
	——— sp.	Panjáb	Higher pliocene.
	Propalæomeryx sivalensis, Lyd.	Sub-Himalaya	„
	Pseudælurus sivalensis, Lyd.	Panjáb	„
	Rhinoceros deccanensis, Foote.	Madras	Pleistocene.
‡	——— indicus, Cuv.	Madras and Narbada	Prehistoric and Pleistocene.
	——— namadicus, F. & C.	Narbada	Pleistocene.
	——— palæindicus, F. & C.	Sub-Himalaya	Higher pliocene.
	——— sivalensis, F. & C.	Sub-Himalaya and Sind	Pliocene.
	——— — var. gajensis, Lyd.	Sind	U. Miocene.
	Rhizomys sivalensis, Lyd. ((?) *Typholodon*, Falc.)	Panjáb	Higher pliocene.
*	Sanitherium schlagintweiti, Myr. (*Sus pussillus*, Falc.)	Sub-Himalaya and Panjáb	„
	Semnopithecus sub-himalayanus, Myr.	Sub-Himalaya	„
	——— sp.	„	„
	——— sp.	Jamna	Pleistocene.
	Sivameryx sindiensis, Lyd.	Sind	Earlier pliocene.
*	Sivatherium giganteum, F. & C.	Sub-Himalaya	Higher pliocene.
	Stegodon bombifrons, F. & C. (*S. orientalis*, Owen.) (*Elephas bombifrons*, F. & C.)	Sub-Himalaya and (?) China	„
	——— clifti, F. & C. (*S. sinensis*, Owen.) (*Elephus clifti*, F. & C.) (*Mastodon elephantoides*, Clift.)	India, Burma, China, and Japan	„
	——— ganesa, F. & C. (*Elephus ganesa*, F. & C.)	Sub-Himalaya and Narbada.	Higher pliocene and pleistocene.

	Stegodon insignis, F. & C. (*Elephas insignis*, F. & C.)	Sub-Himalaya, Japan, China and (?) Narbada.	Higher pliocene and (?) pleistocene.
	Sus giganteus, F. & C. (*Hippopotamodon*, Lyd.)	Sub-Himalaya and Narbada.	Higher pliocene and (?) pleistocene.
	— hysudricus, F. & C.	Sub-Himalaya, Sind, and Perim	Pliocene.
‡	— predicus, Gray. (*S. cristatus*, Wag.)	Madras	Prehistoric.
	— punjabiensis, Lyd.	Sub-Himalaya.	Higher pliocene.
	Tapirus (?) sp.	Burma	„
*	Tetraconodon magnum, Falc.	Sub-Himalaya	„
	Tragulus sivalensis, Lyd.	Panjáb	„
	Ursus namadicus, F. & C.	Narbada, &c.	Pleistocene.
	— sp.	Sub-Himalaya.	Higher pliocene.
*	Vishnutherium iravaticum, Lyd.	Burma and (?) Panjáb	„
	Viverra bakeri, Bose (*Canis* sp., Baker and Durand.)	Sub-Himalaya.	„

Note on the Bijori Labyrinthodont—*By* R. LYDEKKER, B.A., F.G.S., F.Z.S.

As it is always expedient to correct erroneous determinations as speedily as possible, I have thought it advisable to publish a preliminary note regarding the large labyrinthodont skeleton from the Bijori group of the Gondwánas[1], which has recently come into my custody. Careful 'development' has exposed a considerable portion of the palatal aspect of the skull, which was previously concealed by matrix. As I hope eventually to describe and figure this important and interesting specimen, which has hitherto been considered as probably belonging to *Archegosaurus*, in the "Palæontologia Indica," it will only be very briefly noticed on this occasion.

The skull, which is the only part that need now be mentioned, is triangular in shape, and has a length of about 11, with an extreme breadth of 8, inches. The orbits are oval and placed somewhat posteriorly. The teeth are small, subcylindrical, and regular; there are several larger "tusks" close to the symphysis of the mandible, placed (as in *Mastodonsaurus*, *Labyrinthodon*, and *Pachygonia*) interiorly to the row of small teeth. This character alone shows that the specimen cannot belong to *Archegosaurus*. The structure of the teeth seems to be less complex than in the first three of these genera, but more so than in the last. The skull is greatly produced at its postero-external angles, and has large epiotic cornua, thereby differing from *Mastodonsaurus*. The mandible has apparently no distinct post-articular process, but a well-developed internal articular buttress. The palatine foramina are large and approximated.

Except in the apparent absence of a distinct post-articular process to the mandible, the skull shows decided affinity to the first division of the Euglypta[2]; in that respect, however, it agrees with *Loxomma*, but is distinguished by the

[1] See "Manual," part I, p. 128.

[2] See "British Association Report," 1874, p. 150.

characters of the teeth and orbits. The specimen will almost certainly have to be referred to a new genus.

It may not be out of place to mention that in describing the lower jaw of *Glyptognathus fragilis*, represented in figure 1 of the plate accompanying my last notice of Gondwána labyrinthodonts[1], the specimen, from the presumed absence of a post-articular process, was inferred to belong probably to the Brachiopina. It should have been stated, assuming the correctness of the inference as to the absence of the process, that it probably belonged to the Brachiopina, or some of the subsequent sections of Professor Miall's classification[2].

Note on a skull of Hippotherium antilopinum, *by* R. LYDEKKER, B.A., F.G.S., F.Z.S.

Among a small collection of Siwalik fossils from Perim Island lent by Mr. Theodore Cooke, LL.D., F.G.S., of Poona, and transmitted to me for determination, there is a very fine example of the skull of *Hippotherium antilopinum*. The species was previously unknown from Perim, and this is the first known example of the skull. It shows the complete molar dentition of the left side and is otherwise fairly perfect: I shall hope to give a further description of it on a future occasion.

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[1] "Records," Vol. XV, p. 27.
[2] "British Association Report." *loc. cit.*