A GUIDE

TO THE

FOSSIL MAMMALS AND BIRDS

IN THE DEPARTMENT OF

GEOLOGY AND PALÆONTOLOGY

IN THE

BRITISH MUSEUM (NATURAL HISTORY),

CROMWELL ROAD, LONDON, S.W.

WITH 116 ILLUSTRATIONS.

PRINTED BY ORDER OF THE TRUSTEES.

1896.

PRICE SIXPENCE.

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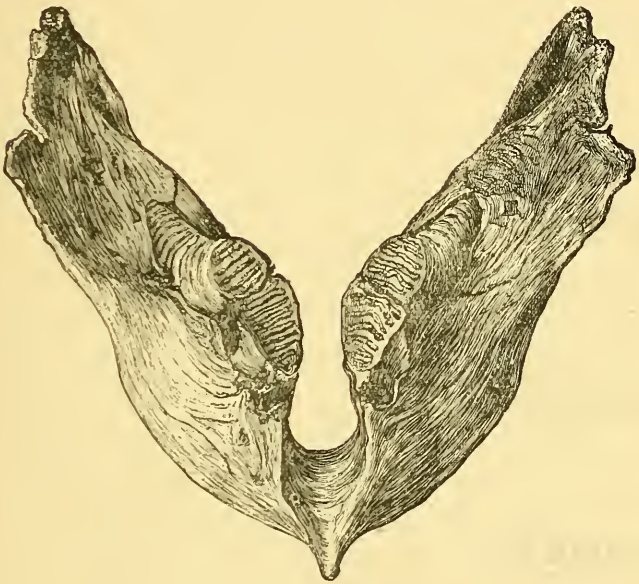

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LIST OF ILLUSTRATIONS.

PREFACE.

The First Edition of this Guide was issued, without illustrations, on the 19th April, 1881; the second in 1882, illustrated with thirty-one wood engravings; a third, slightly altered, appeared in 1884. A fourth Edition, almost wholly re-written, with many fresh illustrations, appeared in 1886, and a fifth, with only a few alterations, in 1888. The sixth Edition appeared in April, 1890, and 3,000 copies were sold up to October, 1895. Of these six editions, altogether 18,000 copies have been issued.

The publication of Mr. R. Lydekker's Museum Catalogues of the "Fossil Mammalia," Parts I–V. (1885–87), and "Fossil Birds" (1891), and the numerous additions made to the exhibited series of specimens have necessitated the re-arrangement of a great part of these Collections, and also changed the plan of the Guide.

The writer is largely indebted to the authors of Nicholson's and Lydekker's "Palæontology" (Vol. II., "Vertebrata," by R. Lydekker), from which numerous notes and extracts have been made in the compilation of this Guide. The Director, Sir William Flower, has kindly read the sheets and made valuable suggestions and emendations. The Members of the Staff of the Department have also obligingly assisted in the preparation of the work.

HENRY WOODWARD.

Department of Geology,
8th April, 1896.

TABLE OF STRATIFIED ROCKS.

Periods.	SYSTEMS.	FORMATIONS.
CAINOZOIC. — Quaternary.	RECENT	Terrestrial, Alluvial, Estuarine, and Marine Beds of Historic, Iron, Bronze, and Neolithic Ages
	PLEISTOCENE (250 ft.)	Peat, Alluvium, Loess Valley Gravels, Brickearths Cave-deposits Raised Beaches Palæolithic Age Boulder Clay and Gravels
CAINOZOIC. — Tertiary.	PLIOCENE (100 ft.)	Norfolk Forest-bed Series Norwich and Red Crags Coralline Crag (Diestian)
	MIOCENE (125 ft.)	Œningen Beds Freshwater, &c.
	EOCENE (2,600 ft.)	Fluvio-marine Series (Oligocene) Bagshot Beds London Tertiaries (Nummulitic Beds)
SECONDARY OR MESOZOIC.	CRETACEOUS (7,000 ft.)	Maestricht Beds Chalk Upper Greensand Gault
	NEOCOMIAN	Lower Greensand Wealden
	JURASSIC (3,000 ft.)	Purbeck Beds Portland Beds Kimmeridge Clay (Solenhofen Beds) Corallian Beds Oxford Clay Great Oolite Series Inferior Oolite Series Lias
	TRIASSIC (3,000 ft.)	Rhætic Beds Keuper Muschelkalk Bunter
PRIMARY OR PALÆOZOIC.	PERMIAN or DYAS (500 to 3,000 ft.)	Red Sandstone, Marl Magnesian Limestone, &c. (Zechstein) Red Sandstone and Conglomerate Rothliegende
	CARBONIFEROUS (12,000 ft.)	Coal Measures and Millstone Grit Carboniferous Limestone Series
	DEVONIAN & OLD RED SANDSTONE (5,000 to 10,000 ft.)	Upper Old Red Sandstone Devonian Lower Old Red Sandstone
	SILURIAN (3,000 to 5,000 ft.)	Ludlow Series Wenlock Series Llandovery Series May Hill Series
	ORDOVICIAN (5,000 to 8,000 ft.)	Bala and Caradoc Series Llandeilo Series Llanvirn Series
	CAMBRIAN (20,000 to 30,000 ft.)	Arenig and Skiddaw Series Tremadoc Slates Lingula Flags Menevian Series Harleeh and Longmynd Series
	EOZOIC—ARCHÆAN (30,000 ft.)	Pebidian, Arvonian, and Dimetian Huronian and Laurentian

LIFE-PERIODS.

Range of Invertebrata and Plants in time.
Range of Fishes in time.
Range of Amphibia and Reptilia in time.
Footprints of Birds?—Range of Birds in time.
Range of Mammalia in time.

Dominant type, Man.
Dominant types, Birds and Mammals.
Dominant type, Reptilia.
Dominant type, Fishes.
Dominant type, Invertebrata.

DEPARTMENT OF

GEOLOGY AND PALÆONTOLOGY.

INTRODUCTION.

NEARLY every city has within its bounds some relics of earlier times, when a more ancient people occupied the same spot.

Thus below modern London we find various layers of accumulated soil, each marked by tokens of former times. In one we find the charred relics of the wooden buildings which preceded the more modern brick and stone houses; beneath this are found weapons, coins, and pottery, telling of Norman and Saxon times. More than 20 feet down we come upon the relic-bed of Roman London, and in some parts *two* Roman *periods* have been recognised with remains of buildings at different depths. At a still lower level, along the course of the ancient Wall-brook, remnants of pile-dwellings have been discovered, which were probably occupied by an earlier British race.

In the ancient gravels of the Thames Valley, both beneath and around London, stone implements, left by a yet earlier people, have been frequently met with, associated with bones and teeth of the Mammoth.

If in a similar manner we investigate those larger layers of Chalk and Limestone, Sandstone, Clay, or Slate, composing the Earth's crust, we not only find that they rest upon one another, so that we can judge of their relative age by the order of their superposition, but that, like the layers of soil below London, they are often full of relics which tell of the former inhabitants that lived, flourished, and died out, to be succeeded by another race which have in their turn shared the same fate.

Geology deals with the Earth, the composition of the various strata, or layers, of which it consists, their present and former extent, and the physical conditions under which they were deposited, and the changes they have since undergone.

Palæontology deals with the remains of ancient life found in the various layers, and strives, by comparison with living forms, to restore the successive faunas and floras which have passed away, and to trace by those relics their past distribution, and thus to show the evolution of life on the earth from the earliest times to our own.

So many good books on Geology and Palæontology have been published * that it is not necessary to give in such a guide-book as the present a treatise on the science, but merely to explain that the Vertebrata in the Galleries are arranged according to their zoological classes, orders, and families (so far as these can be ascertained); and upon the label to each is placed its name, its geological position, and the locality whence it was derived. In the Invertebrata and Plants each class is also grouped chronologically in order, from the latest deposits to the earliest in which it occurs.

Whenever a specimen has been figured and described in a scientific work, a green disk is affixed to it, and a reference is given to the author, and to the name and date of the work where it was published.

Explanatory labels and illustrations have been introduced in many instances, to afford fuller information to visitors respecting the objects exhibited.

A plan of the Gallery will be found affixed to the wall in each room, which will serve to show the general arrangement of the cases and their contents. The small Table of Strata, on p. x, is given to indicate the range in time of the great groups of Mammals, Birds, Reptiles, Fishes, Invertebrates, and Plants.

H. W.

* *See* specially "Manual of Palæontology," by Prof. H. Alleyne Nicholson and R. Lydekker, in 2 vols. (3rd Edition). Wm. Blackwood and Sons, Edinburgh and London. 1889.

GUIDE TO THE DEPARTMENT

OF

GEOLOGY AND PALÆONTOLOGY.

SOUTH-EAST GALLERY.

VERTEBRATE ANIMALS.*

CLASS 1.—MAMMALIA.

THE Cases in the South-east Gallery are devoted to the exhibition of the remains of Animals of the class MAMMALIA,† the great proportion of which are only met with as petrifactions or fossils in those newer layers known to geologists as the Tertiary and Quaternary deposits, forming the more superficial part of the earth's crust. (*See* Table of Strata, p. x.) Earlier traces of such animals are comparatively rare, and a very few remains of the lower types, which are mostly extremely small in size, occur in rocks of Secondary age. For example, the skull of a small mammal, named *Tritylodon longævus*, from the Trias of Basuto-land, South Africa: *Microlestes Moorei* (represented by teeth only), from the Rhætic beds of Somerset, and *M. antiquus* from the Trias of Germany; *Dromatherium*, from North America; and other species, small but more numerous, from the Great Oolite of Stonesfield, and the Purbeck beds of England and America. Seven years ago (1889) Prof. O. C.

Gallery No. 1, on Plan.

See Table-case, No. 14, Pavilion. Gallery, No. 2, on Plan.

* In this great division of the Animal Kingdom are included all animals which possess a backbone.

† Animals that suckle their young; in this class are included, besides man, all the higher animals.

Marsh discovered in the "Laramie" formation in strata of Cretaceous age, in Dakota and Wyoming Territory, N. America, numerous remains of small mammals having close affinities with those previously known and described from strata of Triassic and Jurassic age. (For drawings, *see* small Table-case, No. 14A, in S.E. Pavilion.)

Most of the mammalia found fossil are extinct, but a very large number belong to forms closely related to, or even identical with, existing terrestrial species—such as the lion and tiger, the dog, wolf, the seal, the bear, and hyæna; the rhinoceros, horse, elephant, hippopotamus, pig, giraffe, camel, deer, ox, sheep; the beaver, marmot, hare; the whale, etc.

Nature of Deposits.

The deposits which have yielded the largest proportion of these remains are met with in caves and fissures in limestone rocks; in old lake and river valley-basins, filled up with gravels, sands, loess clays, and brick-earth washed down from the higher lands by rain and rivers; shell-marls, and peat-deposits; ancient forest-beds, which have been covered up and submerged; and delta deposits formed in the estuaries of great rivers, such as the Thames, the Severn, the Rhine, the Nile, the Ganges, the Mississippi, the Amazon, and La Plata. The frozen soil of the great alluvial plains bordering the Arctic sea both in the Old and New World is also rich in remains of large herbivorous animals, such as the "Mammoth" and the "Woolly Rhinoceros," that once inhabited these high northern latitudes before the climate became too damp, or too cold for the growth of forest trees.

Human Remains in Caves.

Wall-case, No. 1, Pier-case, No. 2, Table-case, No. 1 (South side).

All over the world caves are to be met with, hollowed out by underground waters in wearing their way through limestone rocks. Examples of the animal remains found in some of these may be seen in the Wall and Table-cases. As these caves have frequently served in prehistoric times as habitations for Primitive Man, when he lived by hunting and fishing, we frequently meet with evidence of human occupation, as the charcoal and ashes of fires,—the burnt and broken fragments of the bones of animals upon which he subsisted,—the rude implements of stone and bone which served as his weapons in the chase, or for domestic purposes, and even—but more rarely—rudely incised figures of the animals which he saw and hunted, and the cherished ornaments of shell or bone which he had laboured to make for the decoration of his person.

It often happens that the same cave has served at different periods as a refuge for man and for various wild beasts, as for instance, the cave-lion, bear, or hyæna. Examples of remains of these animals, and of the gnawed bones of their prey, may be seen from Oreston, Brixham, and Kent's Cavern, Devonshire; from Durdham Down and Pen Park Cave, Westbury, Gloucestershire; Banwell, Hutton, and Wookey-Hole

Caves, Somerset; Doward's Wood Cave, Herefordshire; Windy Knoll fissure, near Castleton, and Creswell Crags, Derbyshire; Kirkdale, Yorkshire; Gower, Glamorganshire; Coygan Cave, Carmarthenshire; Cae-Gwyn and Ffynnon-Beuno Caves, Vale of Clwyd, Denbighshire; and other British caves; from Bruniquel, Nabrigas, and Dordogne in France; from Gailenreuth, etc., in Franconia: from Gibraltar; from Maccagnone, in Sicily; from Minas Geraes, Brazil; from the Caves of Borneo; and from the Wellington Caves, New South Wales. **Wall-case, No. 1, Pier case, No. 2 Table-case No. 1.**

Near the window, adjoining Wall-case No. 1., is placed a small glazed case containing reproductions of 52 objects found in the caves of Aquitaine, France, explored by MM. Lartet and Christy, and comprising barbed harpoons of reindeer-antlers, arrow-straighteners, incised and carved antlers of reindeer, bones of horse, etc. Some of the incised figures give an excellent idea of the animals which the pre-historic cave-folk must have seen and hunted, and whose remains make up so large a proportion of the bone-breccia with which most of these caves were filled. These objects have been described and figured by MM. Lartet and Christy in their work entitled "Reliquiæ Aquitanicæ," 4to, 1865-75, edited by Prof. T. Rupert Jones, F.R.S.

(The originals of most of these objects are in Prof. Lartet's Collection.)

Sub-class 1.—Monodelphia (Eutheria.)

Order I.—PRIMATES.

Sub-order 1.—Anthropoidea.

Man.—In Pier-case 1 are placed skulls and other bones of Prehistoric Man together with specimens of his flint tools and weapons, and the remains of the animals which were contemporary with him and of which many, for example the Cave Lion and Cave Hyæna, are now extinct. All these were from caverns in various parts of Great Britain and the Continent. The most important of these are:—Kent's Cavern in Devonshire, the Gower Caves in Glamorganshire, Kirkdale Cavern in Yorkshire, the Cavern of Gailenreuth in Franconia and of Bruniquel in the Auvergne District of France. **Pier-case, No. 1.**

Pier-case 2 also contains the remains of man and of various extinct animals associated with him, from various caverns and fissures, including those of Cae-Gwyn and Ffynnon-Beuno in Glamorganshire, Windy Knoll and Creswell Crags in Derbyshire, Minas Geraes in Brazil, and the Wellington Caves in New South Wales. Here also is placed the Fossil Human Skeleton brought from Guadaloupe, in the West Indies, by Sir Alexander Cochrane, R.N., and presented to the Museum by the Lords Commissioners of the Admiralty. **Pier-case, No. 2.** **Human Skeleton from Guadaloupe.**

Human skeletons are found at Grand-Terre, adjoining the island of Guadaloupe in a coral-limestone formation which occurs on the sea-shore at the base of the cliffs, and more or less covered by the sea at high-water. This limestone rock, which is of modern formation, is composed of the detritus of shells and corals of species still inhabiting the adjacent sea; it also contains some species of land-shells and crabs, identical with those now living on the island. Accompanying the skeletons are found ornaments of jade, arrow-heads, fragments of rude pottery, and other articles of human workmanship.

Table-case No. 1.

In Table-case 1 are placed human remains from the alluvium of the Thames Valley at Tilbury, and also casts of the famous Neanderthal and Engis skulls. The cranium of an

Pithecanthropus erectus.

exceedingly primitive type possibly of man, *Pithecanthropus erectus*, lately discovered in Java, is represented by a cast. Here also are placed a number of tools and weapons made of reindeer horn, from the caverns of France, and some flint implements from Kent's Cavern, Devonshire. From the Thames Valley a magnificent series of implements and flakes is exhibited.

Spurrell collection of flint implements.

These were collected by F. C. J. Spurrell, Esq., and were presented by him to the National Collection. Some of the specimens are of special interest because they illustrate the method followed by Palæolithic Man in making his weapons. The remains of various extinct animals were found in the same deposits, and of these a jaw of the Woolly Rhinoceros with a flint flake adhering to it is shown in this case; the other specimens will be found in their proper places in the Gallery.

Monkeys.

Table-case, No. 1.

Monkeys.—In the Table-case are also placed the remains of the Quadrumana (four-handed animals), including at the present day the various families of the monkey tribe, the "Catarhine,"* or Old-World Monkeys, and the "Platyrhine,"† or New-World Monkeys. Remains of these animals are very rarely met with in any part of the globe as fossils.

The earliest trace of Old-World Monkeys (Catarhina) is found in the Miocene Tertiary formations of France and Italy; *Dryopithecus* occurs in the Miocene of Sainte Gaudens, France, and at Eppelsheim, Germany; *Hylobates* in the Miocene of Switzerland; *Oreopithecus* in Italy; and *Mesopithecus* at Pikermi, near Athens. *Anthropithecus*, *Semnopithecus*, *Macacus* and *Cynocephalus* have been found in the Lower Pliocene deposits of the Siwalik Hills, India. A single tooth, referred by Prof. Owen to *Macacus pliocœnus*, was obtained from the brick-earth of Grays, Essex. *Macacus* has also been found in the Pliocene of

* From Greek: *kata*, downwards; *rhines*, nostrils; because they have the nostrils approximated and opening downwards, as in man.

† From Greek: *platus*, broad; *rhines*, nostrils; because the nostrils open on the surface of the face, with a wide space between them.

Italy; *Semnopithecus* in that of France; and *Hylobates* in the newer deposits of Borneo.

Here are also placed the remains of two Platyrhine monkeys —*Cebus apella* and *Mycetes ursinus*, from the Caverns of Minas Geraes in Brazil.

Sub-order 2.—Lemuroidea.

The Lemurs are represented by *Adapis* and *Necrolemur* (*Microchœrus*) from the Eocene of Hordwell and the Older **Lemurs.**

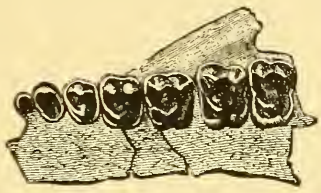


Fig. 1.—Palatal aspect of the left upper teeth of *Adapis magnus* (Filhol); from the Upper Eocene of Hordwell, Hampshire.

Tertiaries of France; by *Hyopsodus*, *Microsyops* and *Tomitherium* from the Miocene of Dakota, United States, and by *Megaladapis madagascariensis* from the Pleistocene of Madagascar. This last is considerably larger than any other known Lemur. **Table-case, No. 1.**

Fig. 2.—Palatal view of right upper cheek-teeth of *Microchœrus crivaceus* (Wood); Upper Eocene, Hordwell, Hants.

Order II.—CARNIVORA (Flesh-eating Animals).

Sub-order 1.—Fissipedia.

Here are exhibited the remains of a large number of carnivorous animals, chiefly from caves, representing the Lion, Lynx, Hyæna, and Wolf, all ancient denizens of this Island; with the Fox, Dog, Badger, Glutton, Otter, Weasel, and many other allied forms—mostly represented by skulls and lower jaws. Here are also placed the skulls, teeth, and bones of the "great sabre-toothed tiger" (*Machærodus*) remarkable for the enormous development **Pier-case, No. 3, Table-case, No. 2. South side. Carnivora: Lion, Tiger, Hyæna, &c**

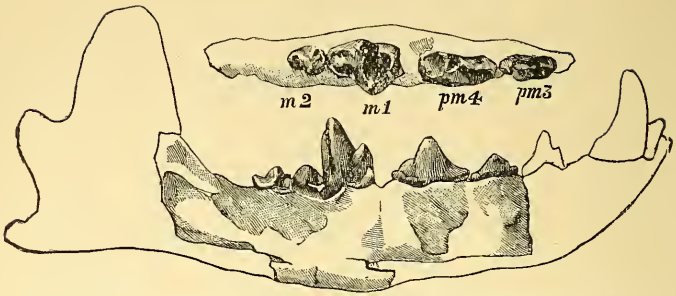


Fig. 3.—Upper and outer aspects of the right ramus of the mandible of *Viverra Hastingsiæ* (Davies); Upper Eocene, Hordwell, Hampshire.

Fig. 4.—Lateral aspect of skull of the "Great Sabre-toothed Tiger, "*Machœrodus neogœus* (Lund); from the Newer Tertiary deposits of South America.

of the canine teeth, and also for its wide geographical distribution. These remains have been met with in Kent's Cavern, Torquay, in Creswell Crag Caves, Derbyshire, in the Norfolk Forest-bed, in the Miocene Tertiary deposits of Eppelsheim in Germany, the Auvergne in France, the Val d'Arno in Italy, the Pampas deposits and the bone-caves of South America, and the Lower Pliocene freshwater sandstones of the Siwalik Hills in India.

The *Machœrodus* is now quite extinct.

Remains of *Hyœna eximia* from Samos and Pikermi, of *Hyœnodon*, *Pterodon*, etc., from the Lower Tertiaries of France, are placed in these cases. Here also are exhibited various early representatives of the Carnivora,

Table-case, No. 2, Pier-case, No. 3.

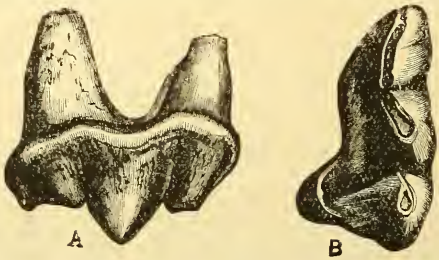


Fig. 5.—The right upper carnassial tooth of *Hyœna striata* (Zimm.); from the Suffolk crag (A, outer: B, oral aspect of tooth).

the *Amphicyon*, *Simocyon*, *Dinocyon*, *Cephalogale* and the *Cynodictis*, together with other Miocene types; also remains of the Glutton, Badger, Otter, Marten, Weasel, etc.

In the opposite Pier-case (No. 4) are exhibited the skeleton of the great cave-bear, *Ursus spelæus*, from the Pleistocene cave-deposits of Lozère, France, and numerous skulls of the same species of bear from Westphalia, Franconia, Poland, etc.; also the partially-restored skeleton of another large bear-like animal whose remains have been obtained from the alluvial deposits of Buenos Ayres, the *Arctotherium bonariense*, of P. Gervais. **Pier-case, No. 4.**

Remains of the Grizzly Bear (*Ursus horribilis*), are exhibited from Ilford and Grays, Essex; from Caves in England and Wales; from Ireland, Gibraltar, and Franconia. Also remains of the Brown Bear (*Ursus arctos*), from the Manea Fen, Cambridgeshire, and from Brixham Cave, Devonshire. **Bears. Table-case, No. 3. Pier-case, No. 4.**

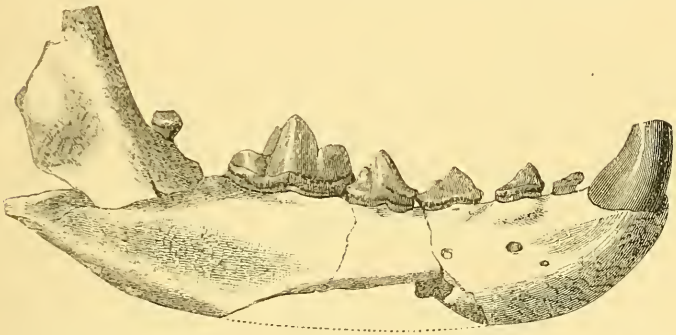


Fig. 6.—Right ramus of mandible of *Cephalogale brevirostris* (Croizet); Upper Eocene, Bach (Lot), France.

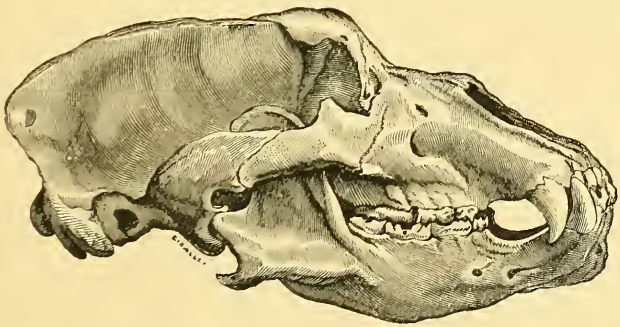


Fig. 7.—Profile of skull and lower jaw of the "Cave-Bear" (*Ursus spelæus*, Rosenm.) from the Pleistocene cavern deposits of Germany (reduced).

Sub-order 2.—**Pinnipedia** (Fin-footed).

Seals and Walrus.

Table-case, No. 3.

In the Table-case are exhibited remains of the marine Carnivora (Seals and Walruses); comprising a good series of the tusks, or canine teeth, of a large extinct Walrus (*Trichechus Huxleyi*), from the Red Crag of Suffolk; a lower jaw of the common Walrus (*T. rosmarus*), from the Dogger Bank; and a series of plaster casts of portions of skeletons of several extinct species from the Antwerp Crag, the originals of which are preserved in the Brussels Museum.

Order III.—INSECTIVORA (Moles, Shrews, Hedgehogs).

Hedgehogs Moles, and Shrews.

North side, Table-case, No. 24.

This order comprises a number of small insect-eating mammals, similar in many respects to the Rodentia; but the molar teeth are always serrated with numerous small pointed eminences or cusps adapted for crushing insects. One of the oldest of these is the *Necrogymnurus*, from the Eocene of Hordwell; and a species of hedgehog (*Erinaceus*) is found in the Miocene deposits of Oeningen. Others occur in the Pleistocene brick-earth of Grays, Essex, the Norfolk Forest-bed, etc.

"Flying Lemurs."

The *Galeopithecidæ*, or "Flying Lemurs," have no fossil representatives known.*

Order IV.—CHIROPTERA (Bats).

Bats.

Table-case, No. 24.

The bats are characterised by having the fingers of the fore-limbs enormously elongated and united by an expansible membrane (or *patagium*), which also unites the fore with the hind limbs and the sides of the body. Some of the large tropical bats are fruit-eaters; while others are insectivorous in their diet. They are found fossil in the Gypsum quarries of Montmartre (Upper Eocene), Paris, the species being named *Vespertilio parisiensis;* others occur at Caylux, Sansan, and Mayence. *Rhinolophus* is found in Kent's Hole, Torquay. The Vampire bat, *Vampyrus spectrum*, with several undetermined species of *Phyllostoma*, occurs in the cave-deposits of Brazil.

Order V.—RODENTIA (Gnawing Animals).

Rodentia.

Table-case, No. 24.

The Rodents, represented by the hares, rabbits, porcupines, beavers, rats, mice, dormice, squirrels, and marmots, are characterised by the large development of their incisors, and the absence of canine teeth.

* *See* Recent Mammalian Gallery, West side, first floor, Case 10; and Osteological Gallery, second floor, Case 8, division A.

The Rodents are divided into two sub-orders, namely, the *Simplicidentata*, which have only two upper incisor teeth; and the *Duplicidentata*, which possess a second smaller pair, placed *behind* the large anterior upper pair.

Sub-order 1.—Simplicidentata.

Squirrel, Beaver, Rat, &c.

This division comprises the squirrel, beaver, rat, porcupine, field and water voles, &c.

Table-case, No. 24.

The "Souslik," or pouched marmot (*Spermophilus*), is found fossil in the Pleistocene brick-earths of the Thames Valley at Erith, &c.

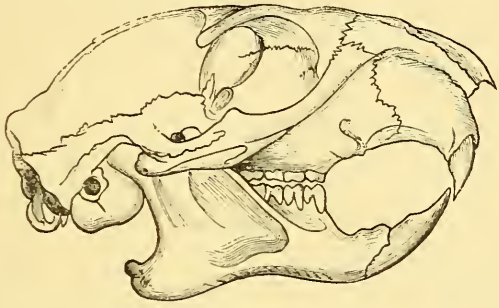


Fig. 8.—Profile of skull of a Rodent, *Cynomys ludovicianus* (Baird), the "Prairie Marmot."

The true marmot (*Arctomys marmotta*) is met with in the Loess formation of Germany, at Champeix, in France, and many other localities.

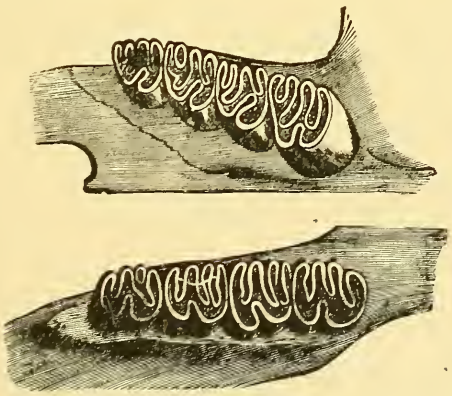


Fig. 9.—Dentition of Beaver, *Castor europæus* (Owen). A the left upper, B the right lower molar series. Pleistocene, Cambridgeshire Fens.

Gallery No. 1. North side, Table case, No. 24.

The living beaver is not only widely spread, but its fossil remains prove it to have had an equally wide distribution in the past. It was once abundant in this country, even down to historic times,* and its remains have been frequently found in the Pleistocene deposits of the valley of the Lea, near London, in the Cambridgeshire fens, and elsewhere. It is probably still living on the Elbe in Germany, on the Rhone in France, on the Danube, the River Kola and other Russian and Siberian rivers, in the Kurile Islands, and in North America.

The Great Extinct Beaver.

A far larger beaver, the *Trogontherium Cuvieri*, formerly inhabited the south of Russia and the east of England. Its remains have been found at Taganrog, Sea of Azof, and near Odessa; also in the Pleistocene Forest-bed series of the Norfolk coast. A similar gigantic form, the *Castoroides ohioensis*, occurs in the Post-Tertiary deposits of Ohio, New York, Mississippi (Natchez), &c.

Table-case, No. 24.

Remains of a large rodent (*Myoxus melitensis*) have been found in the Post-Pliocene deposits of the Island of Malta, associated with those of the "Pigmy Elephant." The "Viscacha" (*Lagostomus trichodactylus*), a marmot-like animal related to the "Chinchilla," inhabits the grassy plains or "pampas" of S. America, from Buenos Ayres to Patagonia. Its remains are found fossil in the Pampas formation. Another South American rodent, the "Paca" (*Cœlogenys paca*) has been met with in a fossil state in the cavern deposits of Minas Geraes, Brazil.

Cœlogenys.

Sub-order 2.—Duplicidentata.

Hares, &c.

In this sub-order are included the hares, rabbits, and pikas (*Lagomys*).

Lagomys.

The *Lagomys*, or "tail-less hare," occurs in Brixham Cave and Kent's Hole, Torquay; entire skeletons have been obtained from the Miocene freshwater deposits of Oeningen.

Remains of the hare are also found fossil in many newer Tertiary deposits.

Order VI.—UNGULATA (Hooped Animals).

Ungulata, or Hoofed quadrupeds.

All the animals belonging to this order are known as "hoofed quadrupeds." They are all vegetable-feeders, and are sub-divided as follows:—

* The town of *Beverley*, in Yorkshire, is said to derive its name from the beavers inhabiting its vicinity; many Welsh names, as, *Llyn-yr-afange*, or the beavers' lake; *Nant-yr-afancwm*, or the vale of the beavers, attest its presence in the Principality, where it is said to have survived down to the 12th century.

Sub-order 1.—Proboscidea (Elephants).

Elephants.

Ungulates furnished with a long flexible trunk-like snout or proboscis.

North side, Pier-cases, 29 to 39.

The cases on the North side of this Gallery are nearly entirely devoted to the exhibition of the largest series of fossil remains of the *Proboscidea* ever brought together in any museum. This sub-order is represented at the present day by the elephant alone, but in past times by the elephant, the *Mastodon*, and the *Dinotherium*. These extend from the Miocene epoch to the present day, and are of nearly world-wide distribution, save on the island continents of Australia and New Guinea.

Dinotherium. Glazed-case, B, and Wall-case, No. 39.

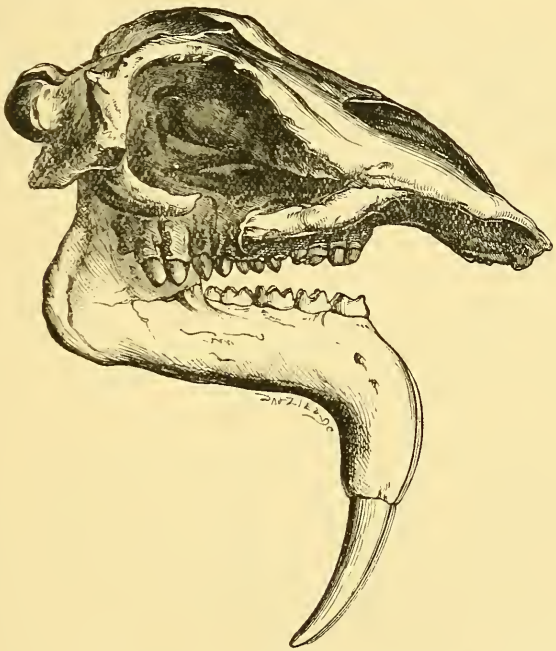


Fig. 10.—Skull and lower jaw of *Dinotherium giganteum* (Kaup); from the Upper Miocene of Eppelsheim, Hessen-Darmstadt.

[Marked (B) on plan, and placed near the entrance to Gallery on the left-hand side.]

The elephants form a well-marked group, distinct from other types of hoofed animals; their direct ancestry is as yet unknown. The nose is extended into a long, muscular, very flexible and prehensile proboscis, at the end of which are

Dinotherium. Wall-case, No. 39. Table-case, No. 23.

the nostrils; from this peculiarity the name of the group (*Proboscidea*) is derived. These animals have no *canine* teeth, and in this character they resemble the Rodentia (rats and rabbits). They have ever-growing incisors of very great size, but never exceeding one pair in each jaw, and more often present in one jaw only. These incisor teeth project largely out of the mouth, and are commonly called "tusks"; they are of an elongated conical form, and generally curved. They are chiefly made up of solid dentine, the fine elastic quality and large mass of which have rendered it invaluable as "ivory," for commerce and the arts, since the earliest historic records.

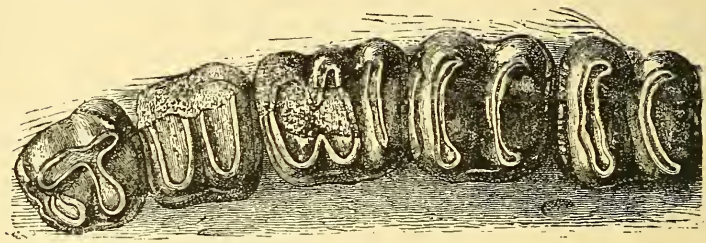


FIG. 11.—Left upper molars of *Dinotherium giganteum* (Kaup); ¼ natural size; Middle Miocene, Sansan (Gers), France (after Gaudry).

The molars or grinding teeth are few in number, but large and complex; they differ from those of other orders of animals, in being developed from behind forwards, not vertically to the tooth in wear (except in a few cases as where a premolar replaces the last milk-molar *from beneath*): and the series lasts until the animal attains extreme old age.

FIG. 12.—The first right lower true molar of *Mastodon sivalensis* (Falc. & Cautl.); ⅓ natural size; from the Older Pliocene of the Siwalik Hills, India.

Mastodon. Pier-case, Nos. 37, 38.

The Mastodons had, when young, a pair of milk-tusks (or incisor teeth) in the upper jaw, and in some species a pair in

the lower jaw: and always one pair, and sometimes two pairs, of tusks were present in the adult animal (*see* Figs. 14 and 26). These tusks, like the front teeth of the rat and the rabbit, were provided with persistent pulp-cavities, and continued to grow as long as the animal lived. In one species, *Mastodon angustidens*, they were partly coated with enamel. They had also

Mastodon. Pier-cases, Nos. 37 and 38.

Table-case, No. 23.

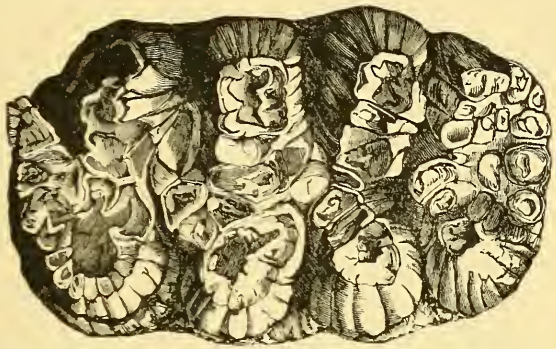


Fig. 13.—The fourth left upper milk-molar of *Mastodon arvernensis* (Croizet et Jobert): from the Norwich Crag, Postwick, Norfolk.

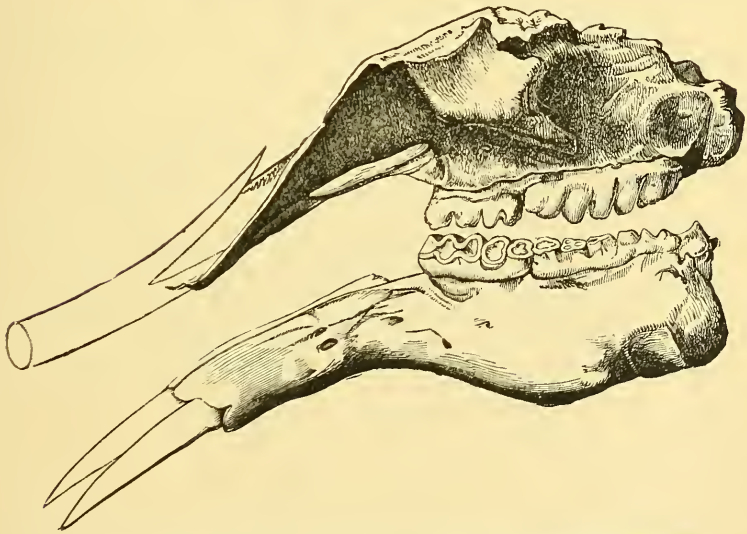


Fig. 14.—Skull and lower Jaw of *Mastodon longirostris* (Kaup); showing tusks in both upper and lower Jaw, from the Upper Miocene, Eppelsheim, Germany. (*See* Pier-case 37.)

three deciduous or milk-molars, and in some species, two premolars, on each side, both in the upper and lower jaws, and

three true molars in the adult, thus making a complement of thirty-four teeth during life.

Elephants. In living elephants there are two incisors, called "tusks," in the upper jaw, but the lower jaw is without incisor teeth.

In the *Dinotherium*, an extinct genus related to the elephants, this order is reversed, there being two tusk-like incisors in the *lower jaw*, and none in the upper (*see* Fig. 10, p. 11).

Mastodon. In *Mastodon longirostris* there were tusk-like incisors developed both in the upper and lower jaws (*see* Fig. 14, p. 13).

Pier-cases, Nos. 37 & 38. In *Mastodon americanus*, two tusk-like incisors, of large size, were present in the upper jaw in the adult, and two small incisors were developed in the mandible in the young, one of

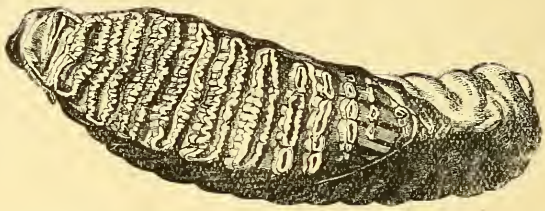


Fig. 15.—View of the grinding-surface of a lower Molar of the living Indian Elephant. (*Elephas indicus*, Linn.)

which was occasionally retained in the adult (probably the male) individual. (*See* specimen No. 17,147, in Pier-case No. 38, a mandible showing the three true molars on either side, and the right incisor present.)

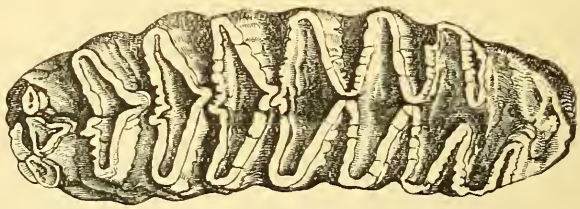


Fig. 16.—View of the grinding-surface of an upper Molar of the living African Elephant. (*Elephas africanus*, Blum.)

All these animals had, like the living elephants, a cylindrical trunk or proboscis (snout) with a prehensile extremity, serving to gather and convey the food to the mouth. The soles of the feet, supporting the weight of so vast a body, are covered with

a thick pad of skin, and in this the five toes are enclosed and concealed in the living animal, but the nails of the toes can generally be seen.*

Elephants. Pier-cases, Nos. 29 to 36.

Only two living species of elephants are known; one, the Asiatic elephant, confined to the forests of India, Ceylon, Burmah, Siam, Cochin-China, the Malay Peninsula, and Sumatra; the other, the African elephant, peculiar to the continent of Africa. These are well-marked species, not only by their external characters, but also by their grinding teeth (*see* Figs. 15 and 16).

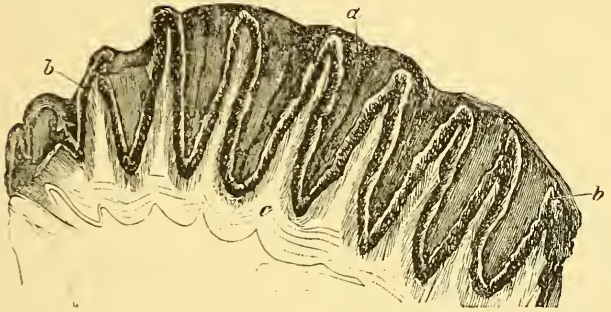


Fig. 17.—Vertical longitudinal section of second upper true molar of *Elephas planifrons* (Falc. and Cautl.); ½ natural size: from the Pliocene of the Siwalik Hills, India. To illustrate the structure of the molar teeth in the Proboscidea.

a, cement. *b*, enamel. *c*, dentine.

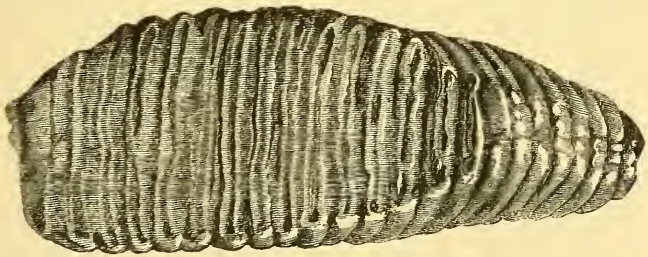


Fig. 18.—View of the grinding-surface of the third left upper true molar of the "Mammoth," *Elephas primigenius* (Blum.); ½ natural size. Dredged off the Dogger Bank, North Sea.

A skeleton of the modern Indian elephant is placed in the middle of the Geological Gallery, and skulls and teeth of the

* The external hard skin covering the feet in the fossil Mammoth can still be seen in the specimen discovered by Pallas in 1799, on the banks of the R. Lena in Siberia, preserved in the Museum of the Academy of Sciences at St. Petersburg. (*See* woodcut, Fig. 32, p. 23.)

North side, Pier-case, No. 30.

Indian and African elephant can also be seen in Pier-case 30, placed near the fossil species, for comparison.

Molar teeth of Elephants.

The teeth in the elephants are composed of numerous more or less closely-folded plates of dentine, coated with enamel, and encased in a thick setting of cement (*see* Fig. 17), the plates varying in number and in pattern in the different species. Thus the African elephant has few enamelled plates in each tooth, and these on the grinding surface are worn down to a lozenge-shaped

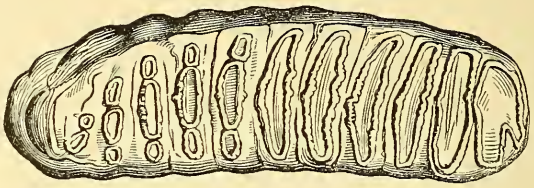


Fig. 19.—View of the grinding-surface of the second right lower true molar of *Elephas antiquus* (Falc.); $\frac{1}{3}$ natural size; from the Pleistocene of Grays, Essex.

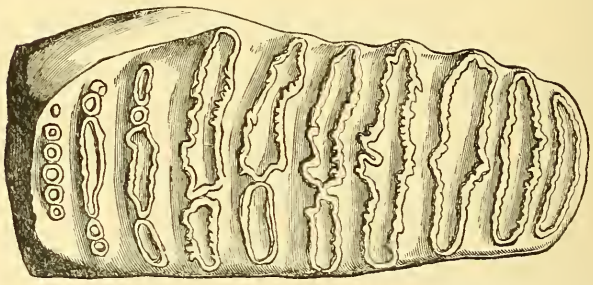


Fig. 20.—View of the grinding-surface of upper molar of *Elephas meridionalis* (Nesti); $\frac{1}{3}$ natural size: from the Upper Pliocene of Tuscany.

pattern (Fig. 16); the Indian elephant has many plates, closely folded together and finely crimped at their edges (Fig. 15). The teeth of the larger number of fossil elephants resemble those of existing species, but in some of the earlier forms they

Mastodon.

approach more nearly in character those of the *Mastodon;* the ridges are, however, more numerous in the elephant, and the valleys which divide them are filled with cement, but in the Mastodon the spaces between the ridges had little or no cement. Figures 17–23, are given to illustrate some of these variations in the mode of growth and development in the molar teeth of extinct forms of Proboscidea. Fig. 17 shows, in section, a molar tooth of *Elephas planifrons* in which all the valleys are

quite filled with cement. Fig. 23 shows, in section, a molar tooth of *Mastodon angustidens* in which the cement is quite absent and the valleys are empty.

Molar Teeth of Mastodon.

Table-case, No. 23.

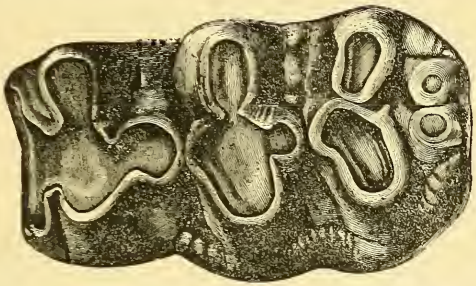


Fig. 21.—Left lower milk-molar of *Mastodon angustidens*, var. *palæindicus* (Lydekker). Lower Siwaliks, India.

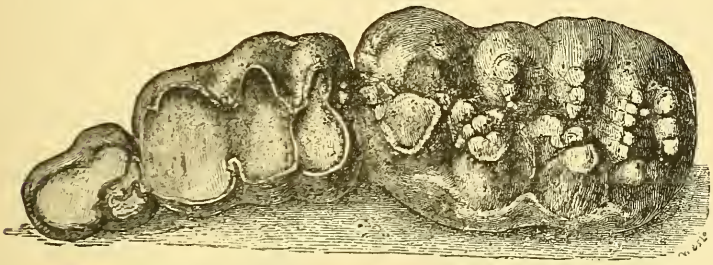


Fig. 22.—Left upper milk-molars (nat. size) of *Mastodon longirostris* (Kaup), from the Upper Miocene, Eppelsheim, Hessen-Darmstadt (after Gaudry).

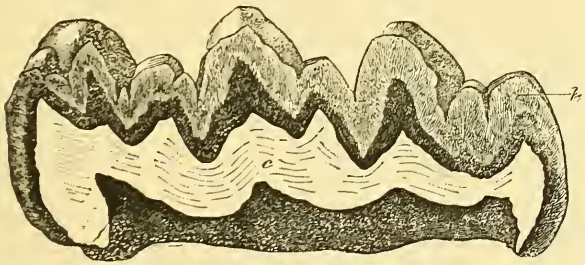


Fig. 23.—Vertical longitudinal section of the first lower true molar of *Mastodon angustidens* (Cuvier), from the Middle Miocene of Simorre, France; *b*, enamel; *c*, dentine. (⅔ nat. size).

North side, Wall-case, No. 39.

The series of Proboscidean remains commences with those of the *Dinotherium*, a hoofed quadruped, nearly related to the *Mastodon* and Elephant, the most perfect remains of which have been found in the Miocene Tertiary formation of Eppels-

heim, Hessen-Darmstadt, Germany, while others have been found in France, Switzerland, and Perim Island, Gulf of Cambay. The original skull of *Dinotherium*, described by Dr. Kaup, together with a reproduction of the lower jaw, is placed in a separate case in this gallery. (*See* p. 11, Fig. 10.)

Glass-case B.

Table-case, No. 23.

The Mastodons were elephants with the grinding teeth less complex in structure, and adapted for masticating coarser vegetable substances. The grinding surface of the molars, instead of being cleft into numerous thin plates, are divided into wedge-shaped transverse ridges, and the summits of these are often subdivided into smaller cones, more or less resembling the teats of a cow, whence the generic name is derived.* They are divided into two groups (Trilophodonts and Tetralophodonts), characterised by the number of the transverse ridges in the first and second true molars. In the Trilophodonts the ridges are but three in number, the Tetralophodonts having four.

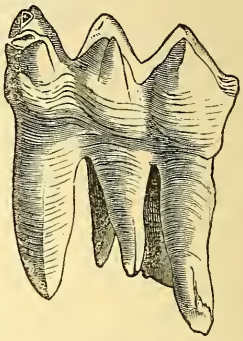
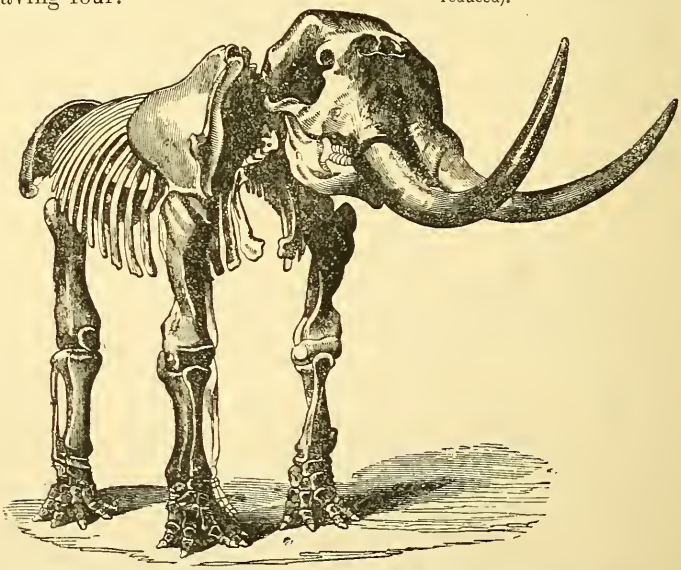


Fig. 24.—Profile of outer aspect of second left lower true molar of *Mastodon americanus* (Cuvier), a Trilophodont form from the Pleistocene of North America (much reduced).



Stand A.

Fig. 25.—Skeleton of *Mastodon americanus* (Cuvier)=*M. ohioticus*; (greatly reduced) from the Pleistocene, Benton County, Missouri, N. America.
(*See* skeleton on Stand A, at entrance to South East Gallery 1.)

* From *mastos*, teat, and *odos*, tooth.

The entire skeleton of the *Mastodon* from Benton Co., Missouri (Fig. 25), stands facing the entrance to the Gallery. Near it, in a separate case, are placed the head and lower jaw of the South-American *Mastodon* from Chile (*Mastodon Humboldtii*)*; and in the Wall-case is exhibited the cast of the skull and

Mastodon. Stand A. Glass-case C. Wall-case, No. 39

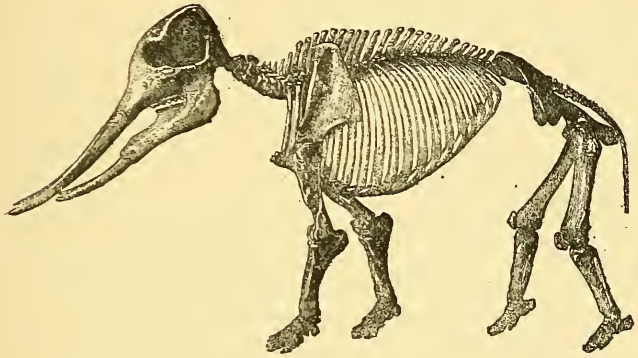


Fig. 26.—Restored skeleton (greatly reduced) of *Mastodon angustidens* (Cuvier); Middle Miocene, Sansan, France (after Gaudry).

lower jaw of a young individual of *Mastodon americanus*, Cuv., from shell-marl beneath a peat-bog in the State of New Jersey, United States.

In the Pier-case are arranged several heads and jaws, besides numerous detached limb-bones, and other parts of the skeleton of *Mastodon americanus* from North America. Most of these remains were obtained from alluvial deposits on the banks of a small tributary of the Osage River, in Benton Co., Missouri; and others from a peat deposit at "Big-Bone-lick," Kentucky.† One fine lower jaw of this species has a small tusk in front.

Pier-case, No. 38. (North side.)

The next Pier-case is occupied with remains of *Mastodon longirostris* from Eppelsheim, in Hessen-Darmstadt; *M. angustidens*, from the Miocene of Sansan, and *M. turicensis* from Haute Garonne, both in France; *M. perimensis* from Perim Island, Gulf of Cambay; and *M. sivalensis* from the Siwalik Hills,

Mastodon. Pier-case, No. 37.

* Marked (C) on plan and placed on the North side of this Gallery next Table-case 23.

† Several entire examples of the American Mastodon have been met with. Three perfect skeletons have been obtained from the freshwater marshes of Orange County, New York, another from near Cohoes Falls, on the Mohawk, another in Indiana, one from a morass in New Jersey, another on the banks of the Missouri; the best was obtained by Dr. Warren from a marsh near Newburgh. Its height is 11 feet, length 17 feet, the tusks 12 feet long, 2¼ feet being inserted within the sockets.—*Dana.*

India. Of these there are some very perfect remains, including about eight skulls. The specimens of *M. angustidens* and *M. longirostris* show clearly that this old type of proboscidean had tusks, or incisor teeth, in both the upper and lower jaws, as represented in Fig. 14, p. 13, and in Fig. 26, p. 19.

North side, Table-case, No. 23.

In the Table-case are arranged a large series of the molar teeth of various species of *Mastodon* from the Red Crag of Suffolk, from Eppelsheim, from India, and from Missouri and Kentucky, in North America, showing all stages of growth and wear, from the milk-teeth to the last true molars of very aged animals.

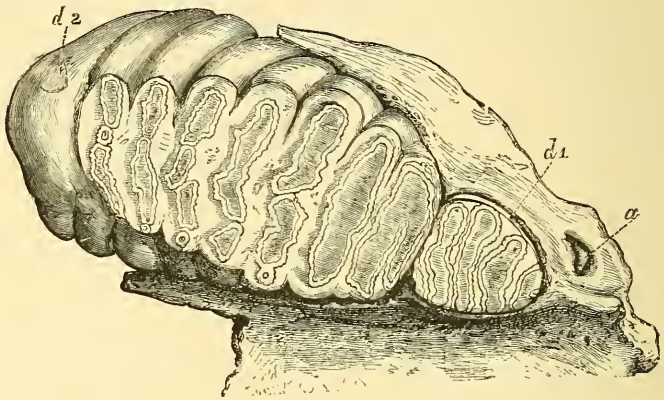


Fig. 27.—Portion of right side of palate of a very young individual of *Elephas primigenius* (Blum.), showing milk-molars 2 (*d* 1) and 3 (*d* 2), *a*, the anterior root of milk molar 2; from the Creswell Crag Cave, Derbyshire (natural size).
(*See* Table-case, No. 17A.)

Geographical Range of the Mastodon & Elephant.

Twenty-six species of Mastodon have been found over an area extending from England through France, Germany, Switzerland, Italy, to Greece, Samos, Persia, Armenia, India, and Ava; they occur also both in North and South America. There are fifteen species of fossil Elephants whose range was coextensive with that of the Mastodons, and embraced in addition the whole of Africa and the Northern seaboard of the Asiatic and North American continents.

The Mammoth:

Most abundant remains of one species, the "Mammoth" (*Elephas primigenius*), have been found in the frozen soil of the vast alluvial plains, called "tundras," intersected by the rivers Yenesei, Irtish, Obi, Indigirka, Lena, &c. In several instances, entire individuals have been found, so completely frozen, as to have retained the skin with the flesh as well as the skeleton: the body being covered with reddish hair and

Hair of the Mammoth:

wool as if to protect it from the colder climate.* The tusks of this Arctic elephant are still collected for the sake of the ivory; and every few years a shipload is sent from Archangel to the port of London for sale. The Siberian mammoth closely agrees with the specimens found fossil in various parts of England, particularly those from the brick-earth of the valley of the Thames near London, from the Dogger Bank, and the coast of Norfolk.

Pier-case, No. 31.

Fossil Ivory from Siberia

Pier-cases Nos. 31 and 32. Table-cases, Nos. 17, 18, 19, 20.

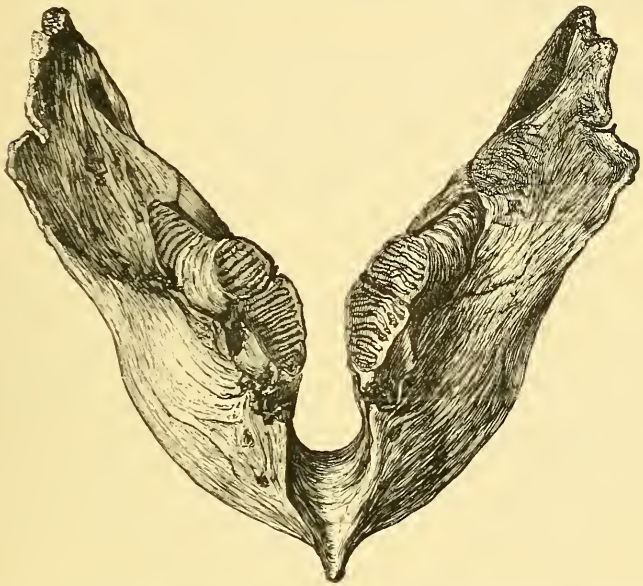


Fig. 28.—Mandible of Mammoth, *Elephas primigenius* (Blum.); Dredged off the Dogger Bank, in the North Sea, 1837.† (The original specimen is exhibited in Pier-case 32.)

Some of the grinders of the Mammoth are of very large size, and have as many as twenty-eight or even thirty plates, or laminæ, in a single tooth.

Many of these remains may be seen in the Pier-cases, and in the centre of the Gallery floor is placed a magnificent specimen, consisting of the skull and both tusks, complete, showing their characteristic double curve, of a Mammoth found at Ilford in Essex. Similar remains have also been found beneath modern London, associated with flint implements made by early man, with whom this old elephant was contemporary.

Pier-cases, Nos. 29 to 32. Glazed-case E.

India, the present home of one of the two species of existing elephants, has also yielded abundant evidence of numerous

Pier-cases, Nos. 32 to 36.

* An example of the hair may be seen, in a glass jar, in Pier-case No. 31.

† *See* "Geol. Mag.," 1878, decade ii. vol. v. pl. xii. p. 443.

extinct species of this animal. The cranium of *Elephas ganesa*, probably one of the largest of all the fossil elephants known,

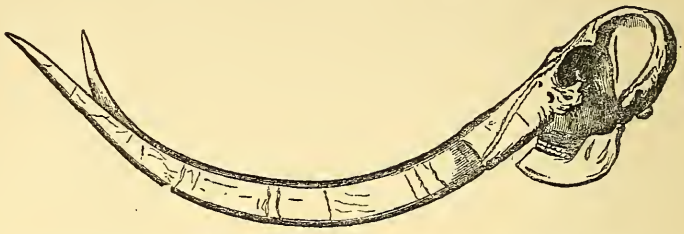


Fig. 29.—Profile of the skull and tusks of *Elephas ganesa* (Falc. and Cautl.) ($\frac{1}{17}$ natural size) Older Pliocene, Siwalik Hills, India. [The original is marked (D) on plan, and occupies a stand in the centre of this Gallery, between the American Mastodon and the Ilford Mammoth.]

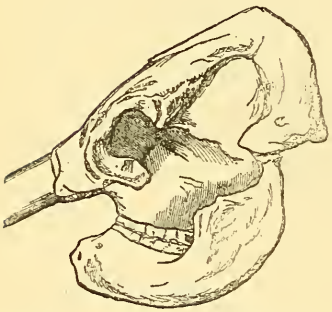


Fig. 30.—Profile of skull of *Elephas planifrons* (Falc. and Cautl.) ($\frac{1}{15}$ natural size); Older Pliocene, Siwalik Hills, India.

Fig. 31.—Profile of skull of *Mastodon sivalensis* (Falc. & Cautl.) ($\frac{1}{17}$ natural size); Older Pliocene, Siwalik Hills, India.

Elephas ganesa. Stand D.

from the Siwalik Hills in India, exhibited next the Ilford Mammoth in the centre of the Gallery, has tusks which measure 10 feet 6 inches in length.* This fine specimen was presented to the Trustees by General Sir William Erskine Baker, K.C.B.

Fifteen extinct species of elephants, seven of which are from India, and three whose fossil remains have been found in this country, are represented in the cases.

* A mammoth's tusk from Eschscholtz's Bay, in the collection, measures 12 feet 6 inches along the curve. (*See* tops of Pier-cases, North side, also on the upper shelf of Pier-case No. 30.)

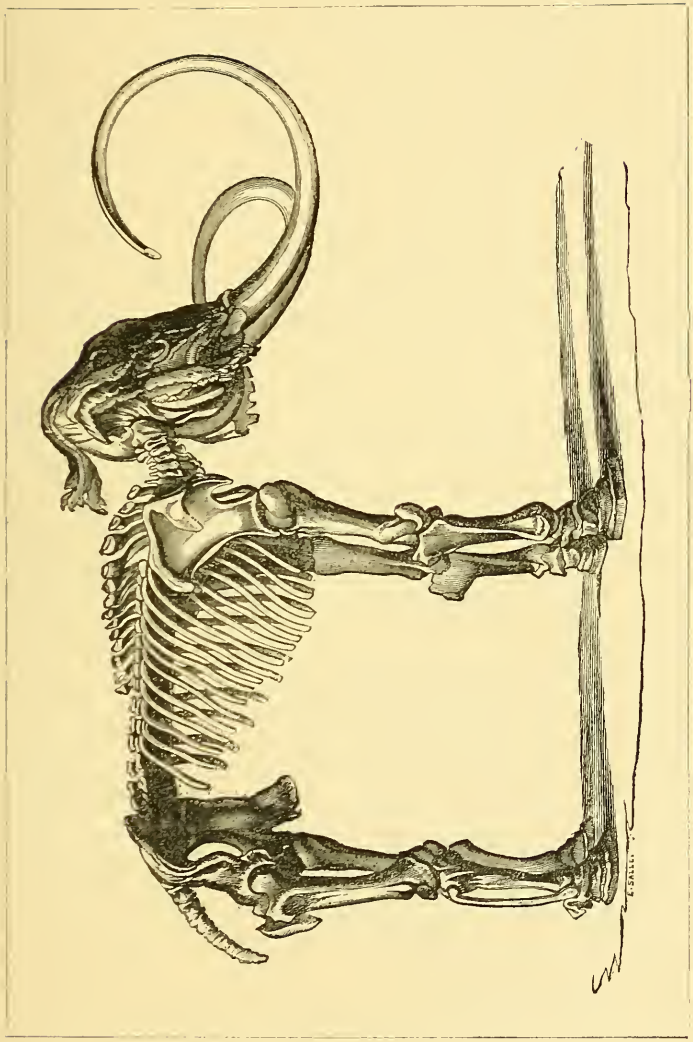


Fig. 32.—Sketch of the skeleton of the "Mammoth," *Elephas primigenius* (Blum.), preserved in the Museum of the Academy of Sciences, St. Petersburg. This specimen has much of the dried skin still covering the head and feet. Its carcase was originally found entire, buried in frozen mud, near the mouth of the River Lena, in Siberia; the skeleton was brought to St. Petersburg by Adams in 1806.

Pier-case, No. 33. Pier-cases, Nos. 34, 35, and 36.

Pier-case No. 33 contains some British remains of *Elephas antiquus*; the rest of the case, and also of Pier-cases Nos. 34, 35, and 36, are entirely devoted to the great collection of elephant-remains from the Older Pliocene of the Siwalik Hills, India (figured and described in the *Fauna Antiqua Sivalensis*). This series includes more than thirty heads and parts of skulls of extinct species of elephants, besides numerous lower jaws, detached teeth, vertebræ, and limb-bones. For this magnificent suite of skulls, tusks, and teeth of fossil Indian elephants, we are mainly indebted to the late Colonel Sir Proby T. Cautley, K.C.B., so large a donor of fossil vertebrates to the Geological Department.

Pier-case, No. 30.

In Pier-case No. 30 are exhibited skulls of the two varieties of the existing Indian elephant, and also a skull of the modern African elephant, together with a series of detached molar teeth of individuals of different ages. In the upper division of the case is arranged a fine series of tusks of the Mammoth (*Elephas primigenius*) from Siberia, from the Dogger Bank, and from various localities in England.

Table-case, No. 16. Sections of Molar teeth.

In Table-case No. 16 is exhibited an instructive series of sections of the incisor and molar teeth of fossil and recent proboscideans (*Dinotherium*, *Mastodon*, and *Elephas*), illustrative of the structure, gradation in form, and varying number of plates or ridges in the teeth of the different species.

The elephant-remains in the collection from this country comprise the larger number of the specimens, either figured or described by Dr. Leith Adams, F.R.S., in his Monograph on British Fossil Elephants, published in the volumes of the Palæontographical Society from 1877-81.

Table-cases, Nos. 21, 21a. Pigmy Elephants of Malta.

Before quitting the fossil elephants, attention is drawn to Table-cases Nos. 21, 21*a*, containing the truly remarkable series of Pigmy Elephants from the island of Malta, collected by Rear-Admiral Spratt, R.N., F.R.S., and Professor A. Leith Adams, M.D., F.R.S. These Maltese elephants, which by the form of their grinders are related to the living African elephant (Fig. 16), were represented by one species which only attained the size of a Shetland pony, and as we have evidence of their limb-bones, jaws, and teeth, of *all ages*—even to very old age—it is fair to assume they were a distinct variety, probably the result of isolation in a limited area where they may have suffered from a scanty supply of food, and so become dwarfed.

Sub-order 2.—**Hyracoidea** (Conies).

Hyrax (Conies).

This sub-order contains a single family of diminutive plantigrade mammals, whose affinities have long been a puzzle to zoologists. Formerly placed by Cuvier near to Rhinoceros, they

have latterly, by Huxley, Flower, and others, been constituted as a distinct group.

Only two genera, *Hyrax* and *Dendrohyrax*, are known, *see* recent Mammalian Gallery, South-west side (Case 10, Division A.); they are found in Africa, at the Cape, and in Abyssinia, thence they extend into Arabia, Syria, and Palestine. No fossil remains of these little mammals have, as yet, been described.

Sub-order 3.—Amblypoda.

Here are placed the remains of *Coryphodon*, from the Lower Eocene of Harwich, Essex; and from Dulwich, near London; **Coryphodon. Pier-case, No. 20.**

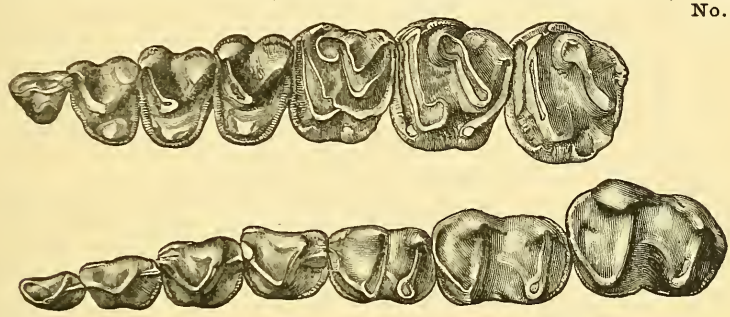


Fig. 33.—(A) the left upper, and (B) the left lower, cheek-dentition of *Coryphodon hamatus* (Marsh), from the Eocene of North America (from Prof. Marsh's Monograph of the Dinocerata).

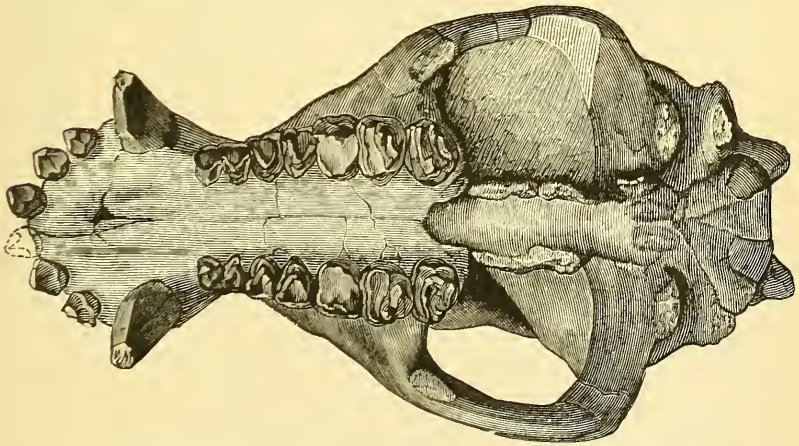


Fig. 34.—Palatal aspect of cranium of *Coryphodon elephantopus* (Cope) ($\frac{2}{3}$ nat. size), from the Wasatch Eocene, New Mexico, U.S.A. (after Cope).

also plaster-casts of teeth and bones of the same animal from the Eocene lignites of Soissons in France. Several species from

the Eocene of North America have been described: plaster casts of the fore and hind feet of one of these are exhibited.

Coryphodon. *Coryphodon* was the largest of the early Eocene Ungulates; it had six upper incisors and moderate-sized upper canines; the cranium has no protuberances or horn-cores; the astragalus has no head; there is a third trochanter to the femur. The five-toed feet, which resemble in structure those of the *Dinocerata*, indicate some affinity to that group, which it also preceded in time.

Sub-order 4.—Dinocerata.

Dinocerata. Pier-case, No. 20. This division contains a most remarkable group of huge extinct herbivorous mammals, the remains of which have been found in great abundance in the Eocene Tertiary strata of Wyoming, North America.

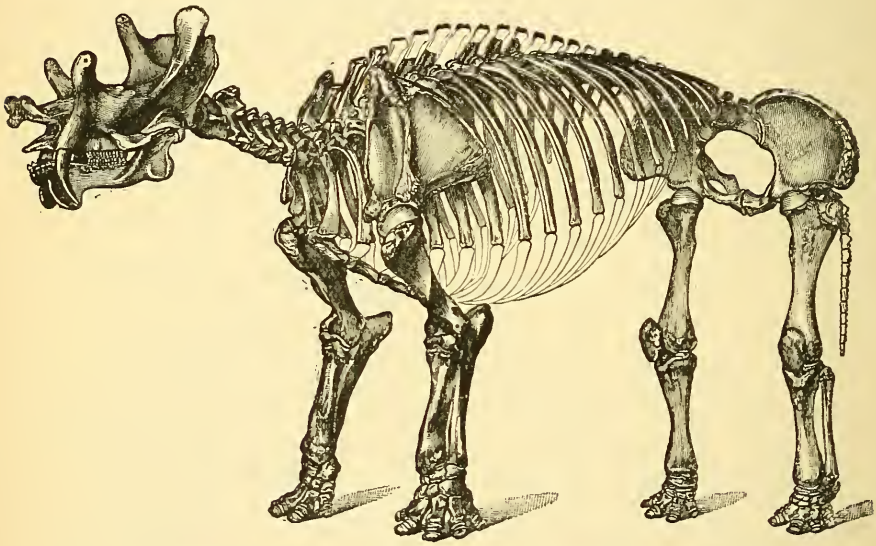


Fig. 35.—Restoration of *Tinoceras ingens* (Marsh). One-thirtieth natural size. Eocene Tertiary lake-basin, Wyoming, North America.

The fore and hind limb had feet with five well-developed toes, each terminating in a hoof: the femur and tibia were placed vertically in a line, as in the hind leg of the elephant. The nasal bones were elongated, having two small pre-nasal bones in front of them; the animal does not appear to have been furnished with a proboscis.

The most striking feature is the skull, which is surmounted by three pairs of rounded protuberances or horn-cores, which

were probably enveloped in horny sheaths. There are no upper incisors, but the upper canines are developed into large and powerful flattened tusks, directed downwards, and protected on each side by the broadly-expanded margin of the bone of the lower jaw. **Dinoceras. Pier-case, No. 20.**

One remarkable feature of this sub-order of Eocene mammals is the diminutive size of the brain. It is, in fact, proportionally smaller than in any other known mammal, recent or fossil, and even less than in some reptiles. A cast of the brain-cavity of *Dinoceras* is placed beside the reproduction of the skull. **Pier-case, No. 20. South-side.**

Casts of the skulls and bones of the *Dinocerata*, presented by Professor O. C. Marsh, are exhibited in the Pier-case on the South side of this Gallery, and a papier maché model of the entire skeleton of *Dinoceras mirabile* (Marsh), is placed in a glazed case in the centre of the Gallery, so that we can now form, from their study, a very fair idea of this singular group of huge Eocene herbivores, once so abundant in western North America, to which region it appears to have been limited. **See Glazed-case, M.M., in centre of Gallery.**

•

Sub-order 5.—Condylarthra.

This sub-order is only represented in the collection by portions of jaws with teeth of two genera, viz., *Periptychus* and *Haploconus* from the Eocene of New Mexico, North America; and by an excellent coloured reproduction of the skeleton of *Phenacodus primævus* (Cope), from the Eocene of Wyoming Territory, U.S.A. (*see* p. 28). **Pier-cases Nos. 20 and 9.**

Sub-order 6.—Toxodontia.

Under this sub-order are placed some large extinct Mammals found in the Newer Tertiary deposits of South America, whose exact zoological position is still rather uncertain. **Toxodon. Pier-case, No. 20.**

Here are arranged incisor-teeth, also the skull and lower jaw and some limb-bones of an animal named *Toxodon*, probably larger than a horse, but having Rodent-like incisor-teeth in its jaws (the name being founded on the bow-like form of these teeth). The remains of this remarkable animal were obtained from the Pleistocene deposits ("Pampas-formation") of Buenos Ayres.

A plaster cast of an allied form *Toxodontotherium* is also shown.

From the same deposits was also obtained a large portion of the skeleton of another aberrant form, related to the above, but belonging to a much smaller animal, named *Typotherium*.

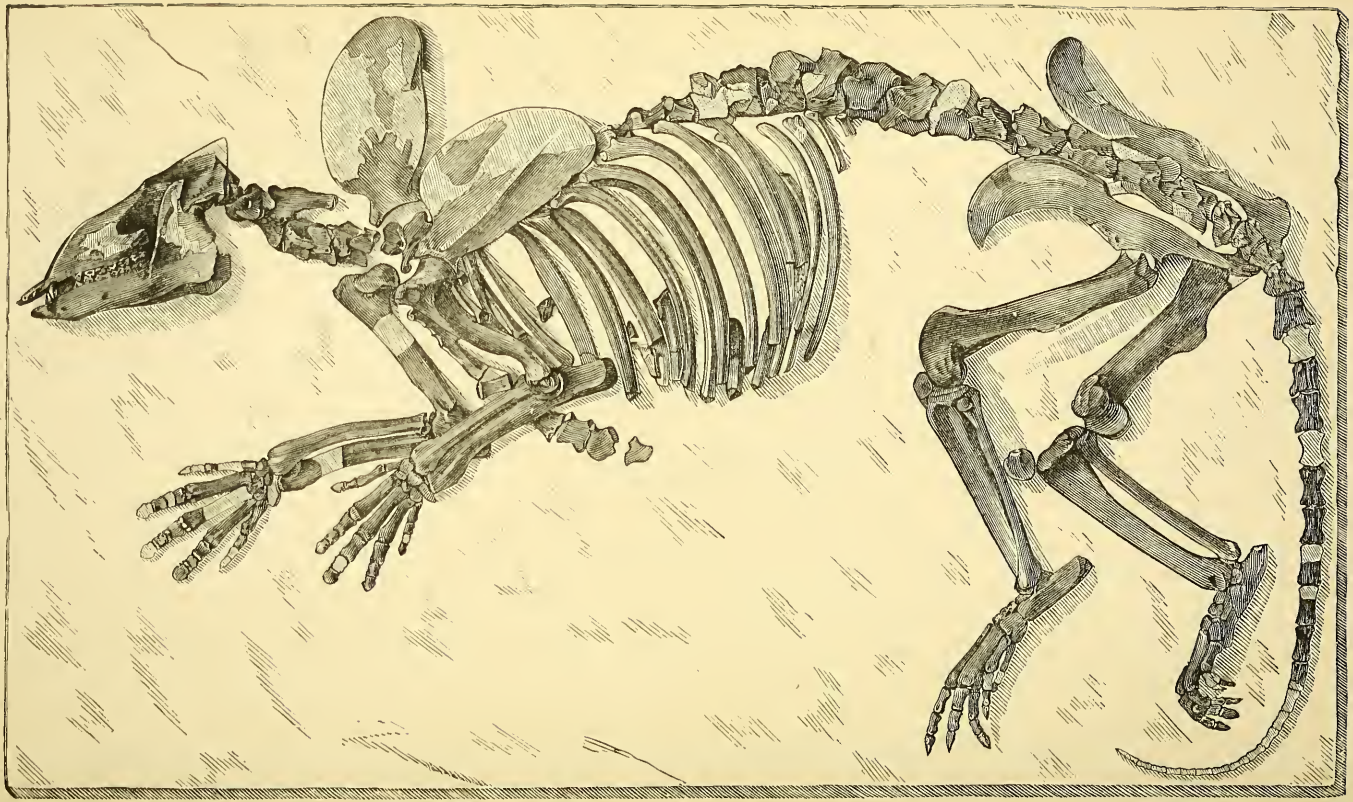


Fig 36.—Skeleton of *Phenacodus primævus* (Cope). Wasatch Eocene, Big-Horn Basin, Northern Wyoming, U.S.N. America. $\frac{1}{7}$th nat. size (*see* Pier-case, No. 9).

Nesodon, another Tertiary genus, discovered in Sonth America, has been provisionally referred to this sub-order. An upper and a lower jaw of the smallest species (*Nesodon ovinus*, Owen)*, from the S.W. Coast of Patagonia, are preserved in the collection. They were brought home by Admiral Sir B. J. Sulivan, K.C.B. **Pier-case, No. 20.**

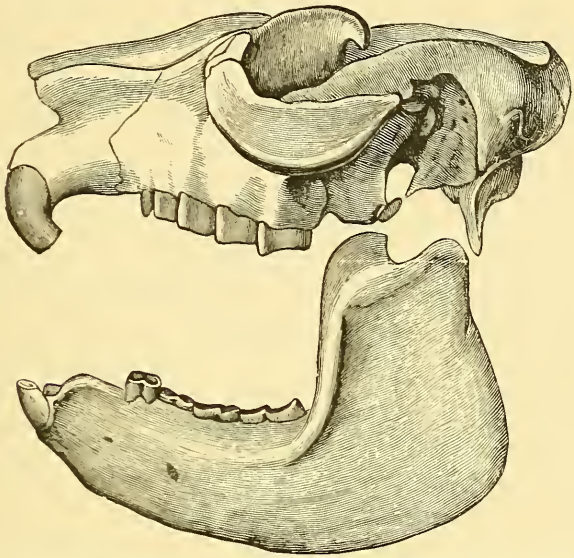


Fig. 37.—Skull and lower jaw of *Typotherium cristatum* (Gervais). ⅓ nat. size
From the Pampas Formation, Pleistocene, Buenos Ayres, South America.

A plaster cast of the skull, upper and lower jaws with teeth, and some limb-bones of a larger species, *Nesodon imbricatus*, have recently been presented by Dr. F. P. Moreno, Director of the La Plata Museum, and are exhibited in this case. Some specimens of the skull and mandible of certain of the smaller and more primitive Toxodonts from Patagonia, presented by the same donor, are shown. **Pier-case, No. 20.**

Sub-order 7.—**Astrapotheria.**

This sub-order like the last is entirely confined to South America.

The upper and lower jaws and some limb-bones of *Homalodontotherium* are exhibited in this case, where also some fine plaster-casts of skulls of *Astrapotherium magnum* and *A. angustidens* are shown.

* These specimens are figured by Sir Richard Owen in the "Phil. Trans." Roy. Soc., 1853, Pls. 15 and 16.

Sub-order 8.—**Litopterna.**

This is also a South American group and includes a number of animals which in their foot and tooth structure resemble the uneven-toed Ungulates (*Perissodactyla*), though they are not related to them. In the collection are jaws and teeth of *Proterotherium* and *Diadiaphorus* belonging to the *Proterotheriidæ*. Some of the members of this family possess feet which much resemble those of *Hipparion*, the third toe being very large and the second and fourth short and very much reduced. These specimens were presented by Dr. F. P. Moreno.

The second family, the *Macraucheniidæ*, is represented by remains of *Macrauchenia patagonica*, including a ramus of a mandible and portions of limb-bones from the Pleistocene deposits of Buenos Ayres, in South America; also plaster casts of a vertebra, a femur, bones of a fore-foot, and other remains, discovered by Charles Darwin at Port St. Julian, South Patagonia, and described by Sir Richard Owen.*

Pier-case No. 20.

Some additional specimens have lately been received from Dr. Moreno. In the older Tertiary deposits of Patagonia is found a smaller form named *Oxyodontotherium*, which is closely allied to *Macrauchenia* and may be ancestral to it; this is represented in the collection by teeth and limb-bones exhibited in this case.

Sub-order 9.—**Perissodactyla** (uneven-toed Ungulates).

Uneven-toed Ungulata.

This group of hoofed herbivorous mammals is represented at the present day by the Rhinoceros,† Tapir, and Horse. Although not numerous in species, they are very widely distributed over the earth's surface, and their ancestors, even as far back as the Eocene Tertiary period, formed a very extensive and varied assemblage of animals.

Ungulata. Perissodactyla.

The middle or third digit on both the fore and hind feet, which is always present, is the largest, and is symmetrical in itself, and occupies the middle line of the foot.

In the Tapir four functional toes are present on the fore-foot; in the Rhinoceros three; and in the Horse only the third, or middle toe, remains. (*See* Fig. 38, A, B, C, p. 31.)

* *See* Fossil Mammalia, Voyage of the "Beagle," 1839.

† A skeleton of the modern Indian Rhinoceros is placed in the centre of the Gallery, near the Pier-cases containing the fossil species, for comparison with them.

Family Rhinocerotidæ.—The Rhinoceroses occupy Pier-cases Nos. 6, 7, and 8, and Table-case No. 4. There is only a single living

Rhinoceros. Pier-cases, Nos. 6, 7, and 8, and Table-case, No. 4.

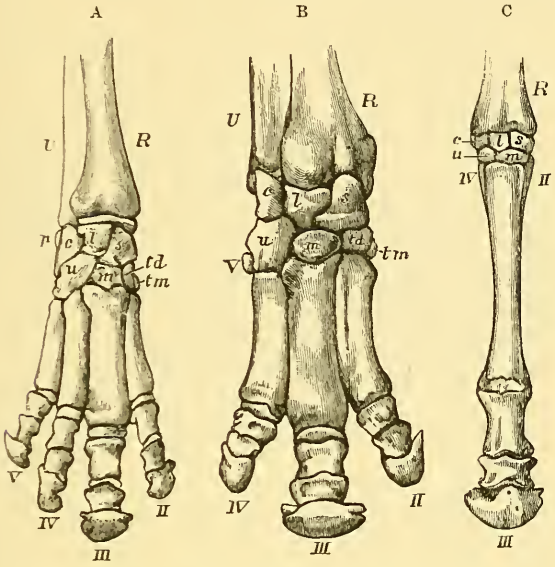


Fig. 38.—Examples of modifications of the bones in the Perissodactyle Fore-foot (after Flower).*

A, Tapir. B, Rhinoceros. C, Horse.

R=radius; U=ulna; *c*=cuneiform; *l*=lunar; *s*=scaphoid; *u*=unciform; *m*=magnum; *td*=trapezoid; *tm*=trapezium.

The Roman numerals indicate the corresponding toes present in each foot.

genus, which includes five or six known species; many genera have been described from fossil remains, but probably some of these might well be referred to Rhinoceros also.

The Rhinoceros is a large herbivorous animal with an extremely thick skin, marked by deep folds; there are seven upper and seven lower molar teeth on each side; no canine teeth are developed, but there are usually incisor teeth in both jaws;† generally one or two horns are present, but some of the earlier extinct species were hornless. The longest horn is fixed on the bones of the snout (nasal bones), the shorter behind it, on the frontal bones. The horns have no bony centre or horn-core

* Reproduced by permission from Sir William Flower's "Osteology of the Mammalia," p. 295, third Edition, 1885.

† Incisor teeth are absent in the adult African Rhinoceroses, but the Indian species have a pair of large upper incisors, and two large and two small lower ones. See the fine series of skeletons of the living species in the Recent Osteological Gallery on the West side, second floor.

The Rhinoceros. Pier-cases, Nos. 6, 7, and 8, and Table-case, No. 4.

(as in the oxen), but are only dermal appendages, and entirely composed of longitudinal fibres, like hairs, cemented together; they are seldom preserved in a fossil state,* but the surfaces of the nasal and frontal bones show traces of the roughened scars where the horns have been attached to the skin. In order

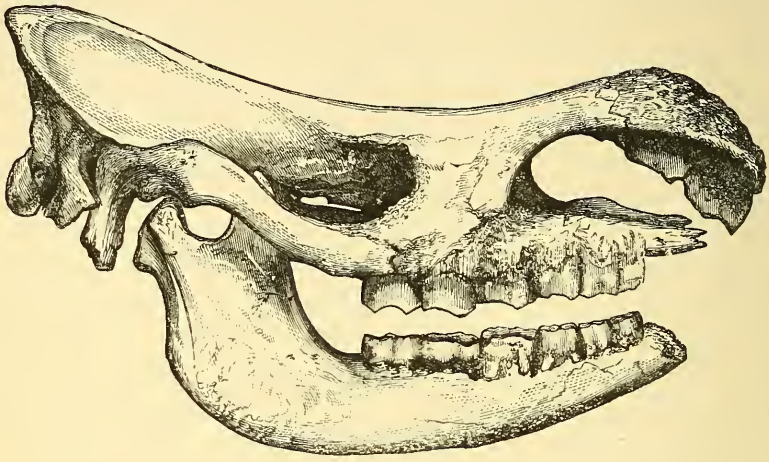


Fig. 39.—Skull and lower Jaw of *Rhinoceros leptorhinus* (Owen), from the Pleistocene Brick-earth of the Thames Valley, Ilford, Essex. (*See* Pier-case, No. 6.)

to give strength to the nasal bones which support the horns, which were used as weapons of offence, the division between the nostrils (usually more or less cartilaginous) was hardened by the addition of bony matter, so as to form a strong septum resembling a T-girder in construction.

The Tichorhine Rhinoceros.

The Tichorhine Rhinoceros is generally known as the "Woolly Rhinoceros," from having a smooth skin without folds, covered with a fine curly and a coarse hairy coat, like the "Mammoth;" it had two horns, one very large. Its body has been found preserved in the most wonderful manner, in frozen soil in Siberia, with the skin, the horns, the hair, and even the flesh still undecomposed. It was once a denizen of this country, and it is the remains of this species which have been most commonly met with in limestone caves. In Pier-case No. 6 are placed three teeth and a portion of a skull, discovered in 1668, in digging a well at Chartham, Kent. The fragments have a special interest, being the subjects of the first notice of

* In Pier-case 6, a specimen of the horn of the Woolly Rhinoceros is exhibited.

the fossil remains of the genus, published in a curious old tract of the period.* **Rhinoceros, Pier-case, No. 6.**

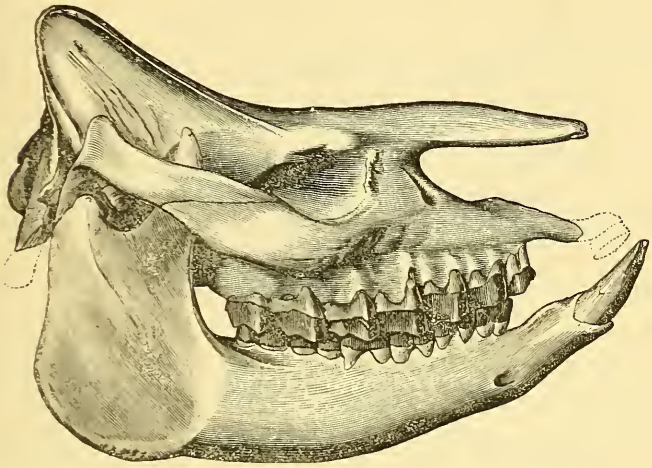


Fig. 40.—Skull and lower jaw of *Rhinoceros megalodus* (Cope), $\frac{1}{10}$ nat. size; from the Miocene (Loup Fork Beds) of Colorado, N. America.

Skulls and other remains have been dredged up by fishermen from the "Dogger Bank," in the North Sea, and they are also found, associated with the remains of the Mammoth, in the gravels and brick-earths of various localities. Several fine examples of rhinoceros remains may be seen in the pier-case.

Five species of rhinoceros have been found fossil in this country, three of which inhabited the valley of the Thames, namely: the "Tichorhine" (*R. tichorhinus*=*antiquitatis*); the "Leptorhine" (*R. leptorhinus*); and the "Megarhine" (*R. megarhinus*); of the two last-named species there is a fine and interesting series of remains, including a nearly perfect skull, which shows the bony septum of the nares (*see* Fig. 39), from the brick-earths of Ilford and Grays, Essex (*see* Pier-case, No. 6). *R. etruscus* is found in the Forest-bed series of Norfolk, and teeth of a species now referred to *R. incisivus*, are frequently met with in the Red Crag of Suffolk. **Pier-case, No. 6. Table-case, No. 4.** **Pier-case, Nos. 6, 7, and 8.**

Various remains of about twenty extinct species of rhinoceroses are arranged in Pier-cases, Nos. 6, 7, and 8, and in Table-case, No. 4; of these, two are from China, and four from the Siwalik Hills, India, and comprise skulls, jaws, and bones of **Pier-cases, Nos. 6, 7, and 8, and Table-case, No. 4.**

* "The Chartham News, or a brief relation of some strange bones there lately digged up in the grounds of Mr. John Sumner, of Canterbury." London: 1669.

Rhinoceros. Pier-cases, Nos. 6, 7, 8. Table-case, No. 4.

the extremities, many being the type specimens figured in the "Fauna Antiqua Sivalensis" of Falconer and Cautley. Other species are represented by examples from France, Italy, Spain, and Germany.

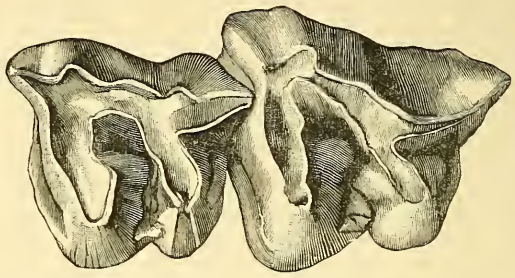


Fig. 41.—Two upper left true molars of *Rhinoceros Croizeti* (Filhol), from the Upper Eocene of Bach (Dept. Lot), France.

There are also placed in these cases several forms which departed widely from the general type of the genus, but belong to the same family. They include the genera *Cadurcotherium*, from the Upper Eocene of Caylux, France; the *Hyracodon*, from the Upper Miocene of Dakota, N. America. In a separate case is placed a cast of the skull and teeth of the *Elasmotherium*, from the Pleistocene deposits of Novousenk, Government of Samara, Russia. The original is preserved in the Museum of the Imperial Academy of Sciences, St. Petersburg.

Cadurcotherium: Hyracodon. Table-case, No. 4. Elasmotherium.

In Table-case No. 4 is exhibited a series of the teeth of rhinoceroses from the Norfolk Forest-bed; from Grays, Essex; from Kent's Hole, near Torquay; from Eppelsheim, Hessen-Darmstadt; from the Val d'Arno, &c.

Table-case, No. 4. Rhinoceros.

Family Titanotheriidæ.—This family includes a large number of ungulates from the Lower Tertiaries of N. America. A skull and mandible of *Titanotherium heloceras* is placed in wall case 8, and a number of teeth of *T. Prouti* in Table-case 4. In the middle of the gallery in separate glazed cases will be found a skull of *T. trigonoceras* and a plaster reproduction of the skull and mandible of *T. robustum*. (See figure of the skeleton, p. 35.)

Pier-case, 8. Table-case, No. 4.

In Table-case 4 are placed some teeth and other remains of *Palæosyops* and a cast of the fore-arm and manus of *Limnohyops* is exhibited in wall-case.

Family Chalicotheriidæ.—This family has a very wide geographical range, being found in Canada and the United States,

Chalicotherium. Table-case, No. 4.

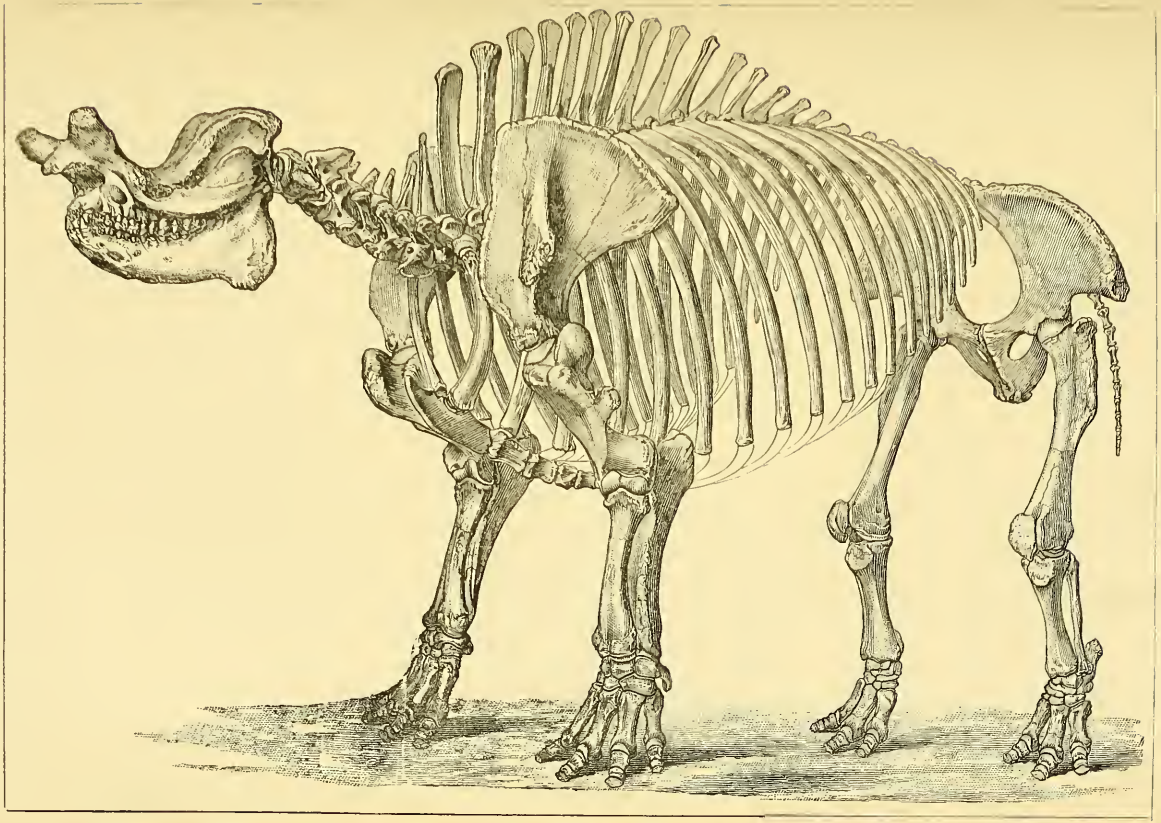


Fig. 42.—Skeleton of *Titanotherium robustum* (restored by Prof. O. C. Marsh), from the Miocene of Dakota, North America. $\frac{1}{24}$ nat. size.

in France, Germany, Greece, India, and China. It is remarkable for the abnormality in the structure of the feet, so much so indeed as to render it for the future unsafe to predict the character of an animal from a single bone, and to invalidate the old maxim, *ex pede Herculem*. While the proximal bones of the feet retain their normal perissodactyle character, the phalanges have been modified to resemble those of Edentates, the second phalangeal bone having a strongly developed distal *trochlea* (pulley) for the articulation of the huge claw forming the terminal joint. These phalangeals have been described under the names of *Macrotherium* and *Ancylotherium*, and were generally considered to belong to the skeletons of huge Edentates. But Dr. Filhol, quite recently, found them in association with the skull and the rest of the skeleton of *Chalicotherium*, so

Table-case, No. 4.

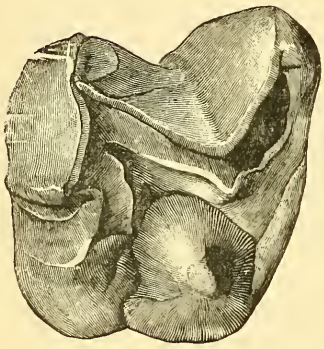


FIG. 43.—The third right upper true molar of *Chalicotherium sinense* (Owen), from the Pliocene of China.

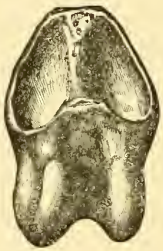


FIG. 44.—Anterior and distal aspects of a second phalangeal bone of *Chalicotherium sivalense* (Falconer and Cautley) from the Older Pliocene, Siwalik Hills, India.

that these names are synonymous for the same animal. This is evidently a very ancient family, and may have been directly derived from the *Condylarthra*.

Palæotherium. Pier-case, No. 9, and Table-case, No. 5.

Family PALÆOTHERIIDÆ.—In the next cases are arranged numerous remains of *Palæotherium* and allied genera—animals which, by the number and characters of the teeth and also by the structure of their skeletons, were all more or less intermediate in form between the rhinoceros, tapir, and horse.

The best known, and type of the family, is the *Palæotherium*, a tapir-like animal, first described by Cuvier from skulls, teeth, and bones of numerous individuals and representing several species which were discovered in the Gypsum Quarries (Upper Eocene) of Montmartre, Paris.

The species varied greatly in size, *Palæotherium magnum* being as large as a horse, four or five feet high; whilst *P. curtum* was about the size of a hog. They all had a short fleshy snout or proboscis, like the tapir; but, unlike the tapir, they had only three toes on each foot, whilst the tapir has four on the fore-foot.

Paloplotherium. Table-case No. 5.

A very closely allied genus, and by some authors considered to be the same, is the *Paloplotherium*, of which a good series, consisting of a skull, jaws, teeth, and bones of two species are exhibited in the same case. The largest of the two

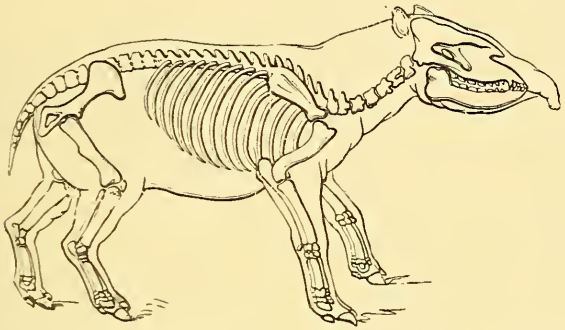


Fig. 45.—Restoration of the skeleton and outline of the form of *Palæotherium*, Eocene, Montmartre. (*See* Pier-case, No. 9.)

(*P. annectens*) was about the size of a sheep; its remains are not uncommon in the Upper Eocene of Hordwell, Hants; and have been found in abundance in deposits of the same age at Vaucluse in France.

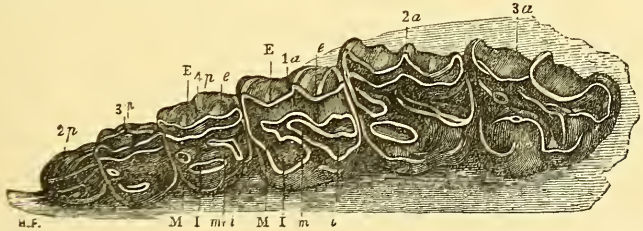


Fig. 46.—The left maxilla, with the cheek-dentition of *Paloplotherium annectens* (Owen); from the Upper Eocene of Hordwell, Hampshire. 2*p*, 3*p*, 4*p*, = premolars; 1*a*, 2*a*, 3*a*, true molars; E, *e*, outer, I, *i*, inner, and M, *m*, middle columns, (after Gaudry).

The remains of the smaller species (*P. minus*) are also met with at Vaucluse.

Anchilophus.

Anchilophus, a small Palæothere, is represented by jaws and teeth from the Upper Eocene at Bembridge, Isle of Wight, and from Vaucluse and Caylux in France.

Anchitherium.

The Miocene genus, *Anchitherium*, is interesting as presenting many characters intermediate between the *Equidæ* and *Palæotheriidæ*. The bones of the extremities, especially the feet, resemble the corresponding parts in *Hipparion*; but *Anchitherium* was a much smaller animal. The feet had three toes; the central toe on each foot was long and strong, and mainly supported the weight of the body; the lateral toes were slender, with small terminal hoofs.

Table-case, No. 5.

Remains of *Anchitherium aurelianense* are not uncommon in the Miocene deposits at Sansan, Gers, France, of which a characteristic series of teeth and bones is exhibited. *A. Bairdi* is a smaller species from the White River beds (Miocene age) of Nebraska territory, North America.

Fig. 47.—The right upper true molars of *Anchitherium Bairdi* (Leidy), from the Miocene of Dakota, N. America.

Hyracotherium.

Other genera of this family are *Hyracotherium* and *Pachynolophus*, which are very closely allied to each other.

Pier-case, No. 9.

Hyracotherium was a small animal, about the size of a hare, principally known by its dentition. Prof. Cope states that the American *Orohippus* is identical with *Hyracotherium*. Its remains are comparatively rare, and have been found in the Lower Eocene (London Clay) of Herne Bay; in Eocene sands at Hordwell, Hants; at Kyson in Suffolk; and also as a "derived fossil" from an older (Eocene?) deposit in the Suffolk Crag.

Pliolophus.

The genus *Pliolophus* was founded on an entire head and some bones of the extremities, embedded in a nodule of "septarium," or "cement-stone," from the London Clay on the coast near Harwich; it appears to be identical with *Hyracotherium*, and therefore with *Orohippus;* a reproduction, by Prof. Cope, of *H. venticolum*, from the Eocene of Wyoming Territory, United States of North America, has been added to this case. The skeleton of *Phenacodus primævus*, Cope, from the same formation and locality, is also represented by a coloured reproduction in plaster; it possessed five toes on each foot, and is in every respect the most primitive Eocene Mammal yet discovered. It indicates an ancestral form allied to *Hyracotherium*, which is generally placed in the Condylarthra (*see* fig. 36, p. 28 and text p. 27).

Pier-case, No. 9.

Pachynolophus.

Pachynolophus is an allied genus of small animals, whose remains are only found in Eocene deposits. Four species are represented in the collection by teeth and jaws from France and Switzerland. The dentition is *complete*, namely:—

Incisors $\frac{3}{3}$, canines $\frac{1}{1}$, premolars $\frac{4}{4}$, molars $\frac{3}{3} \times 2 = 44$.

Family Equidæ (Horses).—In all modern horses the digits are reduced to a single perfect toe on each foot (Fig. 38, C., p. 31); but this character does not hold good for the allied fossil forms, several of which show a tendency to an increased number of toes; but the third is nevertheless always the largest. (*See* the subjoined woodcut, Fig. 48, giving four examples, of the *Perissodactyle* foot, after Marsh.)

Horses.

Pier-case, No. 10.

Table-case, No. 5.

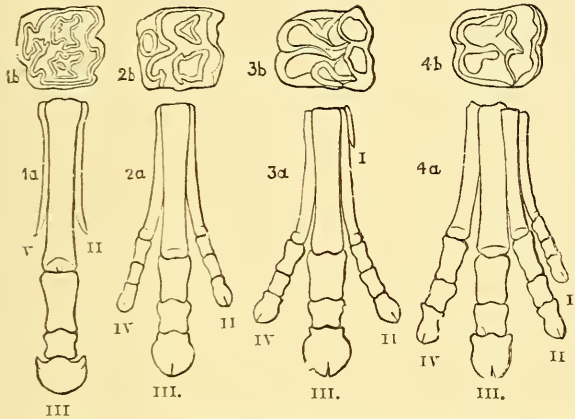


Fig. 48.—Diagram showing the gradual loss of toes in the feet and increase in the complexity of the teeth in the Equidæ.

1. *Equus*.	2. *Hipparion*	3. *Anchitherium*.	4. *Orohippus*.
Recent.	Pliocene.	Miocene.	(*Hyracotherium*.)
1*a*, Fore-foot.	2*a*, Fore-foot.	3*a*, Fore-foot.	Eocene.
	1*b*, 2*b*, 3*b*, 4*b*, Upper Molar tooth of each genus.		4*a*, Fore-foot.

The Roman numerals indicate the corresponding toes present in each foot.

In the next Pier-case are arranged the fossil remains of the Horse from the Thames Valley Brick-earths; the raised beach at Brighton; Kent's Cave, Torquay; they occur in nearly all our British caves where other animal-remains have been found; in a Pleistocene deposit at Juvillac, and in the cavern of Bruniquel, in France; at Eschscholtz Bay, Arctic America; Minas Geraes, Brazil; and from Uruguay, in South America; indeed, its fossil-remains may be truly said to be world-wide. The present race of Wild-horses, which exist in such vast herds on the Pampas, are not the descendants of the fossil horse of South America, but have sprung from those introduced by the Spaniards 350 years ago. Prior to the Spanish invasion the natives of America had no knowledge of the horse.

Pier-case, No. 10.

Pier-case, No. 10. Table-case, No. 5.

The three-toed and most immediate predecessor of the horse (*Hipparion*, Fig. 48, 2), occurs fossil in the Pliocene deposits of the Siwalik Hills in India; in China and at Maragha, Persia; in Samos; Pikermi, in Greece; in France and Germany; and in the Red Crag of Suffolk.

Hipparion and Equus.

More than thirty distinct equine species have been found fossil in North America, ranging from *Eohippus* (?) in the lowest Eocene, to *Equus* in the Quaternary deposits. The genus *Protohippus* of the lower Pliocene equalled the Ass in size. It had three toes on each foot, but only the middle one, corresponding to the single toe of the horse, reached the ground. This genus resembles most nearly the *Hipparion* of Europe; whilst the *Pliohippus* had lost the small hooflets, and was in other respects the most equine. Only in the Upper Pliocene does the true *Equus* appear and completes the genealogy of the Horse, which, in Post Tertiary times roamed over the whole of North and South America, and soon after became extinct. This occurred long before the discovery of the Continent by Europeans.

Pier-case, No. 9.

Family Tapiridæ.—Only a single genus of the family *Tapiridæ* is found living at the present day, the species being confined to Central and South America and the Malay peninsula; but the fossil forms were distributed over a far wider geographical area. Remains of no fewer than five species may be seen in Pier-case, No. 9. The most important and interesting are the entire jaws, with teeth, of *T. priscus*, from Eppelsheim,* *T. arvernensis*, and *T. elegans* from France; and *T. sinensis*, the type specimens,† from China; and teeth, of a species not identified, from the Red Crag of Suffolk.

Lophiodon is an extinct genus nearly approaching the tapirs in its tooth structure, the lower true molars having simple transverse ridges. As in the tapir also, there were four toes on the fore-feet and three on the hind.

Many species are enumerated, ranging in size from the pig to the rhinoceros. Their remains have been met with in several localities on the European continent, and also in this country, in Eocene Tertiary deposits.

In *Lophiodon* the first premolar is absent, and its dentition consists as follows:

Incisors $\frac{3}{3}$, canines $\frac{1}{1}$, premolars $\frac{3}{3}$, molars $\frac{3}{3} \times 2 = 40$.

Sub-order 10.—**Artiodactyla** (Even-toed Ungulates).

Artiodactyla, Bunodonta.

This well-defined sub-order is traceable from early Eocene times. It is characterised by having the third and fourth digits in both fore and hind feet almost equally developed, and their hoof-bones flattened on their inner or contiguous surfaces, so that each is not symmetrical in itself, but when

* These specimens are described and figured by H. von Meyer in the "Palæontographica," vol. xv., p. 173, pls. 25 and 27.

† Described and figured by Sir Richard Owen in the "Quart. Journ. Geol. Soc.," vol. xxvi., pp. 426 to 428, pls. 28, 29.

placed together, they are bilaterally symmetrical; the axis or median line of the foot passing down between them, whilst in the Perissodactyles, the axis or median line passes down the centre of the third digit. **Hippopotamus.**

In all the modern Ruminants (with the single exception of *Hyomoschus*), the metacarpals and metatarsals are ankylosed together so as to form one bone (the "cannon-bone"), whereas, in the Non-ruminants, the bones of the feet remain separate, and

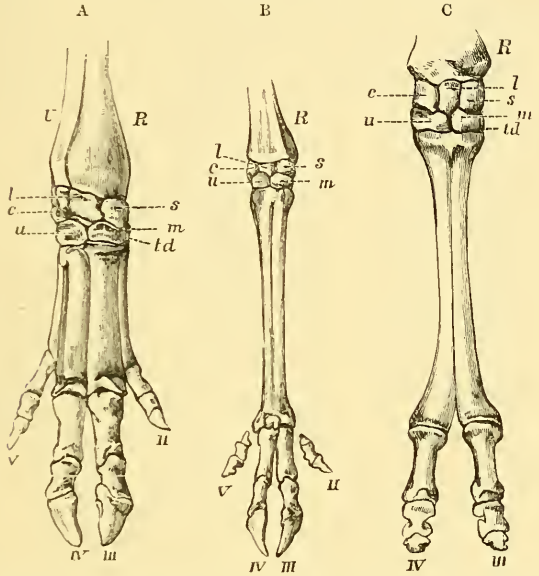


Fig. 49.—Examples of modifications of the bones in the Artiodactyle Fore-foot (after Flower).

A, Pig, $\frac{1}{2}$ nat. size. B, Deer, $\frac{1}{7}$ nat. size. C, Camel, $\frac{1}{8}$ nat. size.
R=radius; U=ulna; *c*=cuneiform; *l*=lunar; *s*=scaphoid; *u*=unciform; *m*=magnum; *td*=trapezoid.
The Roman numerals indicate the corresponding toes, or digits, present in each foot.
[Reproduced, by permission, from Sir William Flower's Introduction to the "Osteology of the Mammalia," 3rd edition, 1885, p. 297.]

are seldom ankylosed together. The existing Artiodactyla are readily divided into two very distinct groups: firstly, the Non-ruminants, which have been named the Bunodonta,* embracing the hippopotamus and the pigs; and secondly, the Ruminants—animals which chew the cud—these are named Selenodonta,†

* From βουνὸς, hilly, and ὀδους, a tooth, in allusion to the irregular hilly or mammillated structure of the molar teeth in the pig and hippopotamus.

† From σεληνὶς, crescent, and ὀδους, a tooth, in reference to the crescent-shaped structure of the dentinal folds in the molar teeth of deer, antelopes, oxen, &c.

A. B.

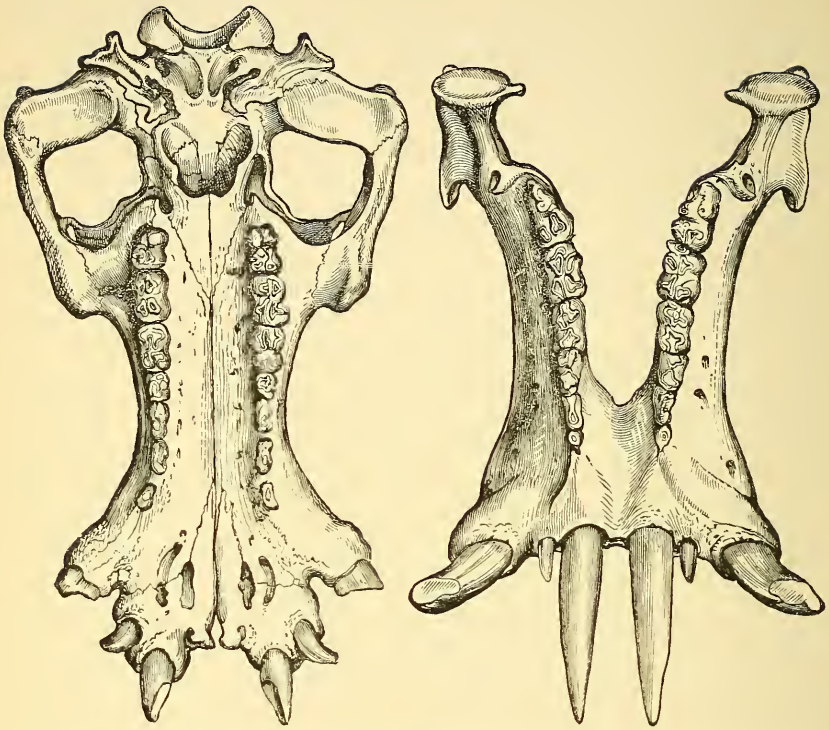


Fig 50.—A. Palatal view of the skull of the recent *Hippopotamus amphibius* (Linn.), from Africa; and B. Lower jaw of same (seen from above).

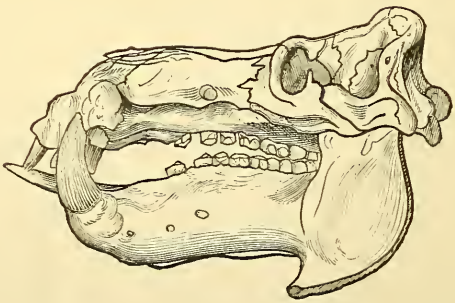


Fig. 51.—Profile of skull and lower jaw of *Hippopotamus amphibius* (Linn.), Africa (*see* Pier-case, No. 11).

and embrace the deer, antelopes, oxen, &c.; but when the extinct species are considered, these groups are found to be connected by many intermediate or transitional forms.

Family Hippopotamidæ (Hippopotamus).—In these cases are arranged the various remains of the first genus of this group, the *Hippopotamus*, now only found living along the shores, rivers and lakes of tropical Africa, but once common in England, in the southern parts of Europe, and in India.

Pier-cases, No. 11, 12. Table-case, No. 6.

The European Pleistocene species (*Hippopotamus major*), formerly considered distinct, is now admitted to be indistinguishable from the existing African species (*H. amphibius*), and to that species therefore the fossil remains of *Hippopotamus*, found in this country, are now referred.

Pier-case, No. 11.

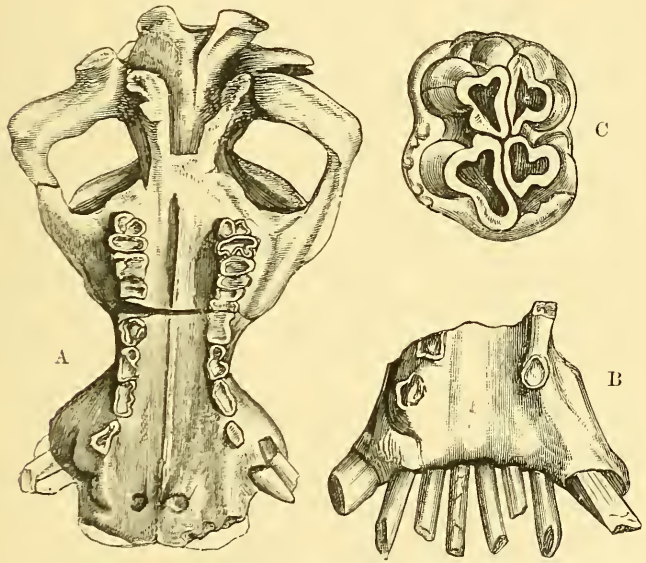


Fig. 52 A.—Palatal view of skull of *Hippopotamus sivalensis* (Falconer and Cautley) from the older Pliocene, Siwalik Hills, India.

„ B.—Front or symphysial portion of lower jaw of *H. sivalensis*, showing the six incisors and the tusk-like canines.

(Both figures one-eighth natural size.)

„ C.—Molar tooth of same species, showing the worn-down double trefoil pattern of the crown (one-half natural size).

The series comprises specimens from Malta, Sicily, the Val d'Arno, Italy, from Auvergne, France; from the Narbada Valley and from the Siwalik Hills, India. Its remains have also been found in the Gower Caves, South Wales; in Kent's Hole, Torquay; in Kirkdale Cave and near Leeds, Yorkshire; in the Norfolk Forest Bed series; at Lavenham, Suffolk; at

Chelmsford, Essex; in great abundance at Barrington, Cambridge; in the Ouse near Bedford; and many remains have been obtained in the valley of the Thames both in and around London.

In Pier-case, No. 11, are exhibited a very fine and nearly perfect lower jaw of *Hippopotamus amphibius*, from the Pleistocene deposits of Barrington, near Cambridge; and another equally well-preserved example from the Upper Pliocene of Mt. Perrier, Puy de Dôme, France. A skull and mandible of the living African Hippopotamus is also placed here for comparison.

Table-case, No. 6.

Here are placed the fossil remains of two species of dwarf *Hippopotami*, the smaller of which *(H. minutus)* is from Pleistocene deposits in the Island of Malta, and was probably a contemporary of the pigmy Elephants. The other *(H. Pentlandi)* was obtained from the Grotta di Maccagnone, near Palermo in Sicily. So abundant were the remains of these animals in the various caverns near Palermo that for many years their bones were exported, by shiploads, to England and Marseilles for the manufacture of animal charcoal for sugar-refining. Two hundred tons were removed from one cave (San Ciro) in six months. Dr. Falconer writes that literally tens of thousands of two species of *Hippopotami* have been found fossil in Sicily. He points out that, at the time these animals lived, Sicily was connected by land with North Africa, and that Malta and Sicily must have been continuous. (*See* "Falconer's Palæontological Memoirs," 1868, 8vo, vol. ii., pp. 544-553.)

Pier-case, No. 11.

Another small species of hippopotamus (*Hippopotamus madagascariensis*) formerly existed in Madagascar, but is now quite extinct. This species is represented in the collection by numerous skulls and limb-bones which are exhibited in Pier-case No. 11, and Table-case 4.

Fig. 53.—Third right lower true molar of *Sus cristatus* (Wagner), Pliocene, India. *a*, *d*, middle columns of talon of tooth.

On the other side of the Table-case are placed limb-bones, vertebræ, and teeth of *Hippopotami* from the Older Pliocene deposits of the Siwalik Hills, India (most of which have been figured in Falconer and Cautley's "Fauna Antiqua Sivalensis"), together with teeth and various remains from the Pleistocene deposits at Barrington, near Cambridge, and from Norfolk, with others from Walton, Grays, and Chelmsford, Essex; and from Greenwich, Kent.

Family Suidæ (Pigs).—The Pigs comprise many examples of the Wild-boar from Walthamstow and Grays, Essex; the Red Crag of Suffolk; from the peat of Limerick, Ireland; from Oreston near Plymouth. Other more ancient species are derived from Tuscany, from Pikermi in Greece, and Eppelsheim in Hessen-Darmstadt. Several species, as *Sus hysudricus*, *Sus giganteus*, &c., are from India; and the remains of the Peccary *(Dicotyles)* from the Caves of Brazil.

Wild-boars.

Pier-case, No. 13. Table-case, No. 7.

Other nearly related genera represented in the collection are the *Hyotherium* from the Miocene of Elgg (Zurich), Switzerland; from St. Gérand-le-Puy, Sauvetat, Caylux, and other localities in France. The *Hippohyus* from the Siwalik Hills, India; and the *Phacochœrus* (or "Wart-hog") from the Pleistocene deposits of South Africa.

Hyotherium.

Hippohyus.

The *Listriodon* is another allied genus, but possessing true molars bearing transverse ridges. Its remains have been found in the Middle Miocene at L'Île-en-Dodon, Simorre, and Sansan in France; and in the Siwaliks of the Punjab, India.

Listriodon.

The non-ruminants are connected with the true ruminants by a gradual transition through many early and extinct forms, characterized by having incisor teeth in the upper jaw, the more or less crescentic form of the cusps of the true molars, by the ulna and radius forming two perfect and distinct bones, and by the third and fourth metapodials not being united by ankylosis. (*See* Fig. 49, p. 41.)

Whether some of these extinct genera "ruminated" is doubtful; that many did may be assumed as certain from the more crescentic structure of the upper molar teeth.

Fig. 54A.—The third right upper true molar of *Hyopotamus bovinus* (Owen).

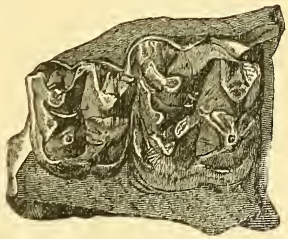


Fig. 54B.—First and second left upper true molars of *Hyopotamus porcinus* (P. Gervais).

From the Hempstead Beds, U. Eocene, Isle of Wight (both nat. size).

The most Porcine of the group are the genera *Elotherium* and *Chœropotamus*, each possessing the typical number of teeth, *viz.*, forty-four. The *Elotherium* was a large animal from the Lower Miocene of Ronzon, near Puy-en-Velay, France. Its remains have also been found in the Hempstead beds of the Isle

Elotherium-Chœropotamus.

Chœropotamus.

Table-case, No. 7.

of Wight. *Chœropotamus* was likewise a denizen of this country. Sir Richard Owen has described* a nearly perfect ramus of the mandible, now in the collection, from the upper Eocene at Seafield, Isle of Wight; also, in the same case, are exhibited jaws and teeth from a deposit of similar age at Débruge, near Apt, Vaucluse.

Anthracotherium.

Pier-case, No. 13, and Table-case, No. 7.

Family ANTHRACOTHERIIDÆ.—The genus *Anthracotherium*, first discovered in a lower Miocene coal-bed† at Cadibona, Piedmont, is represented in the collection by remains of several species ranging in size from an ox to a sheep. *A. magnum* is from the Lower Miocene sands at Flonheim, Hessen-Darmstadt, and the fine series of portions of jaws and detached teeth are respectively from the Upper Eocene, Caylux, France, and Cadibona in Piedmont. Remains of the smallest species, *Anthracotherium Gresslyi*, are found in the Upper Eocene beds of Hordwell, Hants, and Bembridge. The intermediate forms are from many localities and formations, namely, the Upper Eocene of Switzerland and France; the Lower Miocene of Alsace and of Italy, and the Lower Pliocene of India. The *Hyopotamus* (*Ancodus*) is a closely related genus. Its remains are found in some abundance at Hempstead, in the Isle of Wight; representatives of six species are exhibited, three from the above locality. They are also found in France and Switzerland. A gigantic species occurs in the Siwalik Hills, India, and another in Dakota, America. *Merycopotamus*, an allied form of this group, occurs in the Pliocene of the Siwalik Hills.

FIG. 54c—A right upper true molar of *Merycopotamus dissimilis* (F. & C.) from the Pliocene of India.

Hyopotamus.

Merycopotamus.

Table-case, No. 8.

Oreodon.

Table-case, No. 8.

Family OREODONTIDÆ.—Skulls and mandibles of *Oreodon* and *Eporeodon* are shown in table-case 8.

Here are arranged the fossil-remains of some of the earliest known genera of ruminants, referred to several families, all extinct, some of which were true ruminants and others were very probably nearly related to them.

Anoplotherium.

Family ANOPLOTHERIIDÆ.—The best known, by description and figures, of these extinct animals is the *Anoplotherium*,‡ of Cuvier, the only animal known at the time in which the teeth formed one connected series, without any breaks or intervening spaces, and all of uniform height, a character then thought to be peculiar to man. The genus was first described by Cuvier from numerous remains (referred to several distinct species) exhumed from the Gypsum-beds at Montmartre, Paris.

* Owen, "Brit. Foss. Mamm." p. 413, fig. 163.

† Hence the name "Coal-beast."

‡ From *ἀνόπλος*, *weaponless*, and *θηρίον*, *beast*, in allusion to its having neither tusks, horns, nor claws.

Here may be enumerated *Xiphodon*, from Montmartre, Caylux, and Vaucluse in France; also *Dichodon* and *Dichobunus*, from the Isle of Wight and Hampshire, and from Montmartre and Vaucluse, France; *Cœnotherium*, a genus of small animals about the size of hares and rabbits, whose

Xiphodon. Dichodon. Dichobunus. Cœnotherium.

Fig. 55.—The last five right upper cheek-teeth of *Anoplotherium caylusense* (Lydekker), from the Upper Eocene of Caylux, France, ½.

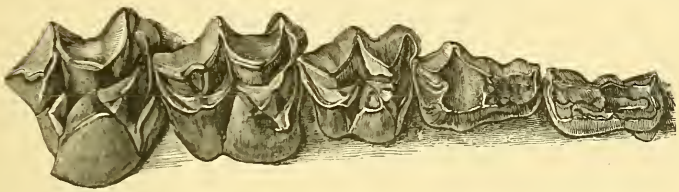


Fig. 56.—Part of the right maxilla of an immature specimen of *Anoplotherium secundarium* (Cuvier). Upper Eocene, Débruge, France, ½.

remains are preserved in the greatest abundance and perfection in freshwater deposits of Lower Miocene age at Cournon and Sauvetat (Puy-de-Dôme), and Allier, and also in the Upper Eocene at Caylux, France. It is likewise found at Haslach, near Ulm, in Wurtemberg. Seven species, varying but little in size, are exhibited. Their dental formula was complete, namely, eleven teeth in each jaw, in all forty-four. In most of the

Cœnotherium.

Table-case, No. 8.

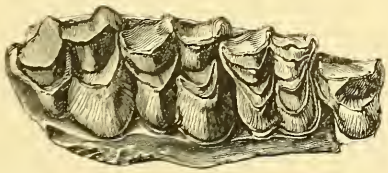


Fig. 57.—The last four right upper cheek-teeth of *Lophiomeryx Chalaniati* (Pomel); from the Eocene Phosphorites of Quercy, France.

species the series is continuous, with no diastema between the canines and premolars. The feet had four complete digits. *Gelocus* and *Lophiomeryx* occur in the Lower Miocene of several localities in France, and *Chœromeryx* in the Siwalik Hills, India.

Gelocus Lophiomeryx and Chœromeryx.

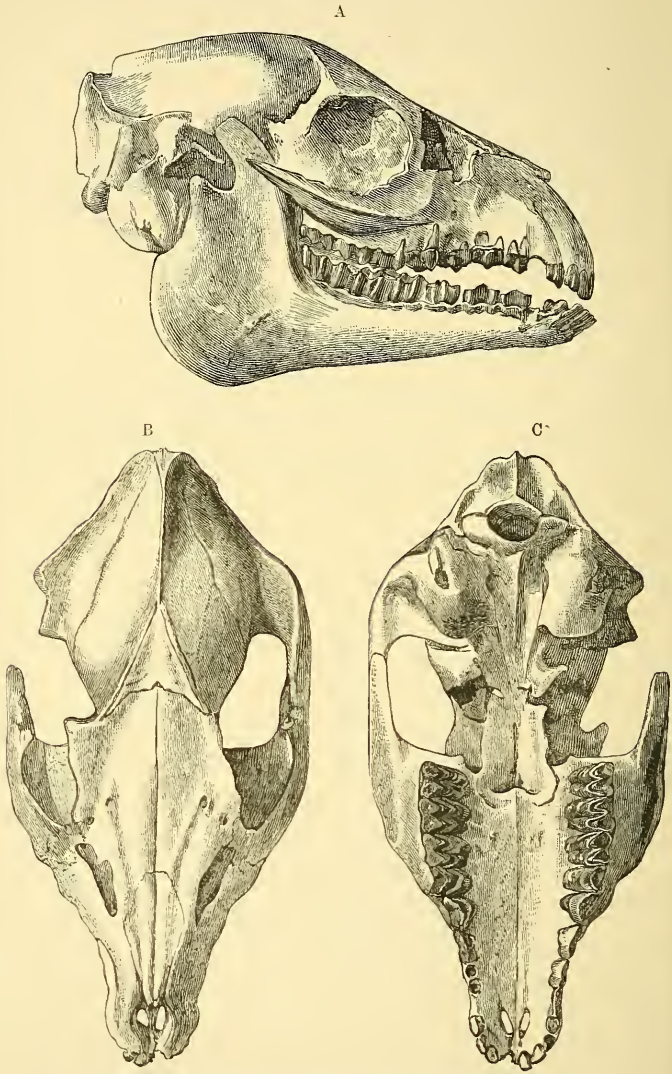


FIG. 58.—(A) Profile, (B) upper, and (C) lower, views of the skull of *Cœnotherium Filholi* (Lydekker). Upper Eocene, Caylux, France.

Family Tragulidæ (Chevrotains).—The extinct fossil genera, *Prodremotherium* and *Bachitherium*, from the Upper Eocene of Caylux, and *Hyomoschus* (= *Dorcatherium*) from Eppelsheim in Hessen-Darmstadt, Sansan in France, and the Siwalik Hills in India, are probably early ancestors of the *Tragulidæ*, or "Chevrotains," the smallest of existing ruminants, not exceeding the hare in size; the fossil forms were, however, considerably larger. The teeth of a species of Chevrotain (*Tragulus sivalensis*) occur in

Tragulidæ Dorcatherium, &c.

Table-case, No. 8.

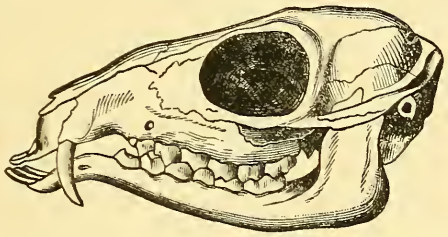


Fig. 59.—Reduced side-view of skull of living Chevrotain, *Tragulus javanicus* (Pallas).

the Siwaliks of the Brámapútra Valley, India. The nearly entire skull with the mandible of *Dorcatherium* (exhibited in Table-case No. 8), is the type-specimen, first described and figured by Dr. Kaup.* All the teeth are preserved, the canines are long and trenchant, and there are four premolars in the lower jaw, but in the recent Chevrotains (*Tragulus*) there are only three.

Tylopoda† (Camelidæ).—The camels and llamas form a somewhat aberrant group of Artiodactyles as regards their general form and in their dentition. In the typical ruminants there are no incisor teeth in the upper jaw, but the camel has two, in addition to twelve molars. The extremities only of the two toes which form the foot are free, and are each terminated by a short somewhat curved nail (*see* Fig. 49, C. p. 41).

Camels.

Pier-case, No. 13.

The fossil remains of the camel are so closely related to the living species that they cannot readily be distinguished from them. They are found in the Siwalik Hills, India. Ancestral forms of *Auchenia*, the living South American llamas and alpacas (*Palauchenia*, Owen) have also been met with in a fossil state in Mexico, Brazil, and Buenos Ayres.

Llamas.

Palauchenia.

The group is an ancient one, and appears to have arisen in N. America, where the remains of several primitive Camels such as *Protolabis*, *Poëbrotherium*, *Procamelus*, are found in Tertiary deposits.

* Ossemens Fossiles. Darmstadt, pt. 5, pl. xxiii. A.

† Pad-footed animals.

True Ruminants.

True Ruminants.

Under this sub-division is placed the second group of hoofed Artiodactyle quadrupeds, the true Ruminants, animals that chew the cud, as the ox and deer-tribes.

They are characterised by the outer toes being rudimentary or absent: they have no teeth in the front part of the upper jaw; they possess a complex stomach with four compartments; the males usually possess either "horns" or "antlers."

The group embraces many extinct genera and also extinct species belonging to existing genera.

Cervidæ, Deer-tribe.

Pier-case, No. 15.

Family—The Cervidæ (Deer-tribe).—The *Cervidæ* or Deer-tribe are characterised by possessing *antlers* which differ remarkably from the *horns* of Oxen or Antelopes. "Antlers" are outgrowths of true bone, covered during their growth with vascular sensitive integument coated with short hair. In this

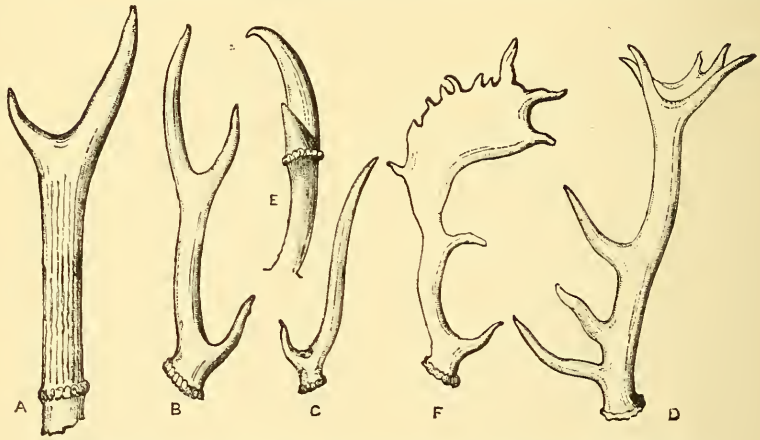


Fig. 60.—Antlers of *Cervidæ* (Deer-tribe). A, Antler of *Cervulus* (?) *dicranoceros* (Kaup), Pliocene. B, Antler of *Cervus pardinensis* (Croizet & Jobert), Pliocene. C, Antler of the Red Deer *C. elaphus* (Linn.), in the second year. D, Antler of Red Deer in its full-grown condition. E, Antler and bony pedicle of the frontal bone of the Muntjak, *Cervulus muntjak* (Zimm.). F, Antler of the Fallow Deer *Cervus dama* (Linn).

state they remain permanently in the Giraffe, but in the true *Cervidæ*, or Deer, when the growth of the antler is complete, the supply of blood to it ceases, the skin dies and peels off, leaving the bone bare and insensible, and after a time, by a process of absorption near the base, it becomes detached from the skull and is "shed." A more or less elongated portion or "pedicle" always remains on the skull, from the summit of which a new antler is developed. This process is

repeated with great regularity at the same period of each year.*

In young animals the antlers are simple (*see* Fig. 60 C) and in those species which attain a great complexity this is acquired gradually in successive annual growths. Each antler consists

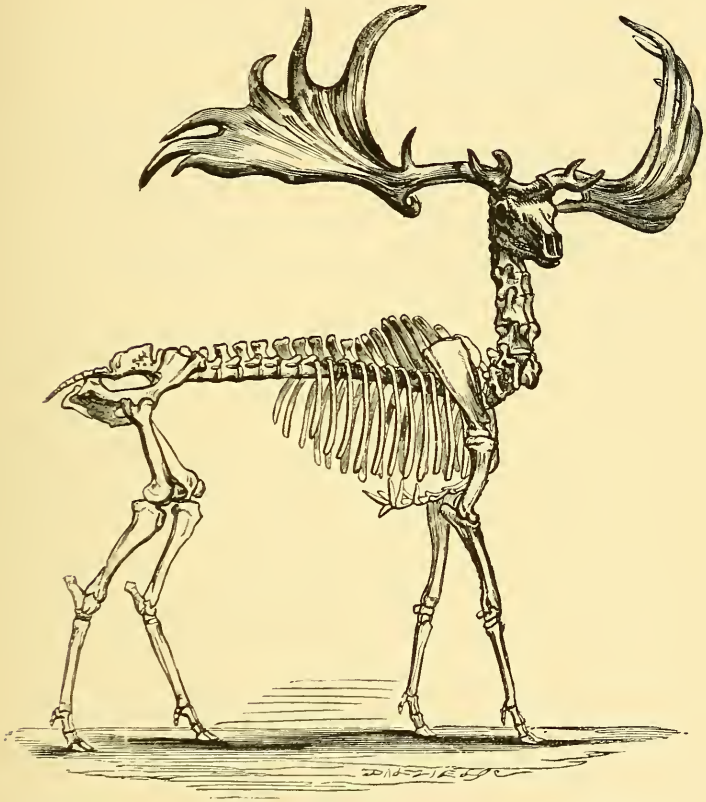


Fig. 61.—The Gigantic Irish Deer *Cervus (Megaceros) giganteus* (Blumenbach), from shell-marl beneath the peat, Ireland.

of a main stem or *beam*, and usually of one or more branches or *tynes*, of which the one immediately above the burr is termed the *brow*-tyne.

* The antlers of the deer tribe are shed and renewed annually, increasing in size with age, a new "snag" or tyne marking each year, being added to the new antler till adult. The horns of the oxen are never shed.

As in many analogous instances, the development of the antlers of the individual is paralleled by their development in the family; since we find that many of the earlier members were totally unprovided with these appendages, and that their extreme complexity in the more specialised forms was not acquired until a late period in geological time.

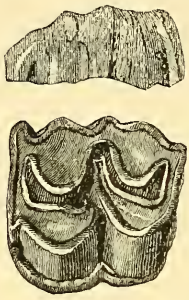


Fig. 62.—Left upper true molar of *Cervus sivalensis* (Lydekker), Pliocene, India.

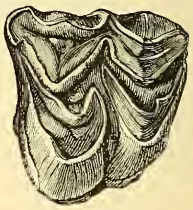


Fig. 63.—Left upper true molar of *Palæomeryx sivalensis* (Lydekker), Pliocene, India.

Pier-case, No. 15, and Table-cases, Nos. 9 and 10.

The Deer-tribe (*Cervidæ*) are well represented both by entire skeletons, in the centre of the Gallery, and also by a fine series of detached heads and antlers of various species in and upon the pier-cases, and affixed to the columns on either side of the central avenue.

Gigantic Irish Deer.

Stands K. L. M. and Pier-case, No. 15.

In addition to the fallow deer,* the roebuck, and the red deer, which still linger on (*preserved* in our parks and forests), we once possessed that king of the deer-tribe, the *Cervus* (*Megaceros*) *giganteus*, commonly known as the "Gigantic Irish deer," its remains having been met with in considerable numbers in Ireland, often in a very remarkable and perfect state of preservation, in the shell-marl beneath the peat-bogs in various parts of the country, particularly in Ballybetagh Bog, near Dublin, and in counties Mayo and Limerick. The gigantic Irish deer was by no means confined to Ireland; its remains are found in many parts of Great Britain, particularly in cave deposits, and also on the Continent. Two entire skeletons of the male, with antlers spreading a little over 9 feet across,† and one skeleton of the hornless female, stand in the centre of the Gallery (*see*

* *Cervus dama* is considered to have been introduced into this country; but an extinct variety, named by Boyd Dawkins *Cervus Brownii*, from the Pleistocene of Essex, may have been its ancestor

† Heads and antlers of several other individuals are placed upon the adjacent wall-cases. The crowns of some of these are of even greater breadth.

Fig. 61). The true elk (*Alces machlis*) and the reindeer (*Rangifer tarandus*) were also denizens of our island in Pleistocene times (*see* Antlers on Piers). **The Elk.**

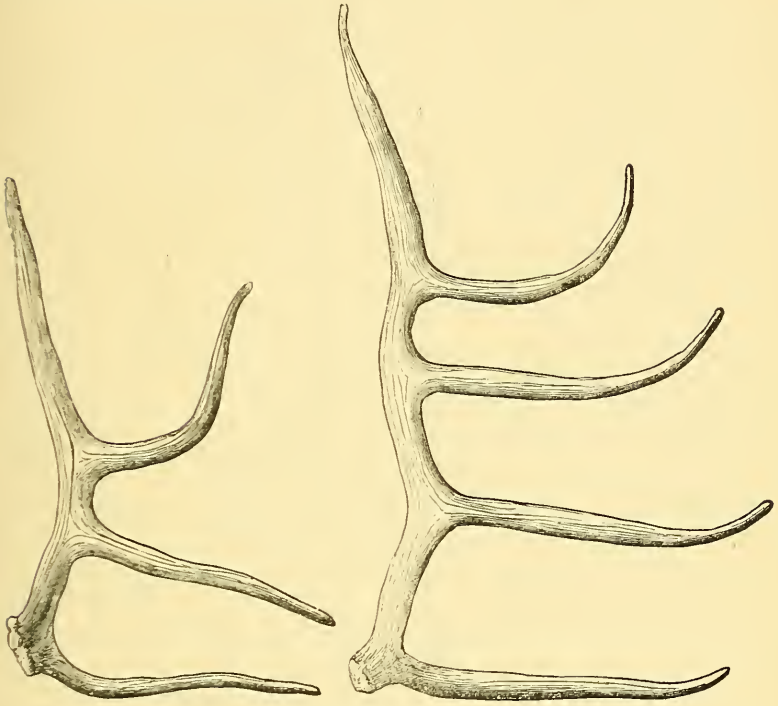


Fig. 64.
Antlers of the fifth and sixth years of *Cervus tetraceros* (Boyd Dawkins), from the Upper Pliocene of Peyrolles, France (*see* Pier-case No. 15).

Thousands of fragments of the shed antlers of the reindeer have been obtained from the Gower Peninsula, South Wales; in the Vale of Clwyd, in North Wales; in Kent's Hole, Torquay; and from many other caves and fissures in limestone rocks in England. Numerous remains of reindeer have been obtained from the Thames valley brick-earth and gravels in and around London, as at Ilford and at Earl's Court, Twickenham, etc. A very fine antler from the last named locality is mounted in Wall-case No. 15. The broken skulls, with the bases of antlers attached, may also be seen from the cave of Bruniquel, in France, and a fine entire antler embedded in stalagmite from Brixham Cave near Torquay.

Pier-case, No. 15.

The Reindeer.

Table case, No. 10.

See Wall-case No. 1, and Pier-case No. 15.

Several extinct forms of Deer, some equalling the gigantic

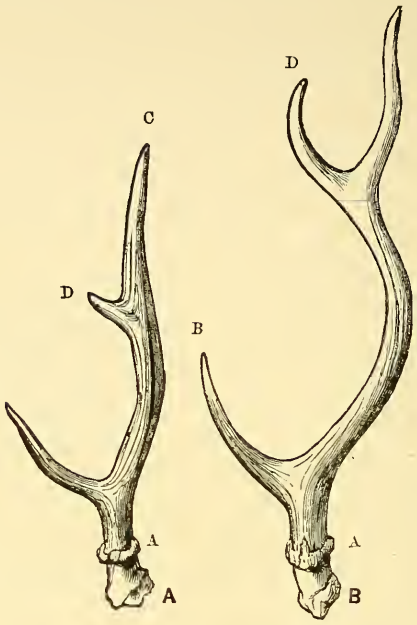


Fig. 65.—Antlers of *Cervus cylindroceros* (Boyd Dawkins), from the Upper Pliocene of Ardé, France.

Fig. 66.—Antler of the Red-deer, *Cervus elaphus* (Linn.), one of a pair, from the bed of the River Boyne at Drogheda, Ireland. Exhibited on one of the columns on the south side. [This specimen is figured in Owen's "British Fossil Mammals and Birds," p. 472 (1846), ex. coll. Sir Philip Grey Egerton, Bart., M.P., F.R.S.]

Irish deer in size (*Cervus verticornis*, &c.), occur in the Forest Bed along the Eastern coast; *C. suttonensis* is found in the Red Crag of Suffolk. An interesting series of antlers, teeth, and

Cervus verticornis.

Fig. 67.—Skull and antlers of reindeer, *Rangifer tarandus* (Linn.); Pleistocene "till", Bilney Moor, East Dereham, Norfolk. (Owen's "Palæontology," p. 374.)

bones, from deposits of Miocene and Pliocene age in Darmstadt, France, and Italy, and also from India, is arranged in the Pier and Table-cases.

Cervus tetraceros.

Family Giraffidæ (Giraffe, &c.). In this group are placed a remarkable series of animals, all of which (with the exception of the Giraffe) are extinct. The most prominent form placed in this case is the *Sivatherium*, a huge beast described by Falconer and Cautley from the older Piocene deposits of the Siwalik Hills, India. It had two pairs of horns on its head, two short and simple in front, and two larger palmated ones behind them. From the persistent character of these bony horn-cores, we may certainly regard this animal as a gigantic four-horned ruminant, having a resemblance in some structural characters to the giraffe, in others to the antelope.

Pier-case, No. 14.

The Giraffe and Sivatherium.

Head of Sivatherium Stand I.

A cast of the original cranium of *Sivatherium*, with the horn-cores restored from actual parts, in the collection and elsewhere, has been placed on a stand in the centre of the gallery adjacent to the case containing the skull and other portions of the skeleton.

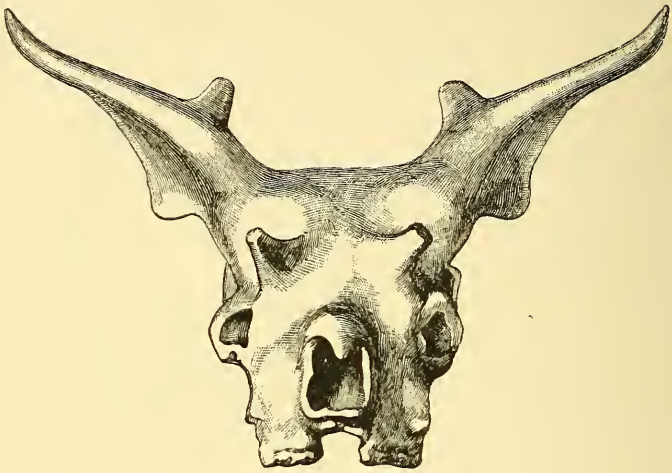


Fig. 68.—Skull of *Sivatherium giganteum* (Falc. & Cautl.), from the Lower Pliocene deposits, Siwalik Hills, India (the horns restored).

Helladotherium, &c.

A hornless skull of a nearly allied animal, from the same formation and locality, is placed with *Sivatherium*, and was considered by Dr. Falconer and other palæontologists to be the skull of the hornless female; but it is now referred, by more recent writers, to a distinct genus *(Helladotherium)*, whose remains were first discovered at Pikermi, near Athens, Greece.

Pier-case, No. 14.

The *Hydaspitherium* from the Siwaliks of India, and the *Bramatherium* from Perim Island, Gulf of Cambay, are allied genera of large size. Remains of an extinct species of giraffe, *(Giraffa sivalensis)*, also from the Siwaliks of India, are placed in the same case.

The most striking new type is a large ruminant, discovered by Dr. Forsyth Major in the lower Pliocene beds of the Island of Samos, off Asia-Minor, named by him *Samotherium Boissieri*, and said to connect *Helladotherium* and the giraffe with some of the ancient aberrant antelopes of Pikermi. Remains of this species are shown in Pier-case 14.

Bovidæ (Oxen, etc.)

In this division are placed all those animals with curved or straight "horns," having a central bony process—or

Horns of the Bovidæ, or Ox-tribe.

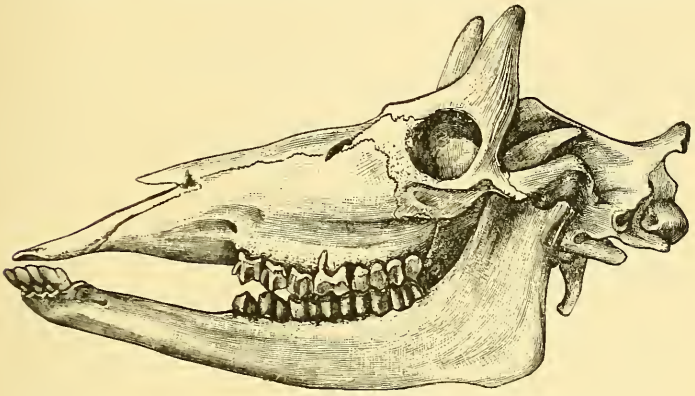


Fig. 69.—Profile of skull and lower jaw of *Samotherium Boissieri* (Forsyth Major), a giraffe-like ruminant from the Pliocene of Samos, Turkish Archipelago.

horn-core—arising from the frontal bones of the skull, ensheathed in a case of true horn*, which continues to grow slowly from the base, and wears away at the apex, but is very rarely, if ever, shed entire. These are all included under the term Bovidæ, embracing all the horned-Ruminants, such as the Oxen, Sheep, Antelopes, &c.

Here are exhibited numerous heads and horn-cores of fossil antelopes and oxen from the Siwalik Hills of India; and a smaller series of remains of the bison from Siberia, Arctic America, and from various British localities.

Pier-cases, Nos. 16 to 19.

Antilopinæ.—The Antelopes resemble other *Bovidæ* in their dentition; canine teeth are absent; the rudimentary lateral digits are not always present, but the metapodial bones which support these digits are absent in all living forms. The variations observed in the different genera are considerable; several sub-divisions have been formed, viz.:—

(1.) The *Palæotragine* forms had laterally compressed horns and "brachyodont"† dentition. *Protragoceros*, the oldest known

Pier-case, No. 16.

* Hence they are frequently spoken of as "the hollow-horned Ruminants" or the *Cavicornia*, from *cavum*, hollow, and *cornu*, a horn. The horny sheath when removed formed the "hollow horn."

† "Brachyodont," teeth with low crowns.

genus from the Middle Miocene of France; *Palæotragus* and *Tragoceros* from the Lower Pliocene of Greece, Samos, and Persia, belong to this division.

(2.) The *Alcelaphine* antelopes have recurved and lyre-shaped horns, but no supraorbital pit in the skull. *Alcelaphus* is fossil in the Lower Pliocene of India and in Algeria.

(3.) The *Cephalopine* forms are of small size, living in Africa and India; fossil species perhaps occur in the latter country.

(4.) The *Cervicaprine* type are large African antelopes, with hornless females; one genus, *Cobus*, occurs fossil in India.

(5.) The *Antilopine* section resembles the last; the pits in the skull above the eyes are large, and the teeth are "hypsodont,"* like those of the sheep. *A. cervicapra* occurs both living and fossil in India. The Siberian *Saiga tartarica* was once common to the whole of northern Europe, and its bones have been found in many cave-deposits.

The African and Asiatic Gazelles, with lyrate, laterally-compressed horns, are represented by *Gazella deperdita* in the Pliocene of Greece, Samos, and Persia; by *G. anglica* in the Norfolk Forest-bed, and by *G. porrecticornis* in the Siwalik formation of India, and others.

(6.) The African *Hippotragine* type occurs fossil both in Europe and Asia. *Hippotragus sivalensis* is fossil in India; *Palæoryx* in the Pliocene of France, Greece, Samos, Asia Minor, and Persia; the horns are long, straight and backwardly curved; they have no supraorbital pit in the skull and the teeth are like those of oxen.

(7.) The *Tragelaphine* antelopes include the Nilghai (*Boselaphus*) of India, and the Kndu (*Strepsiceros*), *Tragelaphus* and *Oreas* in Africa; fossil forms of *Boselaphus* occur in the Narbada valley, India. *Palæoreas* and *Protragelaphus* (related to the living African species) are fonnd in the Lower Pliocene of France, Greece, Persia, and Algeria.

(8.) The *Rupicaprine* type includes only the Alpine Chamois, whose remains also occur in many cave-deposits.

Caprinæ, goats and sheep, form a distinct section of the *Bovidæ*, marked by laterally compressed and angulated horn-cores, "hypsodont" teeth, and the absence of lachrymal vacuity in the skull beneath the eye. The horns are either curved back as in the Ibex, spirally twisted as in the "Markhoor," or with a peculiar outward curvature and twist, as in the Sheep. The Goat (*Capra hircus*) is not uncommon in the Fens and other superficial deposits and in caves in England. In the Pliocene of India several species of Goat have been met with, including *Bucapra*, an extinct hornless form with teeth resembling those of Oxen. The remains of the Pyrenean Ibex (*C. pyreniaca*) are

* "Hypsodont," teeth with high crowns.

abundant in the caves of Gibraltar. A large extinct species *Caprovis Savini*, allied to the living Argali, occurs in the Norfolk Forest Bed.

Pier-case, No. 16.

The Musk-sheep.

The "Musk-sheep" (*Ovibos moschatus*)* of the Arctic regions forms a connecting link between the *Caprinæ* and *Bovinæ*. It is an animal of singular interest to the palæontologist, as it was a denizen of this country in prehistoric times, and has left its remains in the gravel of the Wiltshire Avon, in that of the Thames near Maidenhead, in the brick-earth of Crayford, Grays, and Erith, and at Green Street Green in Kent; it has also been dredged up off the Dogger Bank in the North Sea, and found in the Caves of Dordogne in France.

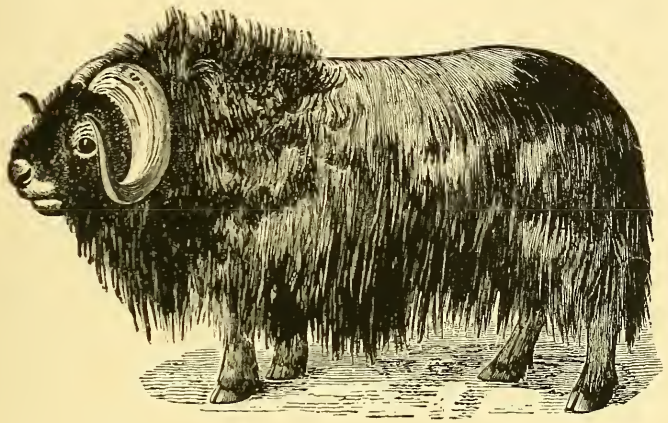


Fig. 70.—The Musk-sheep, *Ovibos moschatus* (Zimm.).
Still found living in North Grinnell-Land, Lat. 82° 27′.

Once its range extended over all the northern lands, as testified by its remains, which are found abundantly in Siberia. It is now only rarely met with living on the treeless barrens of Arctic America and in North Grinnell Land.

Two closely allied extinct species (*O. bombifrons*, Harlan, and *O. cavifrons*, Leidy), have been discovered in the Pleistocene of Kentucky and Arkansas.

Pier-case, No. 16.

Bison.

Bovinæ.—In this case are also placed the remains of the European Bison (*Bison bonasus*, var. *priscus*), obtained from the Pleistocene "brick-earth" of Ilford and Walton, Essex; from Erith, and Crayford, Kent; Peckham, Surrey; Wiltshire and Lincolnshire. Other specimens exhibited from Canada, Eschscholtz Bay, Kotzebue Sound, Alaska, are also referred to the

* Of which a recent skeleton is placed in the centre of the Gallery, near Pier-case No. 16.

Pier-case, No. 16. Bison.

European Bison, thus showing a far wider geographical range for this species in Pleistocene times than at the present day.

The American Bison is represented by a recent skull and mandible, and by the calvarium and horn-cores of a fossil species (*Bison latifrons*, Harlan), from Texas. Both the American and European species of bison are now nearly exterminated by man.

Pier-case, No. 17. Indian Bovidæ.

This case contains a long series of skulls of early forms of Indian Oxen from the older Pliocene deposits of the Siwalik Hills. They have been chiefly referred to the genus *Bubalus*, two species being represented, namely, *B. occipitalis* and *B. acuticornis*.

They are related to the Anoa, a small species of wild buffalo now living in the Celebes. Two other species, referred to the genus *Leptobos*, are also represented in this case.

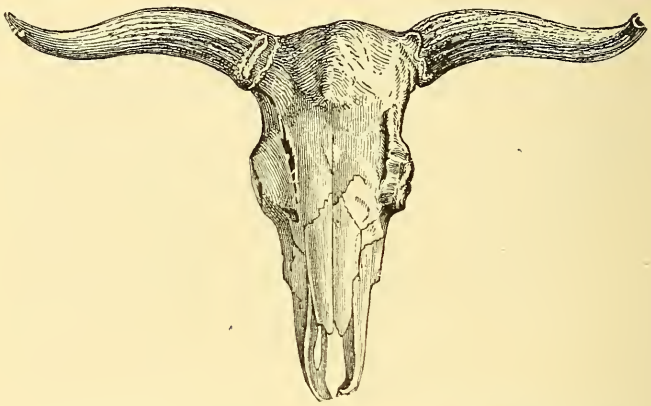


Fig. 71.—Skull of *Bos taurus*, var. *primigenius* (Bojanus); Pleistocene, Athol. (*See* Pier-case, No. 18.)

Pier-case, No. 18. Bos primigenius.

In this case are displayed a very fine series of perfect crania, with the horn-cores and various portions of the skeleton and limb-bones of the gigantic extinct British Ox, *Bos primigenius*, from the brick-earth of Ilford, from Walton and Clacton, Essex, and from Crayford, Kent; and from peat-deposits and Turbaries in Kirkcudbrightshire, Scotland, &c.

These fine animals were probably the oxen referred to by Cæsar under the name of *Urus*; but though they surpassed in size and in the greater expanse and strength of horns any of our modern breeds of cattle, they were probably the ancestors of the larger existing European varieties found in Spain, Italy, and Hungary. The wild cattle at Chillingham Park, Northumberland, may perhaps be the last surviving descendants of *Bos primigenius*, but greatly reduced in size.

Pier-case, No. 19.

In this case are placed a series of skulls with horn-cores, lower jaws, and other remains of *Bos longifrons* believed to be

the immediate ancestor of our existing small Welsh and Scottish cattle. They are commonly found in peat-bogs, Turbaries, and superficial deposits of comparatively recent date, and in prehistoric tumuli, kitchen-middens, &c. **Pier-case, No. 19. Bos longifrons.**

Here are also exhibited skulls of *Bubalus*, an Indian buffalo, from the Pleistocene deposits of the Narbada Valley. One of these skulls is remarkably perfect and has the horn-cores nearly entire and measuring more than six feet in expanse; the facial portion of the skull is also quite complete. This specimen of *Bubalus buffelus*, var. *palæindicus* (Falconer), is figured and described in Falconer's "Palæontological Memoirs," 1868, Vol. I., p. 280, &c., Pl. XXII., Fig. 1. **Bubalus palæindicus.**

Order VII.—SIRENIA. (Dugong, Manatee, &c.)

The Sirenia form a remarkable group of aquatic vegetable-feeding mammals, and are really very distinct from the Cetacea, although they have been sometimes erroneously classed with them. **Sirenia. Pier-case, No. 21.**

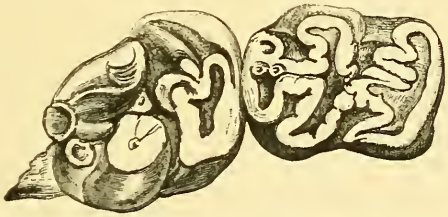


Fig. 72.—The penultimate and last lower molars, right side, of *Halitherium fossile* (Blainville), Middle Miocene, Angers (Maine-et-Loire), France.

The head is of moderate size—not enormously large compared with the body, as in the Cetacea—and although in the living animal the neck is not very apparent, the cervical vertebræ are all distinct, and the head can be turned freely from side to side, which is not the case in the Cetacea.

The eyes are small; there are no external ears visible; the fore limb is paddle-shaped, the digits being enveloped in a fin-like cutaneous covering. The Sirenia have no dorsal fin; the tail is flattened, and expanded horizontally.

The hind limbs are wanting, save in *Halitherium*, in which genus, however, they are quite rudimentary; as is also the pelvis. The bones, more especially the ribs, are extremely compact in structure, like ivory, and of intense hardness, and very massive.

The teeth vary considerably in the several genera. In the Manatee there are as many as 44 molars. In *Halitherium* there are a pair of tusk-like upper incisors (smaller than in *Halicore*), **Sirenia, Manatee, & Rhytina.**

Pier-case, No. 21.

and either five or six cheek-teeth in each jaw, or 24 molar teeth and two tusks. The *Halicore* or "Dugong" has only twelve molar teeth and two tusk-like incisors in the upper jaw. The adult *Rhytina* had no teeth, the palate and anterior portion of the lower jaw being provided with horny plates of hardened epithelium, which served in lieu of teeth for masticating the seaweed which formed its food. The manatee inhabits the west coast and the rivers of tropical Africa, and the east coast and rivers of tropical America, the West Indies and Florida. The dugong (*Halicore*) extends along the Red Sea coasts, the shores of India, and the adjacent Islands, and as far as the north and eastern coasts of Australia.

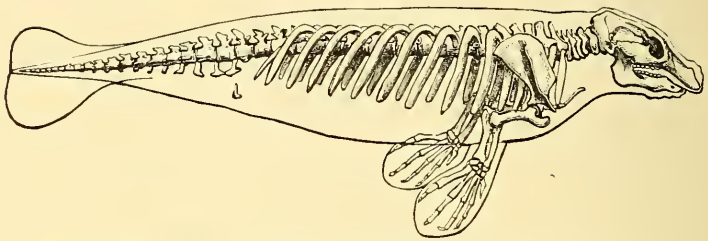


Fig. 73.—Skeleton of the living "Manatee" (*Manatus americanus*), from the River Amazon.

The most remarkable Sirenian is the *Rhytina gigas* (*Rhytina Stelleri*), or "Steller's Sea-cow," once common along the shores of Behring's and Copper Islands, near Kamtschatka, and seen alive by the naturalist Steller in 1741. This is by far the largest of the Sirenia, and when full grown, it is said to have attained a length of 25 feet, and a weight of from three to four tons.

The Sirenia pass their whole life in the water, being denizens of the shallow bays, estuaries, lagoons, and large rivers; but they never venture far away from the shore. Their food consists entirely of aquatic plants, upon which they browse beneath the surface, as the terrestrial herbivorous mammals feed upon the green pastures on land.*

Skeleton of Rhytina.

Stand N.

When Steller came to Behring's Island in 1741, the Sea-cows pastured in the shallows along the shore, and collected in herds like cattle. As they fed, they raised their heads every four or five minutes from below water in order to breathe before again descending to browse on the thick beds of seaweed which surround the coast.

* The large seaweeds called *Laminariæ* grow in water at or just below low-water; they are nutritious and are eaten by animals. They abound in the North Pacific Ocean. Ruprecht, in his account of the Algæ of the North Pacific, records eight species of these large weeds growing in the Sea of Ochotsk, on the shores of Kamtschatka, and the north of North America.

They were observed by him to be gregarious in their habits, slow and inactive in their movements, and very mild and inoffensive in their disposition. Their colour was dark-brown, sometimes varied with spots. The skin was naked, but covered with a very thick, hard, rugged, bark-like epidermis.

Like most of the Herbivora, they spent the chief part of their time in browsing. They were not easily disturbed whilst so occupied, even by the presence of man. They entertained great attachment for each other; and when one was harpooned, the others made incredible attempts to rescue it. They were so heavy and large that they required 40 men with ropes to drag the body of one to land.

The almost perfect skeleton set up in the centre of the Gallery measures 19½ feet in length, but a skull and some casts of detached bones in the Pier-case adjoining give evidence of a much larger animal. Although only seen for the first time by civilized people in 1741, and described in 1751 by Steller, it was so easily killed, and its flesh was found so excellent for food, that in 40 years it had disappeared, and since 1782 has not been seen alive.

Its bones are obtained from peat deposits on Behring's Island, whence the specimen exhibited was procured. Although the living Sirenia are only found inhabiting the warmer sub-tropical regions of the globe, fossil remains testify their former abundance in Europe in the Tertiary period. As many as fourteen genera and thirty species are recorded, namely, one species from the Pleistocene, eight from the Pliocene, fifteen from the Miocene, and four from the Eocene, ranging from the West Indies and Carolina to England, Belgium, France, Germany, Italy, Malta, and Egypt, and from Behring's Island to Australia.

The best preserved fossil form described is the *Halitherium Schinzi*, from the Miocene of Hessen-Darmstadt, of which a

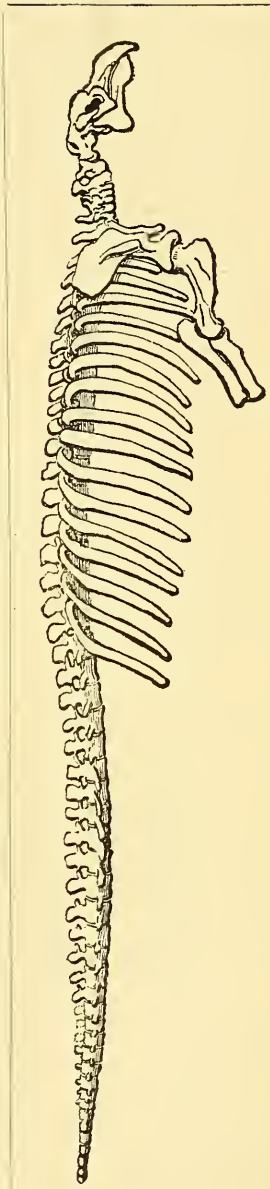


Fig. 71.—Skeleton of *Rhytina gigas*, Zimm. (*Rhytina Stelleri*, Desmarest), from a Pleistocene peat-deposit, Behring Island. (Length of original specimen, 19 feet 6 inches.) (*See* Glass-case N, and Pier-case, No. 21.)

Sirenia.

Pier-case, No. 21.

cast of the entire skeleton and a large series of separate bones are exhibited. The cast of a nearly perfect skull of *Halitherium* (*Felsinotherium*) *Forestii* (Capellini), from Bologna, is also in the Pier-case, together with the skull and lower jaw of *Prorastomus sirenoides* (Owen), from the Tertiary of Jamaica; a cast of the skull of *Halitherium Canhami* (Flower), from the Suffolk Crag; and the *natural* cast of the brain of *Eotherium ægyptiacum* (Owen), from Mokattam Quarries, near Cairo, together with recent skulls of the African Manatee and the Australian Dugong placed for comparison with the fossil forms.

Order VIII.—CETACEA (Whales).

Table-case, No. 11, and Wall-cases, Nos. 22 and 28.

In this order of the Mammalia the body is still more fish-like than in the *Sirenia*. There is no trace of a neck, the contour of the head passing gradually into that of the body. They have a horizontally flattened caudal fin and very generally a median dorsal fin also.

The anterior limbs alone are present externally, and these are not divided into arm, fore-arm, and hand, but they form a broad flattened paddle without any trace of nails. The cervical vertebræ in many species of Cetacea are more or less fused together into a solid mass. None of the vertebræ are united together to form a sacrum. The pelvis is quite rudimentary, as are the hind-limbs when present.

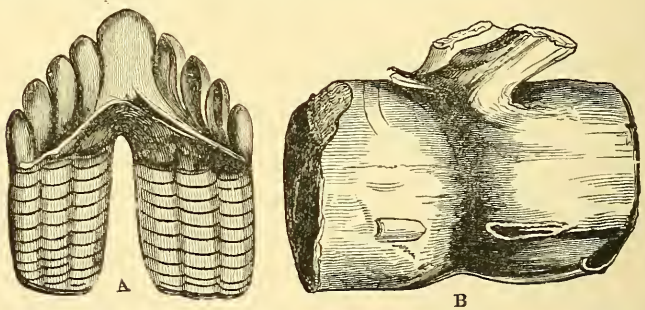


Fig. 75.—A, molar tooth; B, caudal vertebra (reduced) of *Zeuglodon cetoides* (Owen), Middle Eocene, Alabama, U.S., North America.

Teeth are generally present, but they are exceedingly variable in number.

In one group, the *Mystacoceti*, teeth are quite absent, save in the fœtal state, the palate being provided with numerous transversely-placed horny laminæ, termed "baleen."*

* The "whale-bone" of commerce.

The whales are divided into the Mystacoceti (or Whalebone whales), the Archæoceti, and the Odontoceti (or Toothed whales); this last division includes the Sperm-whales—the *Ziphiidæ*, *Hyperoodon*, *Ziphius*, *Mesoplodon*, and the *Delphinidæ*.

Wall-case, No. 22. Table-case, No. 11.

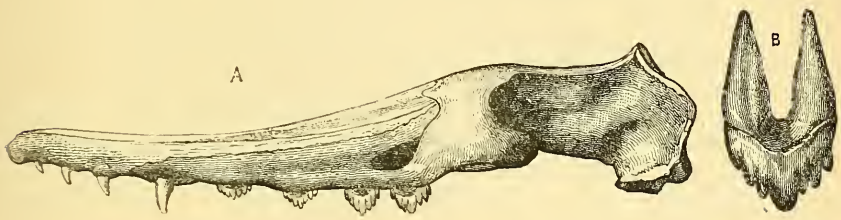


Fig. 76.—A, left lateral aspect of cranium (much reduced); B, an upper molar tooth (less reduced of *Zeuglodon cetoides* (Owen). M. Eocene, Alabama, U.S.A.

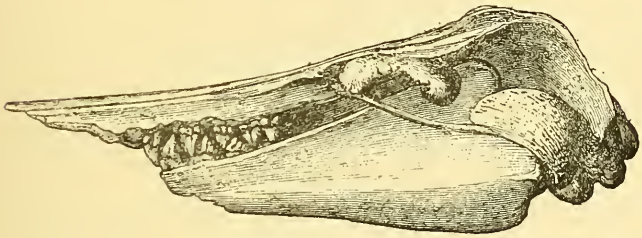


Fig. 77.—An imperfect skull of *Squalodon Grateloupi* (Pedroni), $\frac{1}{2}$ nat. size; from the Middle Miocene of Barie, Drôme, France (after Gaudry).

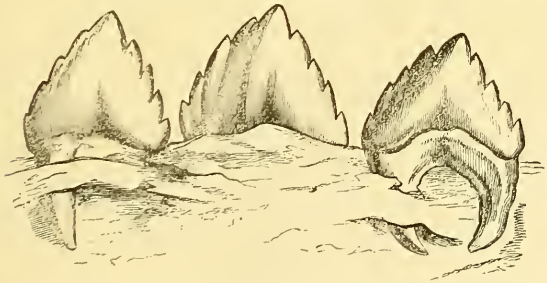


Fig. 78.—Three lower molars of *Squalodon*, from the Miocene of Europe.

The *Archæoceti* embrace the genus *Zeuglodon*, hitherto found chiefly in the Eocene formation of Alabama, Louisiana, &c. It has six incisors, two canines, and 10 molars and pre-

Wall-case, No. 22. Zeuglodon.

Fig. 79.—The right tympanic of *Balæna primigenia* (Van Beneden), from the Red Crag of Suffolk. (½ nat. size.)

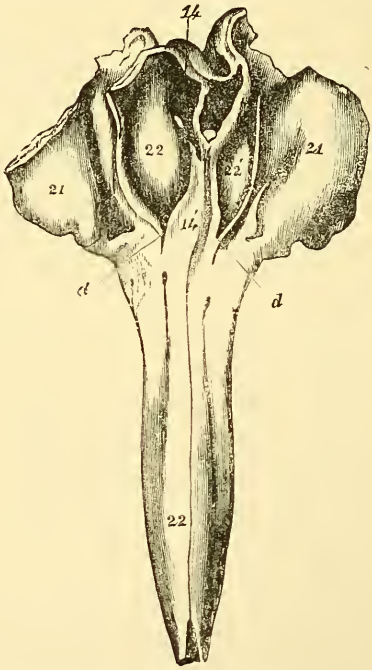


Fig. 80.—Anterior portion of cranium of *Choneziphius planirostris* (Cuvier), Pliocene, Antwerp Crag; ½ nat. size. 14', vomer; 14, mesethmoid; 21, maxilla; 22, premaxilla; *d*, *d*, canals, which terminate in the prenasal fossæ.

molars on each side, or 36 in all. The molar teeth have laterally compressed crowns, with serrated edges and two distinct roots. **Cetacea.**

Coloured reproductions of skulls of another extinct Cetacean, *Squalodon*, from the Miocene of Bavaria and of Central France, are also exhibited here. **Squalodon. Pier-case, No. 21.**

In the Table-case is placed a series of the rostral bones of *Ziphiidæ* and the ear bones (*Cetotolithes*) of true whales from the Suffolk Crag (*see* Figs. 79 and 80, p. 66), and casts of ear-bones from the Belgian Crag Deposits. **Table-case, No. 11.**

In the Wall-case, in addition to a cast of the skull and other bones of *Zeuglodon*, are exhibited a series of vertebræ and other remains of whales from the Red Crag of Suffolk, and **Wall-case, No. 22.**

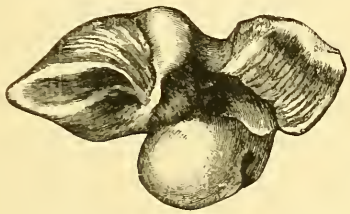


Fig. 81.—The left periotic bone of *Mesoplodon longirostris* (Cuvier), from the Red Crag of Suffolk.

casts of figured specimens from the Antwerp Crag. In the opposite case are placed the remains of Cetacea obtained from superficial and modern deposits in various parts of England. **Wall-case, No. 28.**

THE PAVILION (No. 2 on Plan).

Order IX.—EDENTATA. (Sloth, Armadillo, &c.)

In this gallery are arranged the remains of the various extinct genera of Edentata from America belonging to the Sloths and Armadillos, and remarkable for their gigantic size when compared with their small living representatives. All the animals of this order are vegetarians in diet, except the Ant-eaters and the Armadillos, the former of which subsist on the White Ant, and the latter on the grubs of insects, roots, etc. The name of the order is misleading, as these animals are not entirely toothless, with the exception of the *Myrmecophaga* (Ant-eaters), the front teeth only being wanting in the majority; the cheek-teeth have permanent pulps always growing up as they are worn away at the crown.

Wall-case, No. 26.

The *Megatheriidæ*, represented by *Megatherium*, *Mylodon*, *Scelidotherium*, *Megalonyx*, and *Cœlodon*, present characters intermediate between the existing Bradypodidæ, or Sloths, and the Myrmecophagidæ, or Ant-eaters, combining the skull and dentition of the former, with the structure of the limbs and vertebral column of the latter. Almost all the ancient forms were of gigantic size, *Megatherium* being larger than any Rhinoceros. The teeth in *Megatherium* are prismatic in form (quadrate in transverse section), and composed of hard dentine, softer vaso-dentine, and cementum, so arranged that, as the tooth wears, the surface always presents a pair of transverse ridges, thus producing a dental apparatus well suited, like the molar teeth of *Dinotherium*, *Tapirus*, etc., for triturating vegetable food. *Megatherium* has five such teeth on each side in the upper, and four on each side in the lower jaw, as in the modern Sloth: *Cœlodon* has one tooth less on each side, both in the upper and lower series.

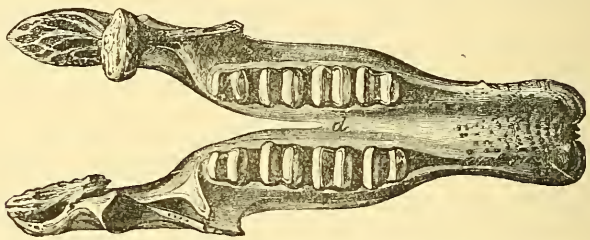


Fig. 82.—Lower Jaw of *Megatherium americanum* (Cuvier), showing the double chisel-shaped Molar teeth; from Pleistocene deposits, Buenos Ayres.
$\frac{1}{8}$ natural size.

None of these huge extinct forms were arboreal in habit, but they were probably all phytophagous in diet, subsisting upon the leaves and young branches of trees.

Great Ground-Sloth.

Although the jaws were destitute of teeth in front, there are indications that the snout and lips were elongated, and more or less extensile, whilst the fore-part of the lower jaw is much prolonged and grooved (*see* woodcut, Fig. 82), to give support to a long cylindrical, powerful, muscular tongue, aided by which the great sloth, like the giraffe, could strip off the small branches of the trees which, by its colossal strength, it had broken or bent down and brought within its reach.

Teeth of Megatherium.

In the Elephants, which subsist on diet similar to that of the *Megatherium*—the grinding of the food is effected by molar teeth, which are replaced by successional ones as the old are worn away. In the Giant Ground-Sloth only one set of teeth was provided, but these by constant upward growth, and continual addition of new matter beneath, lasted as long as the animal lived and never needed renewal.

Mega-therium. Stand O.

On the stand, in the centre of the Pavilion, is placed the cast of the entire skeleton of the great extinct "Ground-Sloth" (*Megatherium americanum*), the separate original bones of the skeleton, and the skull, occupying the Wall-case.

Great Ground-Sloth.

This colossal animal measures 18 feet in length, its bones being more massive than those of the elephant. The thigh-bone is nearly thrice the thickness of the same bone in the largest of existing elephants, the circumference being equal to the entire length. The strength of the *Megatherium* is indicated by the form of the bones, with their surfaces, ridges, and crests everywhere roughened for the attachment of powerful muscles and tendons. The bony framework of the fore-part of the body is comparatively slender, but the hinder quarters display in every part enormous strength and weight combined, indicating that the animal habitually rested on its haunches and powerful tail. Whilst in that position it could freely use its strong

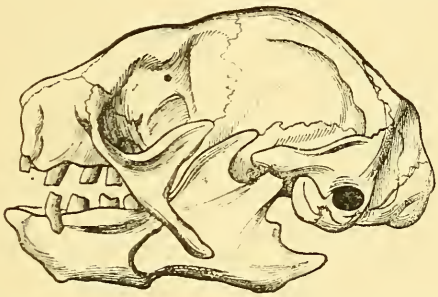


Fig. 83.—Skull of the Tree-sloth, *Bradypus gularis* (recent), S. America (reduced).

flexible forearms and the large claws, with which its hands were provided, to break down or bend the trees upon the leaves and succulent branches of which it fed, like its pigmy modern representative, the existing tree-sloth, which spends its entire life climbing back-downwards among the branches of the trees suspended by its powerful arms and long recurved claws.

Mylodon. Glass-case OO.

A nearly perfect original skeleton of *Mylodon robustus*, Owen, has been set up in this gallery beside the restored skeleton of *Megatherium*, so that we see in juxtaposition examples of two of the largest genera of these great extinct ground-sloths, once the denizens of the vast tropical forests of America, and represented to-day by the tree-sloth (*Bradypus*), an animal not larger than a dog in size; the skeleton of one of which is placed in the adjoining Wall-case for comparison with the *Megatherium*.

Remains of other allied animals, namely, *Scelidotherium* (*see* Fig. 84), and *Megalonyx*, may be seen in the Wall-case adjoining.

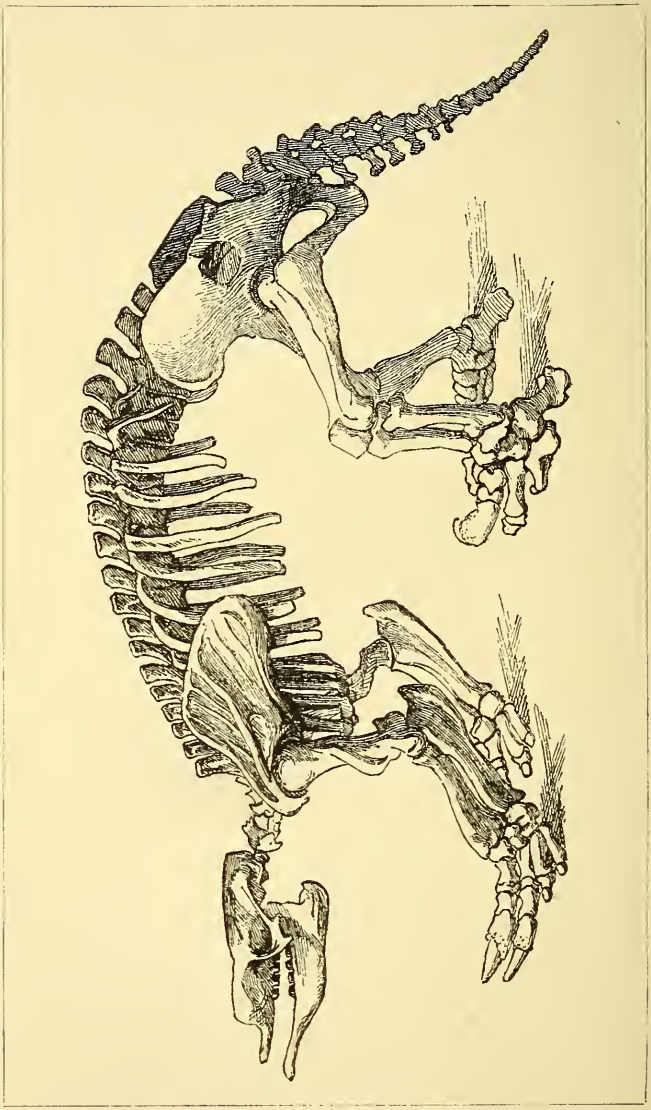


FIG. 84.—Restored skeleton of *Scelidotherium leptocephalum* (Owen): from the Pleistocene deposits of the Argentine Republic, South America (greatly reduced)—partly from Capellini.
(The separate bones used in this restoration are in Wall-case, No. 26.)

In addition to the series of gigantic Ground-Sloths, we may notice the several genera of extinct gigantic Armadillos, also from the Pleistocene deposits of South America.

Wall-case, No. 26.
Table-case, No. 15a.
Glass-case Q.

These large extinct genera differed from the living species of Armadillos in having their coat of mail composed of a single piece, not divided up into a series of bands or segments, by means of which the living forms are enabled, when attacked, to contract the body into the form of a ball. In most of the extinct species the carapace is composed of polygonal or quadrangular bony scutes, closely united by their sutures into a solid buckler, and the caudal portion is enclosed in a complete bony tail-sheath. The top of the head is also protected by tessellated dermal plates of bone.

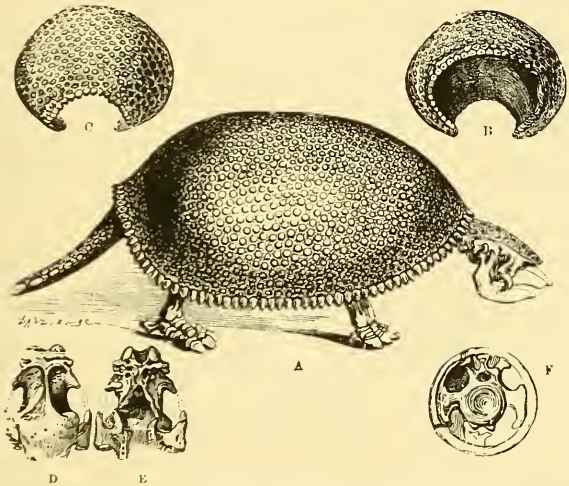


Fig. 85.—Extinct Gigantic Armadillo, *Glyptodon clavipes* (Owen), from the Pleistocene deposits of Buenos Ayres, South America (much reduced).

A, View of entire animal. B, Front end of carapace. C, Back view of same. D and E, Upper and under side of skull. F, Section of tail showing caudal vertebræ inside the bony sheath.

(The caudal sheath represented in this figure probably belongs to *Hoplophorus*.)

The cheek-teeth are sixteen in number, four above and four below on each side, incisors not being developed; they have two deep grooves on either side dividing them into three nearly distinct lobes. The facial portion of the skull is extremely short, and the zygoma has a long descending maxillary process just beneath the eye.

The vertebral column beneath the carapace is almost entirely anchylosed into a long tube, and is confluent with the under surface of the dermal armour, to which the ribs are also united.

Glyptodon. There is a complete joint at the base of the neck, the seven vertebræ of which remain free and moveable; and in the tail all the vertebræ are anchylosed together except the four immediately behind the sacrum.

Several genera and numerous species have been determined, the latter being distinguished principally by the variations in the ornamentation and form of the tesseræ of the carapace and the tail-sheath.

The typical genus is *Glyptodon* (sculptured-tooth), so named by Sir Richard Owen in reference to the sculptured aspect of the grinding surface of the teeth.

Glass-case Q. Glyptodon. In Glass-case (Q), near the centre window at the east end of the Pavilion, is placed the reproduction of the complete skeleton, together with the body-armour of an extinct gigantic Armadillo from South America, named *Glyptodon*, the separate bones and portions of the armour of which are also exhibited in the adjacent wall-case. The casts of the different portions of the skeleton and its carapace are not taken from the same individual, nor probably even from the same species of *Glyptodon*, but are placed together in order to convey a better idea of the great size and general form of these extinct Armadillos.

Wall-case, No. 26.

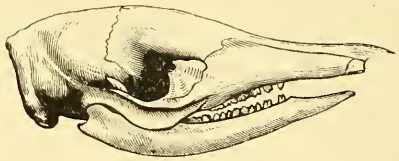


Fig. 86.—Lateral view of the skull of the living Armadillo, from South America.

The restored carapace and skeleton of *Glyptodon* measures from the snout to the end of the armour-plated tail, following the curve of the back, 11 feet 6 inches, the tessellated body-shield being 7 feet in length and 9 feet across, following the curve at the middle of the back.

As already remarked these large extinct species differed from the modern Armadillos in having no bands, or joints, in their coat of mail. The six-banded Armadillo is less than a foot in length, but the great *Glyptodon* was so ponderous and bulky that it could not be overturned, and it only needed to draw up its legs close to its body, so as to rest its carapace on the ground, and bend its armour-plated head down in front, to be perfectly protected on all sides from the attack of any enemy. An example of the skeleton of the small living species

of Armadillo is placed in the case beside the gigantic extinct form for comparison. **Glyptodon. Glass-case, Q.**

The banded and jointed Armadillo is represented by the extinct genus *Chlamydotherium*, detached plates of the carapace and bones of which have been found in abundance in the caves of Minas Geraes, Brazil. It is supposed to be allied to the little living "Mole Armadillo," *Chlamydophorus*. **Wall-case, No. 26.**

A nearly entire carapace and tail sheath, partly restored, of *Hoplophorus*, an allied but smaller genus of extinct Armadillos, is exhibited in Wall-case 26. **Table-case, No. 15a.**

Several very perfect tail-sheaths, showing different patterns of ornamentation, and referable to different genera of giant Armadillos, are exhibited in the Wall-case and in Glass-case Q.

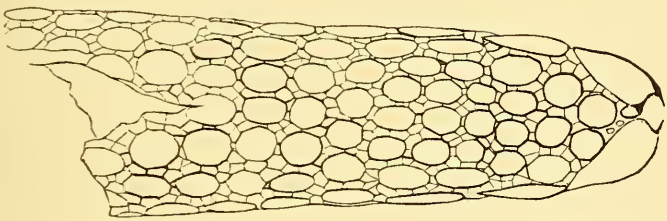


Fig. 87.—Portion of the Tail-sheath of *Hoplophorus* from the Pleistocene of South America. $\frac{1}{2}$ natural size.

Judging by the numbers of remains of these large extinct Edentata which have been collected from time to time, we have evidence, not only of their great abundance and wide geographical distribution in the tropical and subtropical wooded regions of America, but also of the vast numbers of these huge animals which must have perished in floods from their having been unable to climb into trees to escape destruction, after the manner of their modern representatives, the Tree-sloths and Ant-eaters.

Most of these remains have been obtained from the Pleistocene deposits in the Argentine Republic; but similar relics have also been procured from Patagonia, Brazil, Uruguay, Chili, and Bolivia, all in South America, and from nine different States in the United States of North America.

The Edentata, although so largely represented in America, are not strictly confined to that region, but are represented in South Africa by the "Cape Ant-eater" (the "Aard-Vark" of the Dutch settlers), the "Pangolins" or Scaly Ant-eaters belonging to the genus *Manis*, which have a very wide range over the greater part of Africa, and in India from the Himalayas to Ceylon, Sumatra, Java, Southern China, Amoy, Hainan, and Formosa. Remains of the Cape Ant-eater, *Orycteropus* (Fig. 88),

have been discovered in the Older Pliocene deposits of the Island of Samos, Asia Minor, and of Maragha, Persia.

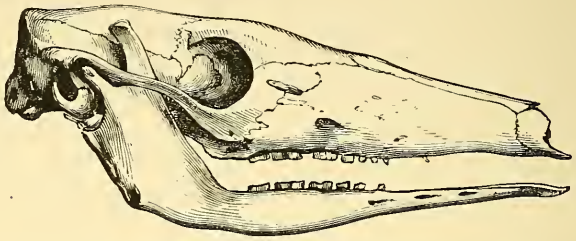


Fig. 88.—Lateral view of the skull of the living Cape Ant-eater, *Orycteropus capensis* (Gm.); South Africa (reduced).

Such a wide geographical distribution naturally implies a correspondingly great antiquity in geological time for this singular group, which must have witnessed most marked changes in the configuration of the ancient continents, on parts of which its modern descendants now find themselves so widely separated geographically.

Sub-class II.—**Didelphia.**

Order X.—MARSUPIALIA. (Kangaroo, Wombat, &c.)

Wall-case, No. 27.
Table-cases, Nos. 14, 14a, and 15.

Just as the South American Continent had, in past ages, its peculiar group of colossal Edentata, represented at the present day by the Ant-eater, the Armadillo and Tree-Sloth, so the great Island-Continent of Australia had formerly its peculiar indigenous fauna of huge Marsupialia, represented by the existing Kangaroos, Wombats, and Phalangers.

The Marsupialia or "pouched animals" comprise a curious series of mammals, offering at the present day considerable variety in form, but all characterized (with the single exception of *Thylacinus*,* the "Tasmanian wolf") by possessing a pair of long, slender, "epipubic" bones attached to the anterior edge of the pelvis, commonly called "marsupial bones," but bearing no special relation to the external pouch or *marsupium*,† and present alike in both sexes. The young in this order are brought

* In *Thylacinus* the epipubic bones are cartilaginous only.
† There is no pouch or marsupium in some of the Opossums.

forth in a blind and very imperfect condition; and, in those forms in which that organ is present, are then placed by the parent within a fold of the integument, which forms the "pouch" or *marsupium*, whence the order derives its name. Within this pouch the mammary glands are situated, and to the prominent nipple the young one at once becomes firmly attached and remains so for some time after birth. In other cases, as among some Opossums, the young are carried on the back of the mother, on which they are supported by twisting their tails round that of the mother. The posterior angle of the lower jaw is generally bent inwards (*see* Fig. 89, showing inflexion). There are

Marsupialia.
Wall-case, No. 27.
Table-cases, Nos. 14, 14a, 15.

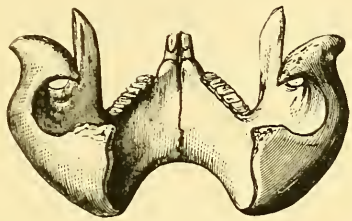


Fig. 89.—Posterior view of the lower jaw of the Wombat, *Phascolomys*.

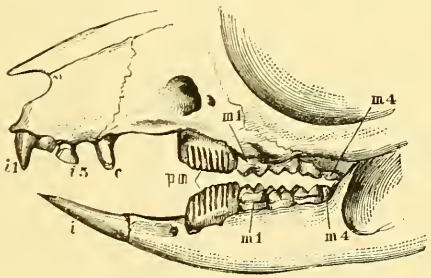


Fig. 90.—Dentition of *Hypsiprymnus*. *i* 1 to 3, three upper incisors; *i*, lower incisor; *c*, canine; *pm*, last upper and lower premolar; *m* 1 to 4, upper and lower molars.

always true teeth implanted in the usual manner in both jaws, and divisible into incisors, canines, premolars, and molars, but they vary much in the different families (*see* Figs. 90 and 93).

There is no vertical displacement and succession of the teeth, except in the case of a single tooth on either side of each jaw, which is always the hindmost of the premolar series, and is preceded by a tooth having the character of a true molar; this is the only one comparable to the milk-teeth of the higher mammalia; all the other teeth remain unchanged.

The Marsupials are primarily divisible into two great sections the first being provided with numerous small incisors and well-developed canines (known as the Polyprotodont* division), con-

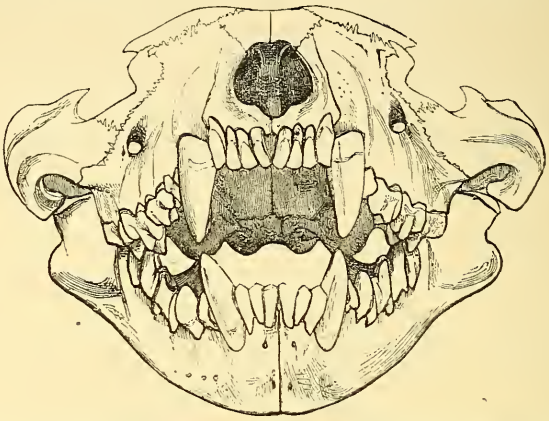


Fig. 91.—Front view of skull of recent *Dasyurus ursinus* (Harr.); showing the polyprotodont and carnivorous type of dentition.

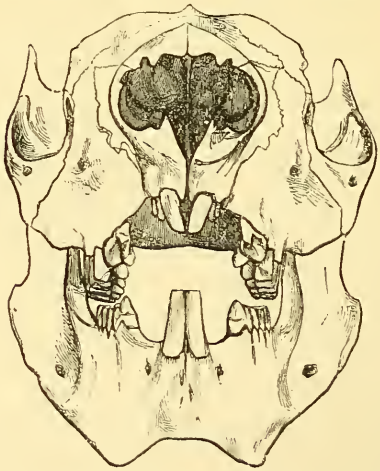


Fig. 92.—Front view of skull of recent Koala, *Phascolarctos cinereus* (Goldf.), showing diprotodont and herbivorous type of dentition.

taining the carnivorous group of Marsupials, such as the Opossums, Dasyures, Thylacines, and Bandicoots; in the second (known as

* From πολύς, πρῶτος, and ὀδούς, "with many front teeth."

the Diprotodont* division), comprising the vegetable feeders, as the Kangaroos, Phalangers, and Wombats, the central incisors are very prominent, and are the only ones in the lower jaw, while in the upper jaw the lateral incisors and canines are very subordinate in function, and may be absent.

Wall-case, No. 27.

Table-cases, Nos. 14, 15, and 15a.

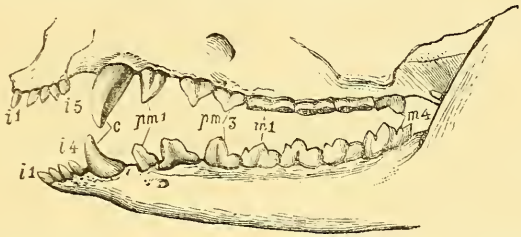


Fig. 93.—Teeth of the Opossum (*Didelphys*), N. America (recent). (*i* 1–5 upper, and *i* 1–4 lower incisors; *c*, canines, *pm* 1–3, premolars; *m* 1–*m* 4, molars.)

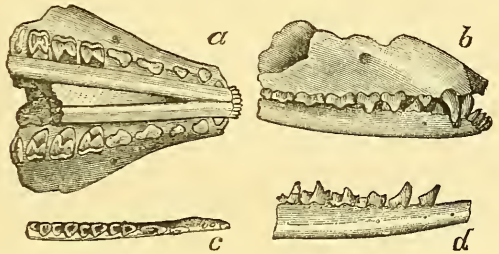


Fig. 94.—Remains of *Didelphys* (*Peratherium*) *fugax* (Cope), from the White River (Miocene) Beds, Colorado, N. America. *a*, inferior, *b*, lateral view of skull; *c*, superior, and *d*, lateral view of right ramus of mandible.
Twice natural size.

Fig. 95.—Inner view of left ramus of mandible of *Dromatherium sylvestre* (Emmons); from the Trias of North Carolina. Twice natural size.

As typical representatives at the present day of the Polyprotodont (carnivorous) division we may mention the *Didelphiidæ* or true Opossums, which differ from all other Marsupials in the fact that they are found living on the American Continent, whereas the great home and centre of the Marsupialia is Australia. They are mostly carnivorous or insectivorous in their diet, and

Table-case, No. 14a.

* From δι = δις, πρῶτος, and ὀδούς, "with two front teeth."

Table-case, No. 14a.

arboreal in their habits. Eight existing species are represented in the collection, chiefly by detached jaws from the bone-breccias of the caverns of Minas Geraes, Brazil, etc. Professor Cope has described a species, *Didelphys fugax*, from the Miocene of Colorado, under the name of *Peratherium*. Several extinct species

Fig. 96.—Lower Jaw and Teeth of *Amphilestes Broderipi* (Owen), (twice natural size), Great Oolite, Stonesfield, Oxfordshire.

(Natural Size.)

Fig. 97.—Lower Jaw and Teeth of *Phascolotherium Bucklandi* (Broderip, sp.) from the Great Oolite, Stonesfield, Oxfordshire.

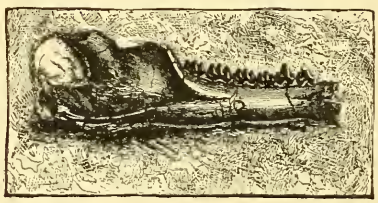


Fig. 98.—Lower Jaw and Teeth of *Triconodon mordax* (Owen), natural size. Middle Purbeck Beds, Dorset.

are represented from the Lower Miocene, the Oligocene, and the Upper Eocene of France, and one from the Upper Eocene of Hordwell, Hampshire. The genus *Chironectes* is also represented from Minas Geraes, Brazil, by remains of the living species. To the Polyprotodont type of Marsupialia may also be referred

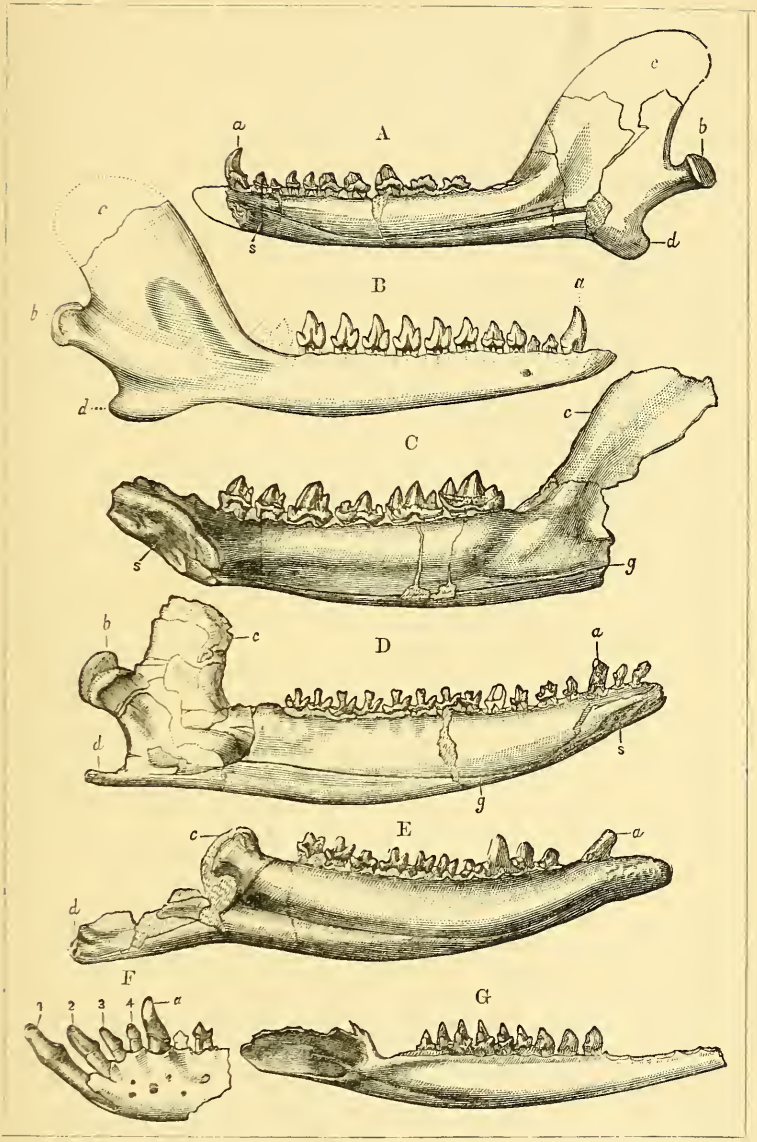


FIG. 99.—AMERICAN JURASSIC MAMMALS (DRYOLESTIDÆ, AMPHITHERIIDÆ, AND SPALACOTHERIIDÆ). Wyoming Territory, North America.

A. *Docodon striatus* (Marsh). B. *Diplocynodon victor* (Marsh). C. *Priacodon ferox* (Marsh). D. *Dryolestes priscus* (Marsh). E. *Dryolestes vorax* (Marsh). F. *Asthenodon segnis* (Marsh). G. *Laodon venustus* (Marsh).

(For explanation of italic letters to figures, see page 87.)

Table-case, No. 14a.

the remains of *Dromatherium sylvestre*, one of the earliest known mammals, from the Trias of North Carolina, and *Microconodon* from the same deposit; also *Phascolotherium*, *Amphilestes*, and *Amphitherium*, from the Lower Jurassic of Stonesfield; *Triconodon* and *Amblotherium* from the Upper Jurassic of Purbeck; *Priacodon* and *Dryolestes* from the Upper Jurassic of North America. These were all very small animals, and their remains are chiefly confined to detached teeth and rami of mandibles.

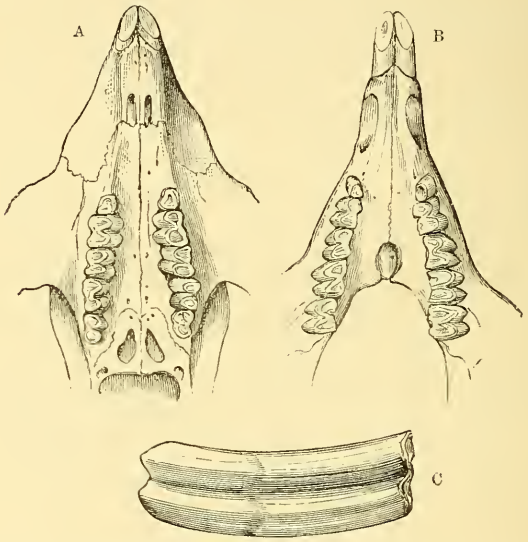


Fig. 100.—Dentition of Wombat, *Phascolomys*.
A. Palatal view of skull. B. View of grinding surface of teeth of lower jaw.
C. Side-view of a single molar tooth detached.

Table-case, No. 14.

But the greatest development of the Marsupialia at the present day, as well as in Tertiary times, is to be found on the continent of Australia. The carnivorous genera *Thylacinus*, *Sarcophilus*, and *Dasyurus*, are all represented in the collection by remains from the caves of Queensland and the alluvial deposits of New South Wales.

Of the Diprotodont type no fewer than ten species of Wombats (*Phascolomys*) are known and described by their fossil remains. They varied in size from that of the existing species up to *Phascolonus gigas*, which was equal in size to a Tapir, but of much stouter build. Only three small species are now living; they are of burrowing habits and are confined to the continent of Australia and to Tasmania. Intermediate between these great

Wombats and the far greater form of *Diprotodon* is *Nototherium*, which may have been as big as a horse in size, but bulkier and shorter, with three incisors above on each side, whereas in the Wombats there is only one.

Wall-case, No. 27.
Table-case, No. 15.

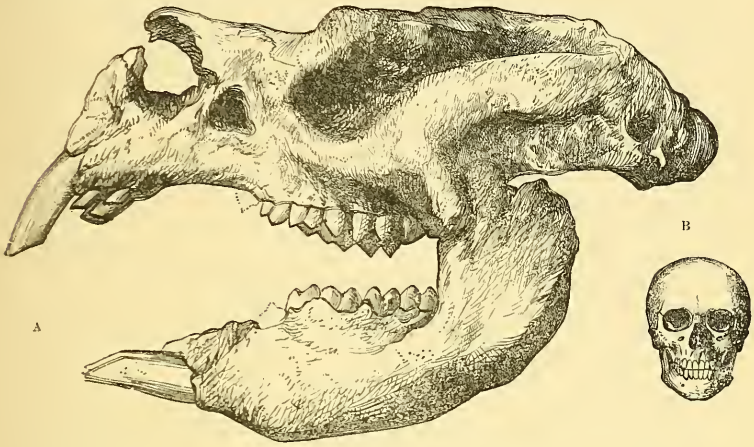


Fig. 101.—(A.) Skull and lower jaw of a gigantic extinct Marsupial, *Diprotodon australis* (Owen), from the Newer Tertiary Deposits, Australia. (B.) A human skull placed beside it to show comparative size. (Wall-case, No. 21.)

In *Diprotodon* the dentition is the same as in *Nototherium*. This huge animal had a skull measuring nearly three feet in length, and it probably exceeded the *Rhinoceros* in bulk.

Diprotodon.
Wall-case, No. 27.

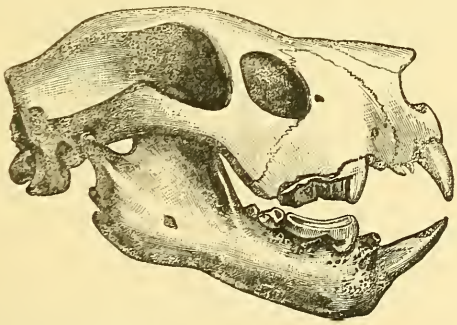


Fig. 102.—Skull and lower jaw of *Thylacoleo carnifex* (Owen), from the Pleistocene of Australia. $\frac{1}{5}$ natural size.

In the Table-case are numerous remains of a very remarkable extinct genus of Diprotodont Marsupial, named by Professor Sir Richard Owen *Thylacoleo carnifex*, and supposed by him to

Table-cases, No. 4.

Table-case, No. 14.

have been a true carnivore (Fig. 102). This singular phalanger-like animal has the pair of large and characteristic middle incisors seen in front, and two additional minute incisors in the upper jaw, a minute canine above, but none below, three premolars above and below on each side, and one small molar above and two below. The last premolar is of enormous size, both above and below, compressed laterally and trenchant. But in all known Carnivorous (Polyprotodont) Marsupials the same general plan of dentition is maintained as in the placental

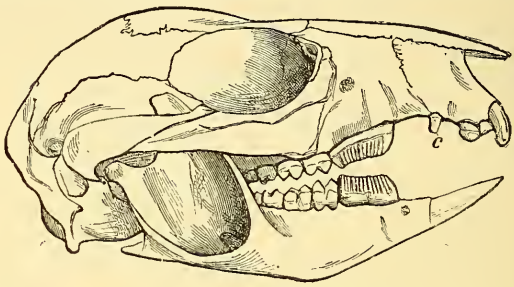


FIG. 103.—Skull and lower jaw of *Bettongia* (*Hypsiprymnus*) *Grayi* (Gould), living in Australia.
c, is the upper canine tooth, immediately behind which the large sectorial premolar is seen opposed to a similar tooth in the lower jaw.

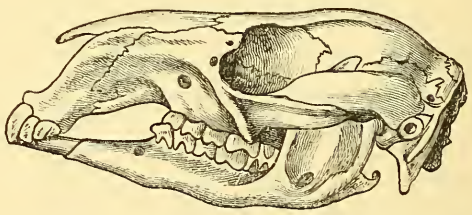


FIG. 104.—Lateral view of skull of the living kangaroo, *Macropus Bennettii*, (Waterhouse), Australia.

Carnivora, *i.e.*, the incisors are small, the canines are large and well-formed for tearing flesh, and the molars have sharp tubercles, whereas in *Thylacoleo* the two central incisors above and below are large and placed close together, as in the Phalangers; the other incisors are minute, and so also are the canines.

The great sectorial premolar in *Thylacoleo* has its exact parallel in the corresponding premolar tooth in the rat-kangaroo, *Hypsiprymnus* or *Bettongia* (Fig 103), which is enormously large and long, exceeding in lateral length the two anterior molars combined, with from 11 to 13 external grooves. The upper canine is also present, though small. This rat-kangaroo thus clearly

explains the origin of the large last premolar in *Thylacoleo* as being not so much a carnivorous as it is a Marsupial Diprotodont character, merely exaggerated.* Table-case, No. 14.

Of the *Macropodidæ*, found fossil in Australia, the following species are preserved in the collection, viz.:—

Æpyprymnus rufescens. *Macropus*, many species, of which the names *titan*, *altus*, *anak*, are intended to convey Sir Richard Owen's idea of the great size which some of these old kangaroos attained. They were all herbivorous, subsisting on grass and roots.

Most of the remarkable series of remains from Australia were obtained from caves, or from lacustrine and river deposits on Darling Downs, Queensland, associated with estuarine shells of the genus *Melania*, and from the Wellington Caves, New South Wales. Marsupialia.

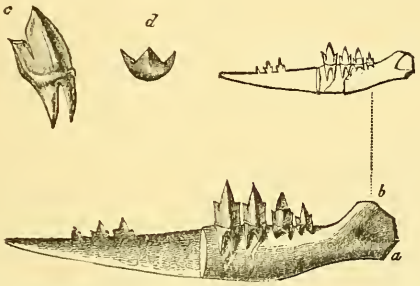


Fig. 105.—Imperfect left ramus of mandible of *Spalacotherium tricuspidens* (Owen), the outline figure is of the nat. size. *c*, *d*, lateral and upper views of a molar tooth. From the Middle Purbeck, Swanage, Dorset. Table-case, No. 14a.

In the Great Oolite of Stonesfield, near Oxford, the jaws of several small mammals were discovered and named *Amphitherium*, *Phascolotherium*, and *Stereognathus*. Mr. S. H. Beckles, F.R.S., subsequently obtained a series of Mammalian remains from the Freshwater Limestone of Purbeck, Dorset, mostly consisting of lower jaws. According to Owen they belong to some fourteen genera, the largest of which did not exceed in size a rat or a mouse. The genus *Spalacotherium* belongs to a small group of Mammals whose affinities are at present uncertain. Phascolotherium, etc Great Oolite. Purbeck Mammals.

Group Multituberculata.†

The Multituberculata include a number of small animals in which the molars bear numerous tubercles, which in the Table-case, No. 14a.

* *See* Prof. Flower "On the affinities of *Thylacoleo carnifex* (Owen)," "Quart. Journ." Geol. Soc., 1868, vol. xxiv., p. 307, and article "Mammalia" (Marsupialia) "Encyclopedia Britannica," 9th ed., vol. xv., pp. 378-383.

† These forms are now considered as distinct from the true Diprotodont type, and are probably referable to the Prototheria or Ornithodelphia.

upper teeth are usually arranged in three rows, in the lower in two. Many of the earliest known mammals belong to this group, but it is doubtful whether some forms from the Trias that have been referred to it may not really be reptiles. For

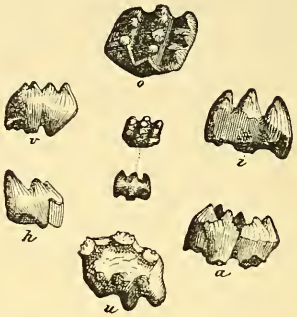


Fig. 106—An upper true molar of *Tritylodon Fraasii* (Lydekker), from the Upper Trias of Strasburg. The two central figures are of the natural size; the others are enlarged three times. *o*, crown surface: *u*, basal surface; *v*, *h*, the two lateral surfaces *i*, *a*, anterior and posterior surfaces.

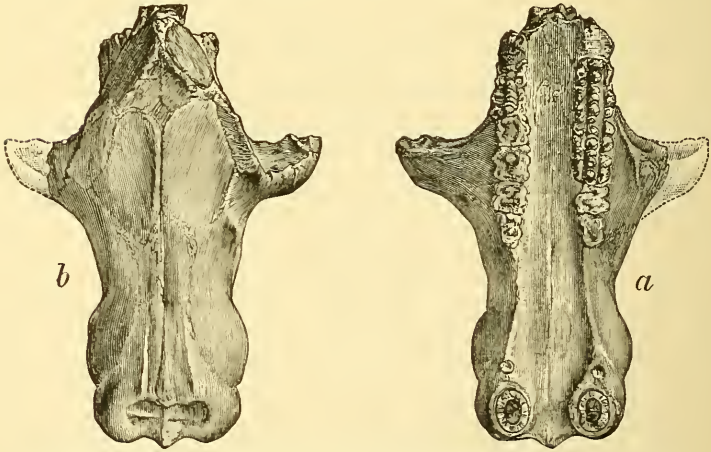


Fig. 107.—Cranium of *Tritylodon longævus* (Owen), Trias, Basutoland, South Africa. *a*=palatal view of skull, showing the dentition; *b*=view of the upper surface of the skull, ⅔ nat. size. (*See* Table-case, No. 14a.)

Tritylodon. instance *Tritylodon longævus*, a skull of which was discovered in Basuto-land in 1884, was referred by Owen to the mammalia, but Seeley has lately shown that it is probably

Microlestes. closely related to the Theriodont reptiles. As to *Microlestes antiquus* from the Trias of Stuttgart in Germany, and *Microlestes Moorei* discovered by the late Mr. C. Moore in the Rhætic beds of Frome, Somerset, they are known only

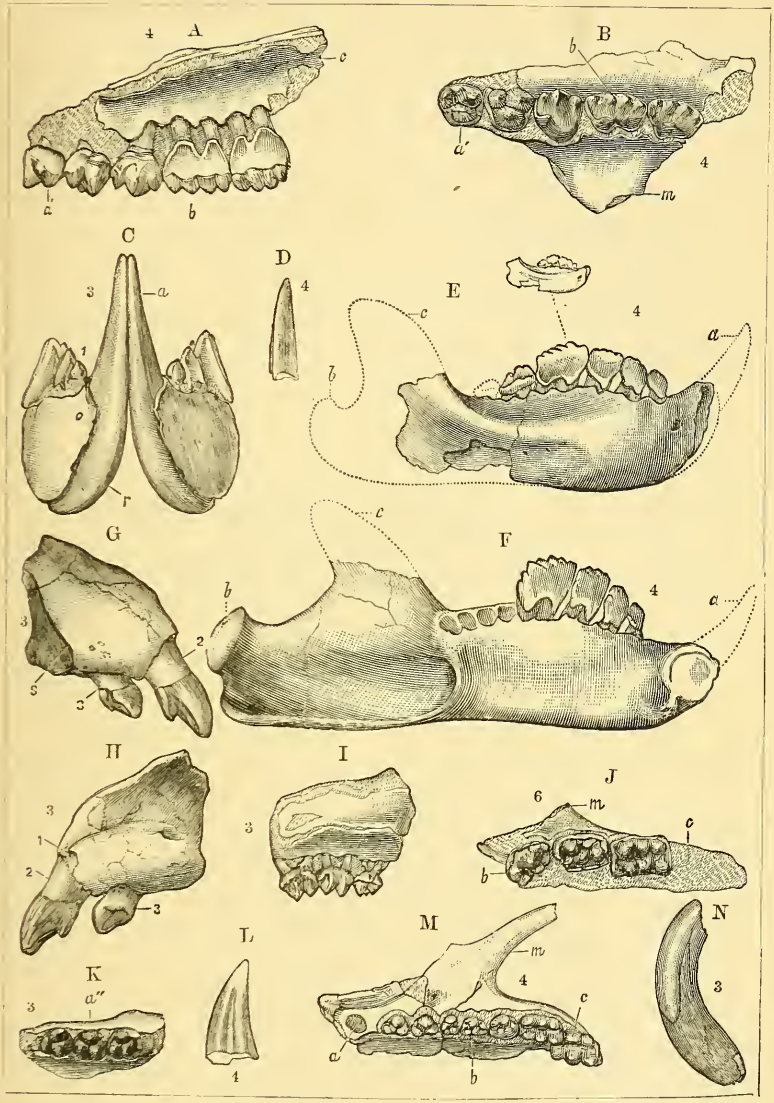


FIG. 108.—AMERICAN JURASSIC MAMMALS—PLAGIAULACIDÆ; WYOMING TERRITORY, NORTH AMERICA.

A. Right upper jaw of *Ctenacodon potens* (Marsh), inner view. B. Palatal aspect of upper jaw of *C. potens* (Marsh). C. *Ctenacodon potens* (Marsh), front view. D. An incisor tooth. E. Right ramus of lower jaw of *Ctenacodon serratus* (Marsh), outer view. F. Left ramus of lower jaw of *Ctenacodon serratus* (Marsh), inner view. G. Outer aspect right premaxillary of *Allodon fortis* (Marsh) and H. Inner view of same. I. Portion of upper jaw of *A. fortis* (Marsh). J. Left upper jaw of *A. laticeps* (Marsh), palatal aspect of cheek-teeth. K. Palatal aspect of left upper jaw of *A. fortis* (Marsh). L. An incisor tooth (*Ctenacodon*). M. Left upper jaw of *A. laticeps* (Marsh). N. Lower incisor of *A fortis* (Marsh).

(For explanation of italic letters to figures, *see* p. 87.)

Table-case, No. 14a.

from their teeth, so that their systematic position is at best uncertain.

To these discoveries must now be added a series of Upper Jurassic mammalia from the "Atlantosaurus Beds," Wyoming Territory, United States; and of Cretaceous mammals from the Laramie formation, Dakota and Wyoming, North America, both discovered by Prof. O. C. Marsh, and in many cases closely related, if not identical, with genera previously known and described from this country.

With the exception of those placed in the Polyprotodont division of the Marsupialia (*see* p. 76), these small mammals are all provisionally arranged in the group of *Multituberculata*. In the *Tritylodontidæ* the upper true molars (of which there are four) are ridged longitudinally.

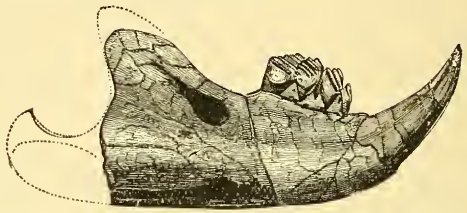


Fig. 109.—Lower Jaw and Teeth of *Plagiaulax Becklesi* (Falconer), twice natural size, Middle Purbeck Beds, Dorset.

Of the *Bolodontidæ* several species have been found in the Purbeck of England and Upper Jurassic of N. America, and recently an incisor apparently of a species of *Bolodon* has been discovered in the Wealden of Sussex.

In the *Plagiaulacidæ* the premolars in the mandible vary in number from one to four, have a cutting edge, and are marked by a series of oblique lateral grooves, while the true molars are small, and usually reduced to two in number. Probably they all had two lower incisors and two functional upper ones.

Fig. 110.—Upper true molar of *Neoplagiaulax eocenus* (Lemoine). Lower Eocene, Rheims, France.

Plagiaulax occurs in the Purbeck Beds of Swanage and probably in the Wealden of Hastings. It is represented by *Ctenacodon* in the U. Jurassic and by *Halodon* in the Cretaceous of Wyoming, by *Ptilodus* from the Puerco Eocene of New Mexico, North America; and by *Neoplagiaulax* from the Lower Eocene of Rheims.

These small mammals are arranged in the Table-case with others from the Tertiaries of France and from the caves of Brazil, &c. Drawings of many of the recently-discovered American forms have also been added to this case. **Table-case, No. 14a.**

Sub-class III.—Prototheria or Ornithodelphia.

Order XI.—MONOTREMATA.

Remains of *Echidna* were met with in a fossil state in 1867 by Mr. Gerard Krefft; more recently, in 1883, Mr. E. P. Ramsay, F.L.S., Curator of the Australian Museum, Sydney, discovered the fossil humerus and three other bones of an exceedingly large *Echidna* (*E. Ramsayi*, Owen) in the breccia of the Wellington Caves, New South Wales, and sent to Prof. Sir Richard Owen plaster casts of the same for description. These are exhibited in Table-case, No. 14a. **Table-case, No. 14a. Echidna.**

The Multituberculata (see p. 83) may belong to this sub-class.

[Note, explanatory of small *italic letters* attached to figures of American Jurassic Mammals, given on pp. 79 and 85, Figs. 99 and 108.

Fig. 99, p. 79, *a*, canine tooth; *b*, condyle; *c*, coronoid process; *d*, angle; *g*, mylohyoid groove; *s*, symphysial surface.

Fig. 108, p. 85, 1, 2, 3, the incisors; *a'*, first premolar; *a''*, second premolar; *b*, fourth premolar; *b'*, third premolar; *c*, second true molar; *m*, malar arch; *s*, suture with maxillary. In the *lower jaws*, *a*, incisor; *b*, condyle; *c*, coronoid process; *r*, root of incisor.]

Fig. 111.—The Longtailed Fossil Bird, *Archæopteryx macrura* (Owen), from the Lithographic Stone. Upper Jurassic, Eichstädt, Bavaria. About one-fourth natural size.
(*See* Table case, No. 13, in the Pavilion.)
For explanation of letters to bones, *see* note on p. 97.

Class 2.—AVES (Birds).

"Birds," says Professor Huxley, "are animals so similar to Reptilia in all the most essential features of their organisation, that they may be said to be merely an extremely modified and aberrant Reptilian type. Their differentiation is, however, so great as to indicate without doubt their rights to form a distinct class."

Pavilion, Table-case No. 13.

It has generally been considered that the most ancient type of birds known is that of the great wingless running birds, such as the Ostrich, Rhea, Emeu, Cassowary, and Apteryx, and no doubt these may have had a very high antiquity, but the oldest fossil bird at present discovered is the *Archæopteryx macrura* of Owen (*see* Fig. 112). This remarkable long-tailed bird was obtained from the lithographic stone* of Eichstädt, near Solenhofen, in

Oldest Bird known.

The Archæopteryx.

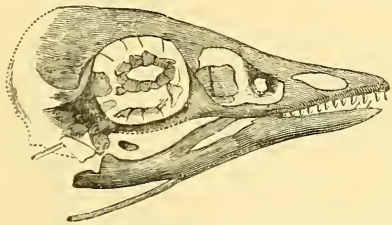


Fig. 112.—Head of the Berlin *Archæopteryx* (nat. size), after Dames.

Bavaria. The stone is so fine-grained that besides the bones of the wings, the furculum, or "merry thought," the pelvis, the legs and the tail, we have actually casts or impressions on the stone (made when it was as yet only soft mud) of all the feathers of the wings and of the tail. The leg-bone and foot are similar to that of a modern perching bird, but the tail is elongated like that of a rat, or of a lizard, with a pair of feathers springing from each joint, a character not to be found in any living bird. More recently another example has been obtained from the same locality, in which the head is very well preserved; this specimen is in the Berlin Museum. A photograph and an engraving of the Berlin specimen are exhibited near the window. Further examination

The Berlin Archæopteryx.

* The equivalent in age of the Kimmeridge clay of England. (See table of strata.)

Table-case, No. 13.

of this newer specimen shows that the jaws were armed with teeth, of which fourteen may be seen in the figure of the head. The teeth appear to have been implanted in distinct sockets, and were smooth, pointed, and coated with enamel (*see* Woodcut, Fig. 111, p. 89).

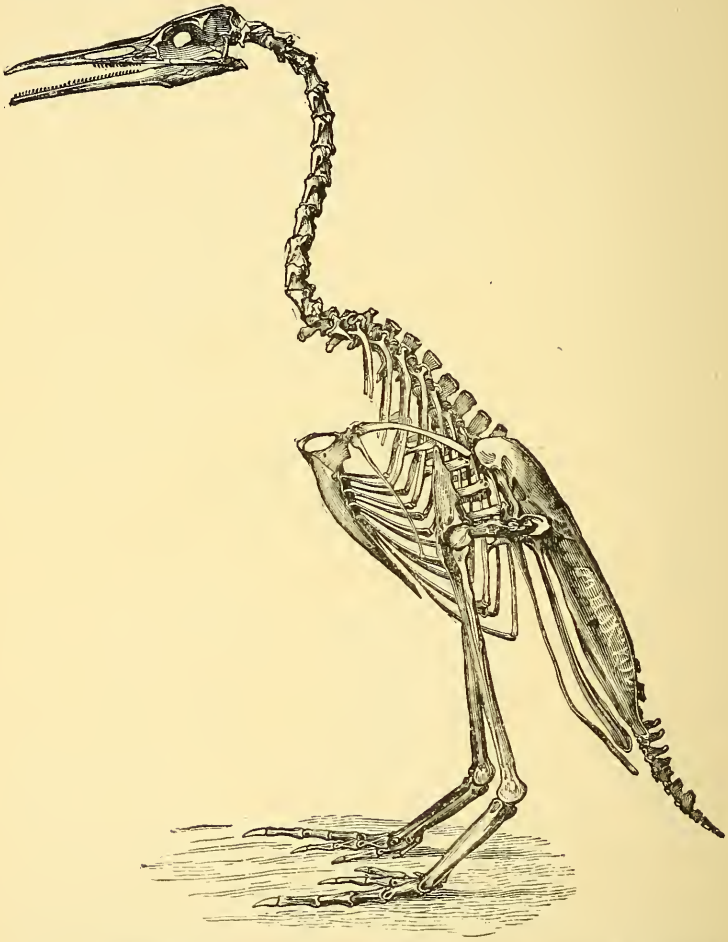


Fig. 113.—Skeleton of *Hesperornis regalis* (Marsh) restored; about one-tenth natural size. (From the Cretaceous of Kansas, N. America.)

Hesperornis.

Here are also exhibited twenty-six casts of bones of *Hesperornis regalis*, a large toothed bird, measuring nearly six feet from the extremity of the bill to the end of the toes. In habit it resembled

the Loons and Grebes of the present day, but was incapable of flight, and only the humerus, or upperbone of the wing, remains in a rudimentary condition. Its legs and feet were very powerful and admirably adapted for swimming. The teeth of *Hesperornis* were numerous and implanted in grooves, but the

Table-case, No. 13.

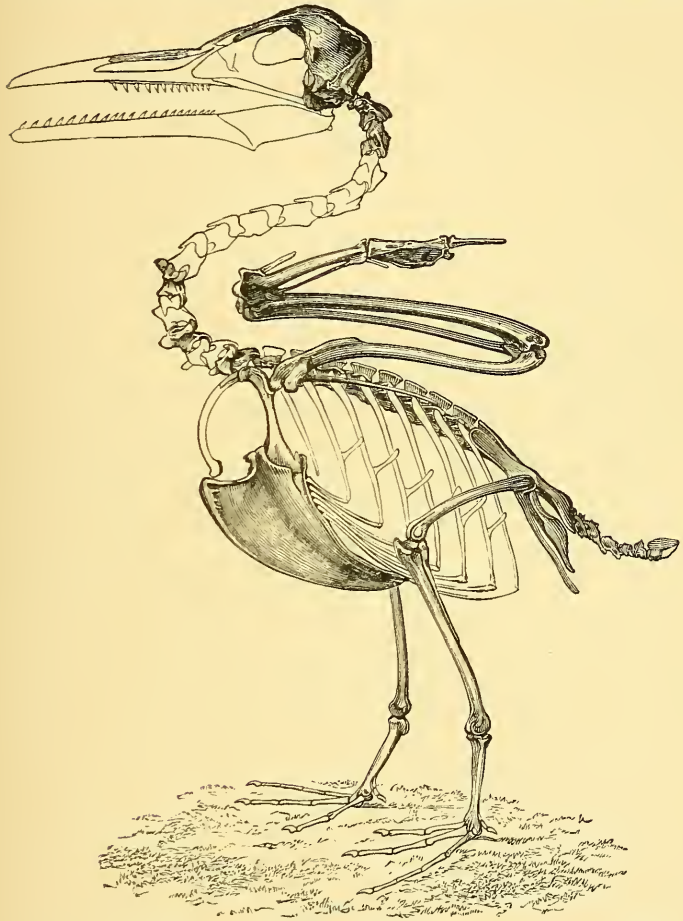


Fig. 114.—Restored skeleton of *Ichthyornis victor* (Marsh), from the Cretaceous beds of Kansas, N. America (from specimens in the Yale College Museum).

extremity of the bill seems to have been protected by a horny sheath, as in recent birds. These bird-remains were discovered in the Middle Cretaceous beds of Kansas, U.S., N. America, by

Table-case, No. 13.

Professor O. C. Marsh, F.G.S., to whom we are indebted for the series of casts. An engraving of the entire skeleton is placed near this case on the right hand side of the window. The originals are preserved in Yale College Museum, New Haven, Connecticut, United States (*see* Fig. 113).

Along with this remarkable form of toothed wingless bird, the *Hesperornis*, there has been found another, named by Marsh, *Ichthyornis* (Fig. 114), which had well-developed powerful wings and a strongly keeled sternum. Its jaws were armed with teeth, placed in distinct sockets, and its vertebræ, unlike those of other birds, were biconcave, as is the case in a few recent and in many extinct reptiles. This character alone unmistakably indicates a great antiquity for the Class of Birds.

The next oldest birds whose remains are preserved in this case are from the London Clay of the Isle of Sheppey (Lower Eocene).

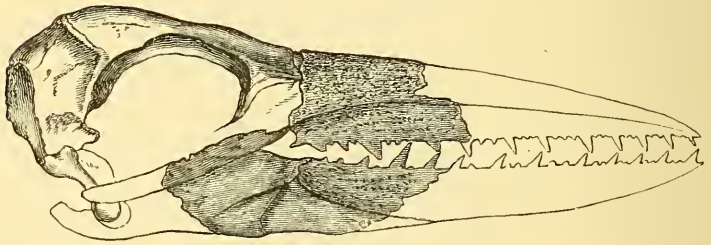


Fig. 115.—Skull of *Odontopteryx toliapicus* (Owen), a bird from the London Clay of Sheppey with serrated mandibles; probably a fish-eating bird, like the Merganser.

Dasornis, Argillornis, etc.

One of these, *Dasornis londiniensis*, represented by a single imperfect skull, was as large as an ostrich. Another (*Argillornis longipennis*) rivalled the albatross in size. A third (*Odontopteryx toliapicus*) had a powerfully serrated bill, well adapted for seizing its fishy prey (*see* Fig. 115). There are also remains of a Vulture (*Lithornis vulturinus*), and of *Halcyornis toliapicus*, a little bird, probably allied to the kingfisher.

Gastornis.

Here are placed the casts of the femur and tibia of *Gastornis parisiensis*, from the Lower Eocene of Mendon, near Paris; also casts of two leg-bones of another equally large bird allied to the above, discovered in the Lower Eocene (Woolwich Beds), Park Hill, near Croydon, and described by Mr. E. T. Newton* under the name of *Gastornis Klaasseni*. They indicate a genus of birds as large as an ostrich, but more robust and with affinities to the Anserine type.

Gastornis Klaasseni.

* "Trans. Zool. Soc.," vol. xii., p. 143, pls. xxviii., xxix. (1886).

In the same case also are the remains of other Eocene birds, including *Palæortyx Blanchardi* from the Eocene of Montmartre, Paris, and other species of the same genus from the later phosphorite deposits of Caylux, France, where also the peculiar genus *Ægialornis* occurs. Table-case, No. 13.

The remains of birds are rather more numerous in the Miocene and Newer Tertiary deposits, though seldom abundant. Perhaps the most interesting are the bones of an Ostrich (*Struthio asiaticus*), found in the Older Pliocene sandstone of the Siwalik Hills, India, showing the once far wider geographical range of this great running bird. The same deposit has yielded remains of a huge Crane, *Leptoptilus (Argala) Falconeri*. Here are also remains of the Pelican from Steinheim, in Bavaria; of a large bird of the duck family (*Anas oeningensis*), from the Miocene freshwater limestone of Oeningen, Switzerland, also impressions of feathers from Oeningen and from the Brown Coal of Bonn, on the Rhine. A very large number of bird bones are obtained from the Miocene deposits of various parts of France: from Allier there are remains of *Palælodus* and *Phœnicopterus*, both flamingo-like birds, numerous gulls, plovers, a species of Ibis, and some ducks. From La Grive-St.-Alban come a large pheasant, numerous owls and many other forms. **The Ostrich in India.** **Carinate birds.**

Here also are exhibited bird remains from various caverns and superficial deposits.

In the Wall-case between the windows at the south-east corner of the pavilion are placed numerous bones of *Æpyornis*, the extinct gigantic bird of Madagascar. Several species are represented in the collection, the largest being *Æ. titan*, which possessed extraordinarily massive legs. Specimens of the eggs of these birds are placed in case RR. The largest measures three feet in its longest circumference and two feet six inches in girth, and its liquid contents equal a little more than two gallons. These eggs are much larger than those of Dinornis, examples of which are exhibited in Table-case 12. **Wall-case, No. 25.**

In Wall-case 25 also are placed casts of the limb-bones of the great extinct bird, *Brontornis*, from the middle Tertiary beds of Patagonia, South America. In the lower portion of the same case are exhibited numerous bones of the Dodo (*Didus*) and the Solitaire (*Pezophaps*), large extinct flightless pigeons from the islands of Mauritius and Rodriguez respectively.

In a small separate case near the last is exhibited a nearly complete skeleton of the great Auk (*Alca impennis*) from Funk Island off Newfoundland, where formerly this bird bred in large numbers: now it is entirely extinct. A coloured reproduction of the egg of this bird is also placed in the same case.

In Table-case, No. 13*a*, are remains of a gigantic goose (*Cnemiornis*) and of a land Coot or Rail (*Notornis*); also of **Table-case, No. 13a.**

Aptornis, an extinct genus allied to the *Rallidæ*, and represented in the collection by many perfect bones of two species, and a complete skeleton of *Aptornis defossor*.

Here also are placed some portions (casts and originals) of the skeleton of *Harpagornis*, the large extinct hawk of New Zealand, together with the remains of various other birds from the same islands. In the same case are exhibited a skull and some portions of the skeleton of a remarkable extinct flightless rail, *Diaphorapteryx Hawkinsi*, together with some bones of a large coot, *Fulica Newtoni*, from the Chatham Islands.

Table-case, No. 12, and Wall-cases, Nos. 23 and 24.

These cases are occupied with remains of the great extinct wingless bird, the "Moa" or *Dinornis*, from the Island of New Zealand.

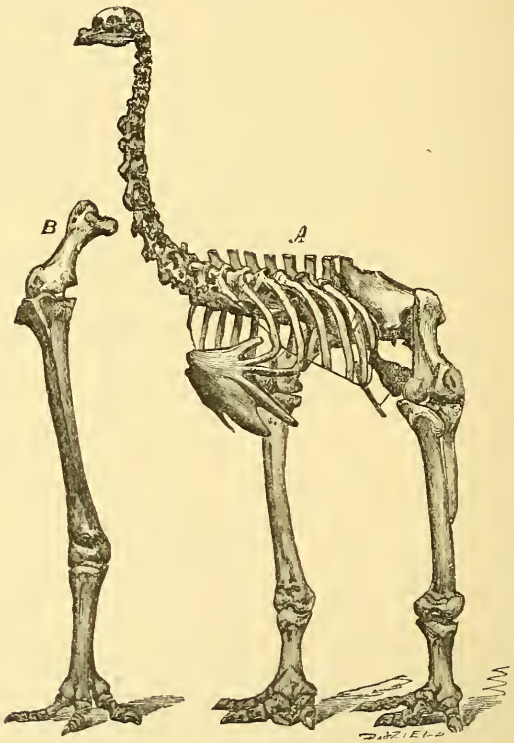


Fig. 116.—A, Skeleton of the "Elephant-footed Moa," *Pachyornis elephantopus* (Owen), from New Zealand. B, Leg-bones of *Dinornis giganteus* (Owen), one of the largest of the extinct Wingless Birds of New Zealand. (Glass-case S.)

The "Moa."

Judging from the vast number of remains of this bird found both in the South and North Island, and also from the fact of

The Moa.

the extraordinary diversity in size which their skeletons exhibit, the *Dinornis* must have enjoyed for hundreds of years complete immunity from the attacks both of man and wild beasts. Professor Owen has described no fewer than eighteen species of these extinct running birds, varying in size from three to upwards of ten feet in height, and differing greatly in their relative forms, some being tall and slender, and probably swift-footed like the modern Ostrich, whilst others were short and very stout-limbed, as in the specimen of *Pachyornis elephantopus*, which was undoubtedly a bird of great strength, but very heavy-footed (*see* Skeleton, Fig. 116). *Emeus crassus* was also very robust of limb.

Glass-case R.

Glass-case S.

The ancient Maoris, when they landed, no doubt feasted on these huge birds as long as any remained, and their extermination probably only dates back to about the period at which these islands were thrice visited by Captain Cook, 1769–1778. Their charred bones and egg-shells have been noticed, by the Honourable Walter Mantell, mixed with charcoal where the native ovens and fires were formerly made; and their eggs are said to have been found in Maori graves.

Table-case, No. 12.

In 1882, the Trustees obtained from a fissure-cave in Otago, New Zealand, the head, neck, and two legs and feet of a "Moa" (*Anomalopteryx didina*), having the skin still preserved in a dried state covering the bones, and some few feathers of a reddish hue still attached to the leg. The tracheal rings of the windpipe may be seen *in situ*, the sclerotic plates of the eyes, and the sheaths of the claws. One foot also shows the hind-claw (hallux) of the bird still attached to the foot.

Glass-cases R., R′., and S.

Five nearly entire skeletons are placed in separate cases; *Pachyornis elephantopus* (Fig. 116), in front of the window, and two in the glass-case placed between the windows on the South side against the wall of this Room, the entire skeleton of one of the tallest (*Dinornis maximus* being over 10 feet), and of one of the smallest (*Anomalopteryx parva*, only 3 feet) species of the Moa family. Case RR. contains the skeletons of *Anomalopteryx didiformis* and *Emeus gravipes*.

The geographical distribution of the flightless birds is a subject of extreme interest, for, notwithstanding the fact that they have only rudimentary wings, they have been found—either living or fossil—in almost every quarter of the globe. Thus, in South America we have Darwin's Rhea, of which three species are recorded. In North America Prof. Cope has described a large wingless bird (*Diatryma gigantea*), from the Eocene of New Mexico. In England Prof. Owen has recorded the *Dasornis londiniensis*, from the London Clay of Sheppey, and Mr. E. T. Newton the *Gastornis Klaasseni* from the Woolwich Beds, near Croydon, related to *Gastornis parisiensis* from the Eocene of Meudon, near Paris; all large flightless birds.

In Africa we have the living Ostrich which once extended through Arabia and Persia, into India, where its fossil remains have been found in the Siwalik Hills. In Madagascar have been found the remains of the extinct *Æpyornis*. In New Guinea we have the living Cassowary, which also extends into Australia, where the Emeu occurs both living and fossil, and the *Dromornis*, a fossil bird as large as the *Dinornis*. In New Zealand we have the genera *Dinornis*, *Anomalopteryx*, *Emeus*, *Pachyornis*, all extinct; and the living *Apteryx*. It may be remarked that these numerous and widely distributed flightless birds are probably derived from flying ancestors, and may have arisen separately in different parts of the world.

Although it is clear that birds are the descendants of some group of reptiles, it is by no means certain which. Professor Huxley's suggestion that the Dinosaurs are the ancestors of birds, has been widely adopted, but probably the resemblances between them are mainly due to the similar bipedal mode of progression of the birds and of the Dinosauria to which they have been compared.

Birds considered as a Class.—Although the remains of Birds are extremely rare in a fossil state, they furnish the following suggestions for a scheme of classification*:—

Sub-class I.—Saururæ (Lizard-tailed Birds).†

The metacarpal bones not anchylosed together; the tail longer than the body; jaws furnished with teeth; three free digits in the manus, all armed with claws; vertebræ biconcave. Ex. *Archæopteryx*.

Sub-class II.—Ratitæ (Raft-breasted birds).†

Division A, Birds with teeth.
[*a*, with biconcave vertebræ, at present unknown.]
b, with saddle-shaped vertebræ. Ex. *Hesperornis*.

Division B, Birds without teeth.
All the later Tertiary and existing forms of raft-breasted birds.

Sub-class III.—Carinatæ (Birds with a keeled sternum).

Division A, Birds with teeth.
a, with biconcave vertebræ. Ex. *Ichthyornis*.
[*b*, with saddle-shaped vertebræ, at present unknown.]

Division B, Birds without teeth.
All the later Tertiary and existing forms of Carinate Birds.

* A. Newton: "Encyclop. Brit.," 9th edit., vol. xviii., pp. 2-50, 1885.
† For explanations of these terms see Index Collection in entrance hall.

The presence of teeth, either in grooves or sockets, is seen to be common to all the earlier members of the class AVES.

Of the first sub-class only a single representative, *Archæopteryx*, is known: this is from the Upper Jurassic of Germany. Of division A of the second sub-class likewise only one representative, *Hesperornis*, has been discovered: this is from the Cretaceous of North America. Section B includes Tertiary and recent raft-breasted* birds except those which like the Dodo and *Cnemiornis*, can be definitely referred to some Carinate group. The Ostrich and Emeu, *Dinornis* and *Æpyornis*, are examples of birds belonging to this section.

The third sub-class includes the vastly greater number of birds. The Eagle, Duck, and Crow may be taken as examples. The great majority of the *Carinatæ* can fly, but, as already mentioned, certain members of the sub-class such as the Dodo, Solitaire, *Cnemiornis*, *Aptornis*, and *Aphanapteryx*, have lost their power of flight. Such birds are usually the inhabitants of islands where there are no carnivorous mammals to prey upon them, so that having little necessity for flight, their wings become reduced through disuse. Of all enemies the most destructive to these helpless birds is man, and it is through his agency that the Dodo, Solitaire, and many others have become extinct. The occurrence of such groups of reduced Carinates is probably not confined to recent times, but instances of it may frequently have happened in the past. The *Stereornithes* (of which *Phororhacos* and *Brontornis* may be taken as examples; *see* Wall-case 25) from the (?) Miocene of South America, and the *Gastornithidæ* from the Eocene of Europe, are probably examples of such groups.

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* This form of breast-bone has been independently acquired in many groups of Carinate birds: it is by itself of little or no value for classificatory purposes, being merely correlated with the loss of power of flight.

[Explanatory note to letters on figure of *Archæopteryx macrura*, p. 88.

FIG. 112.—*b*, cast of brain-cavity of cranium (the dark object to the left of *f*, is part of maxilla); *c*, *c*, ribs; *fu*, furculum; *sc*, scapula; *h*, *h'* humeri; *r*, *r'*, radii; *u*, *u'*, ulnæ; *cr*, carpals; 1, 2, phalangeals of manus; *i*, ischium; *a*, acetabulum: *f*, *f'* femora; *t*, *t'*, tibiæ; *mt*, tarso-metatarsal bone; *p*, phalanges of pes.]

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